# PORT OF BRISBANE CORPORATION

## PORTGATE ESTATE
## SEWERAGE PUMPING STATION

# OPERATION AND MAINTENANCE MANUAL

**VOLUME 2 OF 2**

**Developed by:**

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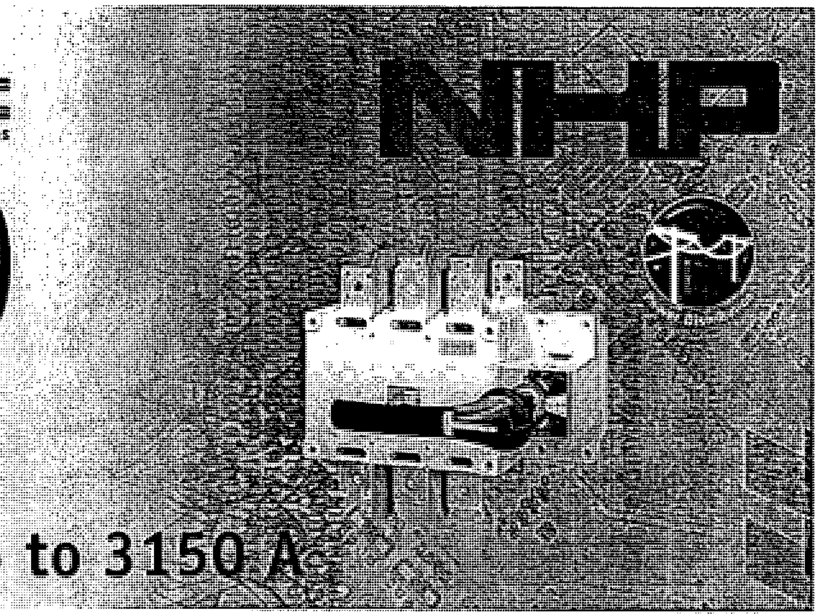
SCSQ

# *6.0 ELECTRICAL EQUIPMENT TECHNICAL INFORMATION*

## *INDEX*

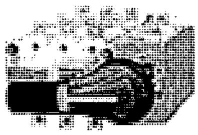
SOCOMEC
Industrial Switching & Protection Systems



# SCO
# Standard changeover switches 125 to 3150 A

## SIRCOVER 125 to 3150 A

The SCO range of Sircover products consists of manually operated multi-polar switches. These IP 30 devices feature 3 stable contact positions (I, 0, II) and full circuit breaking indication. With a switch to suit all currents up to and including 3150 A and a full range of accessories available, there is no change-over requirement that the Sircover range can't satisfy.



SCO 200 4P

## Front operated base mount (I, 0, II)
## (Supplied with external handle and 320 mm shaft)

| | AC 21 400 V (A) | AC 23 400 V (A) | AC 23 400 V (kW) | No. of poles | Cat. No. | Price $ |
|---|---|---|---|---|---|---|
| 125 A | 125 | 125 | 63 | 3 | SCO 125 3P | 1000.00 |
| | | | | 4 | SCO 125 4P | 1100.00 |
| 160 A | 160 | 160 | 80 | 3 | SCO 160 3P | 1100.00 |
| | | | | 4 | SCO 160 4P | 1350.00 |
| 200 A | 200 | 160 | 80 | 3 | SCO 200 3P | 1150.00 |
| | | | | 4 | SCO 200 4P | 1400.00 |
| 250 A | 250 | 250 | 132 | 3 | SCO 250 3P | 1200.00 |
| | | | | 4 | SCO 250 4P | 1450.00 |
| 400 A | 400 | 250 | 132 | 3 | SCO 400 3P | 1700.00 |
| | | | | 4 | SCO 400 4P | 1900.00 |
| 500 A | 500 | 500 | 280 | 3 | SCO 500 3P | 2100.00 |
| | | | | 4 | SCO 500 4P | 2350.00 |
| 630 A | 630 | 500 | 280 | 3 | SCO 630 3P | 2750.00 |
| | | | | 4 | SCO 630 4P | 2850.00 |
| 800 A | 800 | 800 | 450 | 3 | SCO 800 3P | 3300.00 |
| | | | | 4 | SCO 800 4P | 3600.00 |
| 1250 A | 1250 | 1000 | 560 | 3 | SCO 1250 3P | 7000.00 |
| | | | | 4 | SCO 1250 4P | 9600.00 |
| 1600 A | 1600 | 1000 | 560 | 3 | SCO 1600 3P | 7900.00 |
| | | | | 4 | SCO 1600 4P | 13100.00 |
| 2000 A | 2000 | 1250 | 710 | 3 | SCO 2000 3P | 15400.00 |
| | | | | 4 | (i) SCO 2000 4P | 18200.00 |
| 2500 A | 2500 | 1250 | 710 | 3 | (i) SCO 2500 3P | 18900.00 |
| | | | | 4 | (i) SCO 2500 4P | 20900.00 |
| 3150 A | 3150 | 1250 | 710 | 3 | (i) SCO 3150 3P | 22200.00 |
| | | | | 4 | (i) SCO 3150 4P | 26100.00 |

**Note:** (i) Available on indent only.

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**Price Schedule 'B2'**

**Accessories for SIRCOVER switches refer page 11 - 43.**



GST not included

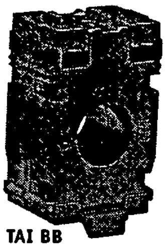
IME

Refer catalogue ITC

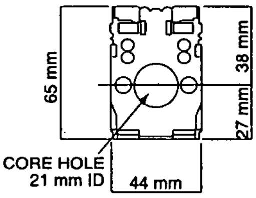
# Current transformers

- Housing, self-extinguishing thermoplastic
- Highest system voltage, 720 V RMS.
- Test voltage, 3 kV RMS 50 Hz for 1 min.
- Frequency of operation, 40-60 Hz
- Insulation Class, B (130 °C)
- Short circuit thermal current (Ith) 60-100 times rated primary current for 1 sec.
- Rated dynamic current 2.5 times Ith
- Rated continuous thermal current 120 % of rated primary current

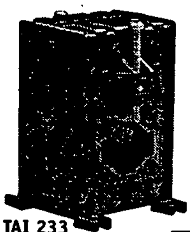
- **Compact miniature CT**
- **DIN rail mountable**



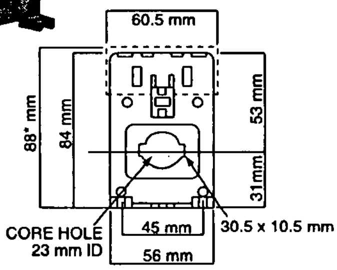
TAI BB



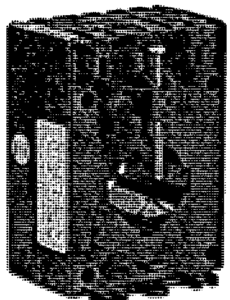

CT Depth 45 mm (overall)



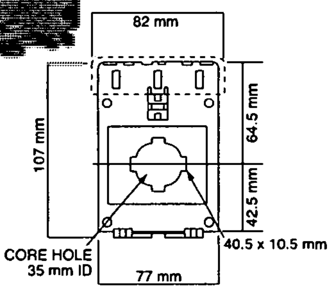
TAI 233




CT Depth 60 mm (overall)



TAI 400




CT Depth 64 mm (overall)

| Accuracy class CL 0.5 VA | CL 1 VA | CL 3 VA | Ratio: Primary / Secondary current - 5 A or 1 A Cat. No [1] | 5A Price $ | 1A Price $ |
|---|---|---|---|---|---|
| **TAI BB - Cable Ø 21 mm max.** | | | | | |
| - | - | 1 | TAI BB 40 / | 51.50 | - |
| - | 1.25 | 1.5 | TAI BB 50 / | 51.50 | - |
| - | 1.25 | 2 | TAI BB 60 / | 51.50 | - |
| - | 1.5 | 2.5 | TAI BB 75 / | 51.50 | - |
| - | 1.5 | 2.5 | TAI BB 80 / | 51.50 | - |
| 2 | 2.5 | 3.5 | TAI BB 100 / | 51.50 | - |
| 2.5 | 3.5 | 4 | TAI BB 120 / | 51.50 | - |
| 3 | 4 | 5 | TAI BB 150 / | 51.50 | - |
| 4 | 5.5 | 6 | TAI BB 200 / | 51.50 | - |
| 5 | 6 | 7 | TAI BB 250 / | 51.50 | - |
| 6 | 7.5 | 8 | TAI BB 300 / | 51.50 | - |
| **TAI 233 - Cable Ø 23 mm, Busbar 30 x 10 mm max.** | | | | | |
| - | - | 1.5 | TAI 233 40 / | 63.10 | 88.60 |
| - | - | 2.5 | TAI 233 50 / | 63.10 | 88.60 |
| - | - | 2.5 | TAI 233 60 / | 63.10 | 88.60 |
| - | 1.5 | 3.5 | TAI 233 75 / | 63.10 | 88.60 |
| - | 1.5 | 4 | TAI 233 80 / | 63.10 | 88.60 |
| - | 2.5 | 5 | TAI 233 100 / | 63.10 | 88.60 |
| - | 3.5 | 5.5 | TAI 233 120 / | 63.10 | 88.60 |
| 1.5 | 5.5 | 6.5 | TAI 233 150 / | 63.10 | 88.60 |
| 4 | 7 | 8.5 | TAI 233 200 / | 63.10 | 88.60 |
| 6 | 9 | 11 | TAI 233 250 / | 63.10 | 88.60 |
| 7.5 | 11 | 13.5 | TAI 233 300 / | 63.10 | 88.60 |
| 10.5 | 15 | 18 | TAI 233 400 / | 71.60 | 102.90 |
| 12 | 18 | 22 | TAI 233 500 / | 71.60 | 102.90 |
| 14.5 | 21.5 | 26 | TAI 233 600 / | 71.60 | 102.90 |
| **TAI 400 - Cable Ø 35 mm, Busbar 40 x 10 mm max.** | | | | | |
| 1 | 3 | 6 | TAI 400 150 / | 65.80 | 90.20 |
| 1.5 | 3 | 6 | TAI 400 200 / | 65.80 | 90.20 |
| 2.5 | 5 | 8 | TAI 400 250 / | 65.80 | 90.20 |
| 4 | 8 | 12 | TAI 400 300 / | 65.80 | 90.20 |
| 8 | 12 | 15 | TAI 400 400 / | 65.80 | 90.20 |
| 10 | 12 | 15 | TAI 400 500 / | 79.60 | 97.60 |
| 12 | 15 | 15 | TAI 400 600 / | 79.60 | 97.60 |
| 10 | 12 | 15 | TAI 400 750 / | 79.60 | 97.60 |
| 10 | 12 | 15 | TAI 400 800 / | 88.00 | 97.60 |
| 10 | 12 | 15 | TAI 400 1000 / | 88.00 | 97.60 |

**Note:** [1]) Add primary and secondary current + 5 A or 1 A suffix to complete Cat. No.

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**Price Schedule 'B2'**

MULTITRODE

Leaders In Pump Station Management Technology™

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This Manual is the support documentation for the
MultiTrode MonitorPro Remote Station Supervisor
Hardware Version 7.x.x – 8.x.x

*Document Revision R10*

*23 November 2006*

# Warnings & Cautions

## Information to User

Read through this manual to obtain a good working knowledge in order to get maximum performance from the product for your application. After reading, put the manual away in a safe place for future reference.

## Documentation Standards

**DANGER:**
THIS SYMBOL IS USED WHERE NON-COMPLIANCE COULD RESULT IN INJURY OR DEATH.

**WARNING:**
THIS SYMBOL IS USED WHERE NON-COMPLIANCE COULD RESULT IN INCORRECT OPERATION, DAMAGE TO OR FAILURE OF THE EQUIPMENT.

**NOTE:**
THIS SYMBOL IS USED TO HIGHLIGHT AN ISSUE OR SPECIAL CASE WITHIN THE BODY OF THE MANUAL.

## Installation Notes

**WARNING:**
THE INSTALLATION AND WIRING OF THE MONITORPRO MUST BE PERFORMED BY QUALIFIED PERSONNEL.

**WARNING:**
THE MONITORPRO HAS NO USER SERVICEABLE PARTS. TO REDUCE THE RISK OF ELECTRIC SHOCK, LEAVE ALL SERVICING TO QUALIFIED MULTITRODE TECHNICAL STAFF.

# Important Information

### Software compatibility

When the MonitorPro is interfacing to either an MT2PC or MT3PC Pump Controllers or to other MonitorPro's, all units on the Local Area Network must have the same minor software version number. The software version number is in the form *X.Y.Z*, such as 7.5.2, where *X* is the Major Version Number, *Y* is the Minor Version Number, and *Z* is the Revision Number.

For example, a version 7.5.2 controller will be compatible with a version 7.5.8 controller, but not with a version 7.7.1 controller.

If the versions are not matched correctly, a "Communications Fault" may occur. It is also possible that no fault will be reported or obvious in the operation of the units, but the operation of the units will not be reliable.

Refer to Section 8—Upgrading MonitorPro Firmware for information on how to identify your current software version and upgrade the software to a later version.

## Safety & Warning Messages

### Installation

The MonitorPro should only be installed by appropriately qualified electrical personnel. All relevant local laws and regulations must be adhered to.

### High Voltages Present

The MonitorPro measures, and internally generates, dangerous high voltages. Even when the MonitorPro is powered from a Low Voltage Source (8–30 VDC) and no high power source is present, the MonitorPro is capable of presenting 500 VDC at its terminals.

### Disclaimer

MultiTrode does not warrant the equipment against damage caused to itself or other equipment or injury or death to persons resulting from the use of this equipment, if the unit was not installed correctly. Please refer to the end of this manual for a full disclaimer.

### Motor Protection Features

By default, all motor protection features, including Insulation Resistance Testing, Locked Rotor Detection, Thermal Protection, Undercurrent Protection, Phase Failure Detection, and Earth Fault Protection, are turned off. They must be commissioned before the MonitorPro can offer any sort of protection. *Refer to Chapter 7—Commissioning* for more information.

# Organisation of this Manual

This Manual is the support documentation for the installation, commissioning and operation of the MultiTrode MonitorPro.

It is intended for use by operators, electricians and technicians concerned with commissioning, using and maintaining the MonitorPro.

It has been divided into three parts, as follows:

## Part 1: Operation Guide

This part describes the basic operation of the MonitorPro, with information on how to operate the User Interface, menu navigation, and fault clearing.

This part is intended for use by operators, and should contain all of the information the operators require.

## Part 2: Installation and Commissioning.

This part describes the physical installation and wiring of the controller, then provides information additional to the Operation Guide that will allow a technician to commission the controller and set up the commonly used functions.

This part is intended for use by electricians or technicians during the installation and commissioning of the controller. It is assumed that before starting this part of the manual, the reader has read and understood part 1.

## Part 3: Technical Guide

This part contains addition technical information on the advanced features of the MonitorPro that are not in the most common installation.

For further technical information concerning the advanced features of the MonitorPro that are not in the most common installation, refer to the MultiTrode website at www.multitrode.com. This information includes:

- Flow rate calculation theory and examples

  This includes information on station inflow, pump rate and volume, fixed flow rate and overflow calculations.

- Communications cables

  Information concerning the correct electrical characteristics and ordering information for the required cables.

- Thermal motor protection theory
- DIP switch settings
- A cross-reference between old versions of this manual and this one.

# List of Abbreviations Used

| | |
|---|---|
| ACC | Accumulated |
| AC | Alternating Current |
| AIN | Analog Input |
| AOUT | Analog Output |
| CIP | Communications Interface Port |
| CT | Current Transformer |
| DC | Direct Current |
| DIN | Digital Input - DIN also refers to an industry standard switchboard component mounting system, as in DIN Rail, DIN mounting clips and so on. |
| DOT | Digital Output |
| FLC | Full Load Current |
| LAN | Local Area Network |
| MP | Modem Port |
| MTxPC | MultiTrode 2 or 3 Pump Controller: (MT2PC, MT3PC, MT2PC-VFD, MT3PC-VFD, MT2SPC, MT3SPC, MT2SPC-VFD. MT3SPC-VFD) |
| N/C | Normally Closed |
| N/O | Normally Open |
| PC | Personal Computer |
| Outpost | MultiTrode's SCADA software package |
| PIN | Personal Identification Number |
| PSTN | Public Switched Telephone Network |
| Rx | Receive |
| SCADA | Supervisory Control and Data Acquisition |
| Tx | Transmit |
| UART | Universal Asynchronous Receiver/Transmitter (Serial Communications Device) |
| VAC | Alternating Current Voltage |
| VDC | Direct Current Voltage |
| WAN | Wide Area Network |

# Table of Contents

# PART 1 – OPERATION GUIDE

# 1 Introduction

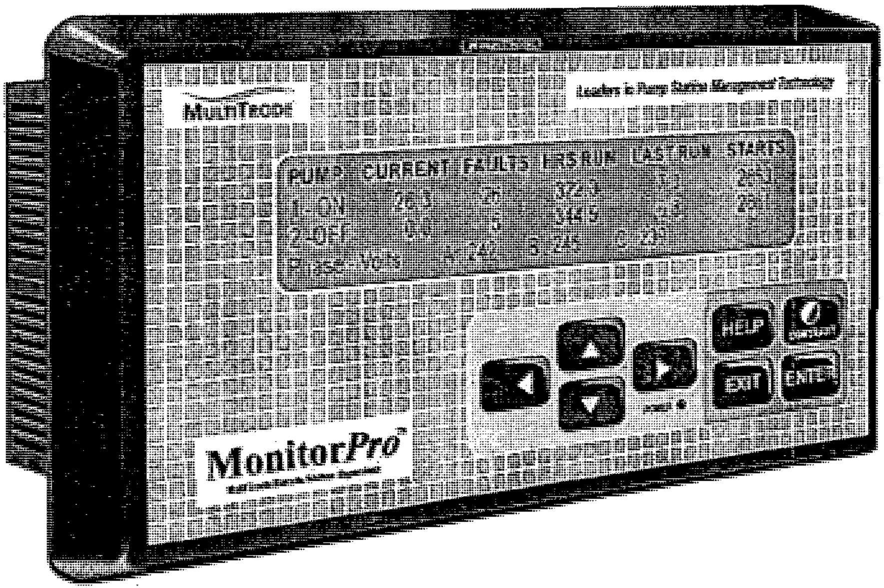


*Figure 1 International Version of MonitorPro Controller.*

The MonitorPro is a pump station supervisor which provides flow monitoring, electronic motor protection, insulation resistance testing, data logging, an RTU and a full 4-line display, all in one integrated package. The unit works in conjunction with the MT2PC family, or standalone.

Using a MonitorPro in a pump station should extend the life of the assets and reduce operating costs. Connecting the MonitorPro to a SCADA system, such as MultiTrode Outpost, can result in a significant reduction in callouts to the station.

## 1.1 Motor protection

Insulation resistance testing

Electronic thermal protection

Undercurrent (e.g. caused by a broken impeller) protection

Over-current (e.g. caused by a locked rotor) protection

Phase failure

Earth fault detection

Supply protection (over-voltage and under-voltage protection)

## 1.2 Flow monitoring

Individual pump flow rates

Total station volumes

Overflow logging, including date, time, volume and duration

## 1.3 Data logging

Time-stamped events on a change of state or time-base for up to 3 months—for root cause analysis of problems

Viewable on screen, or downloadable to a laptop

## 1.4 RTU

Integrated radio modem for SCADA connection

RS232 communication for PSTN, digital radio or cellular modem connection

## 1.5 4-line LCD display

Help functions

13 standard user screens of electrical, hydraulic and pump station status

Menu driven configuration screens for commissioning

## 1.6 Security

Personal identification number (PIN) and job number access can be enabled for better security and maintenance analysis

# 2 MonitorPro Basics

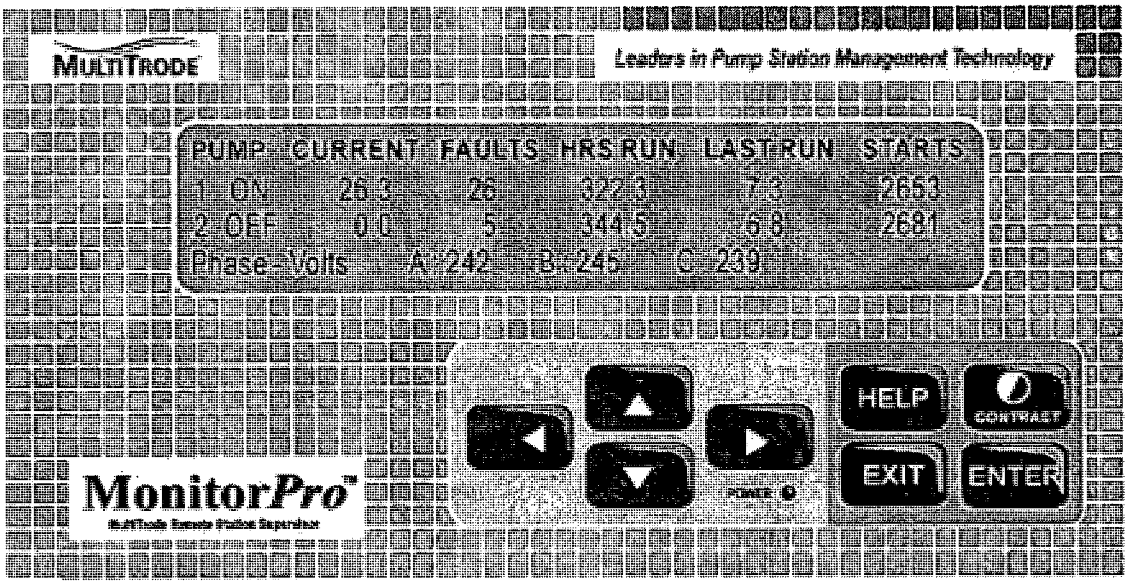



*Figure 2: MonitorPro Faceplate, Showing the Display*

## 2.1 Display

The user interface to the MonitorPro is in the form of a 4-line by 40-character display embedded in the faceplate, as shown in Figure 2. A logical progression of sub-menus allows quick access to the required parameters. Refer to section 2.4 for information on the menu structure. If the MonitorPro is networked to a Pump Controller, the display on the MonitorPro will show intuitive help when the parameters of the Pump Controller are viewed or edited, or when a fault is present on the Pump Controller.

One line will usually be highlighted by a cursor, which appears to the left of a display line as ->.

## 2.2 How to Use the Keypad

The 8 keys allow the user to view and edit all information on the MonitorPro as described below:

### 2.2.1 Direction Keys ◀ ▶ ▲ ▼

Use the direction keys to:

- Move from menu to menu
- Increase/decrease values
- Move within a value
- Browse the list of options
- Scroll from screen to screen

### 2.2.2 The ENTER Key

Use the ENTER key to:

- Enter a menu which is currently selected
- Start changing a setting which is currently selected
- Accept a setting which is currently being modified

### 2.2.3 The EXIT Key

Use the EXIT key to:

- Return to a previous menu
- Exit a setting without modifying the original value

### 2.2.4 The HELP Key

The HELP key can be pressed at any time. When it is pressed, the screen will display help for the current menu, or for the value which the cursor is pointing to. When it is pressed again, the MonitorPro will return to the menus/values it was previously displaying.

## 2.3 The CONTRAST Key

The CONTRAST key allows you to adjust the screen contrast to improve the clarity according to the ambient light conditions. Repeated pressing of the CONTRAST key will either increase or decrease the contrast. To reverse the contrast adjustment direction, wait one second between presses.

**NOTE:**
Previous versions of the MonitorPro (prior to Jan 2002) have a large range on the CONTRAST key, and it is possible to get a blank screen. This does not mean the unit has failed (the power light will still be on). Follow the instructions above to change the contrast to a viewable level.

## 2.4 Map of the Menu Structure

See Figure 3: MonitorPro Operators Menu Layout for the simplified menu structure. This diagram only shows the menu items relevant to the operators. The full menu layout and detail on the rest of the menus can be found in 5.15—Port Configuration Options.

# MonitorPro Menu Structure Overview

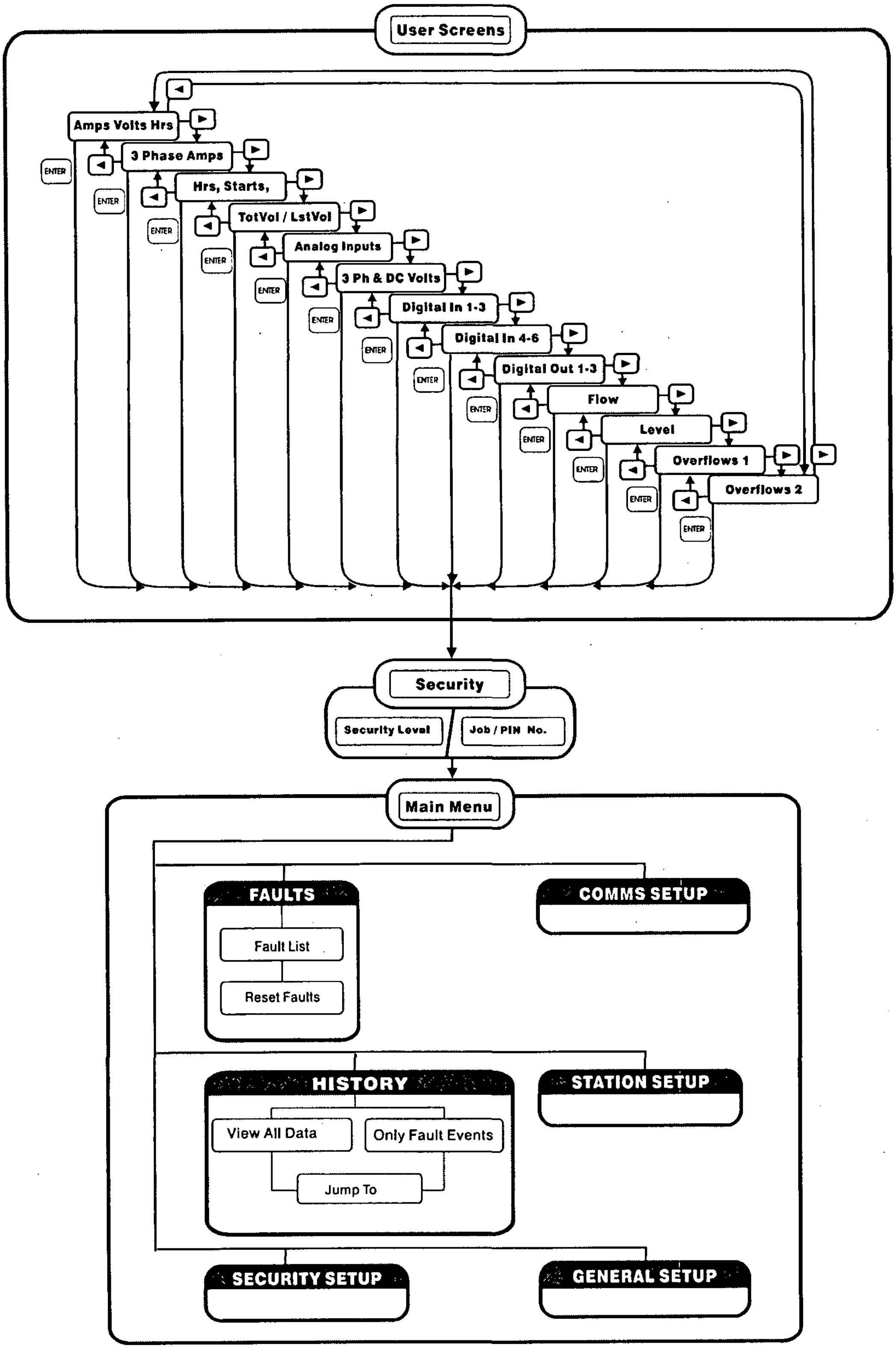



*Figure 3: MonitorPro Operators Menu Layout*

## 2.5 User Screens

In normal mode, (i.e., you are not accessing any menu items), there are 13 user screens, which display all of the status information for the pump station. One of these screens will be shown while the MonitorPro is in normal mode. To scroll through the different user screens, use the direction keys. The screens will be displayed in the order shown below, and the order will wrap around, i.e. after screen 13, the next screen will be screen 1.

The user screens provide a high level of visual information relevant to the everyday running and monitoring of the pump station, as follows:

- 3-phase supply voltage
- 3-phase currents for each motor
- Insulation resistance for each motor
- Hours run, starts and fault accumulators for each pump
- Station and individual pump volumes
- Inflow and pump flow rates
- Digital input and outputs and accumulators
- Analog input values
- Overflow records

### 2.5.5 User Screen 1: The Default Display

The default display, User screen 1, shown in Figure 4, shows a summary of motor currents, supply voltages, accumulated hours run, number of minutes run for the last pump event, and accumulated starts. This information can be customized—see section 7.11—Customising the Default Display for more information.
Press the right arrow ▸ to go to the next display.

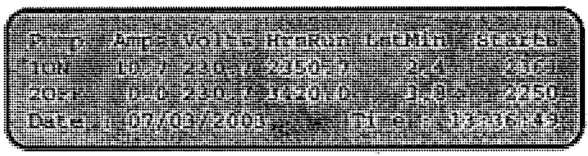


*Figure 4 - Default Display*

### 2.5.6 User Screen 2: Currents

User screen 2, shown in Figure 5, shows motor currents for all three phases along with the result of the last test of the insulation resistance of the motor windings for each pump.

Press the right arrow ▸ to go to the next display.

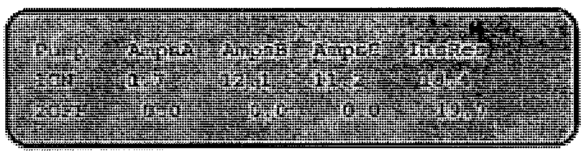


*Figure 5 – Motor Status*

### 2.5.7 User Screen 3: Time & Starts

User screen 3, shown in Figure 6, shows statistics for each pump, displaying the total hours run (HrsRun), the duration of the last pump run in minutes (LstMin), the number of pump starts in the last hour (Sts/Hr), the total number of starts since the accumulators were reset (Starts) and the total number of pump faults since the accumulators were reset (Faults).

Press the right arrow ▸ to go to the next display.

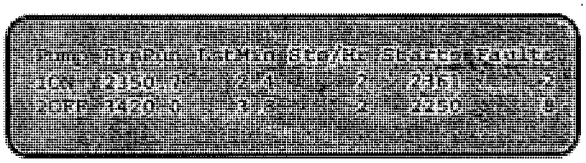


*Figure 6: Time and Starts Summary*

### 2.5.8 User Screen 4: Volumes and Rates

User screen 4, shown in Figure 7, is a summary of all pump cycles since the accumulators were reset, showing the volumes pumped by each pump and the rates at which the pumps ran.

**Note:** *These values will only be correct if Flow Rates have been calibrated. See section 7.5—Volume and Flow Rate Setup for more information.*

Press the right arrow ▸ to go to the next display.

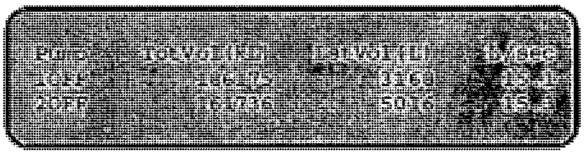


*Figure 7: Volume & Rates Summary*

### 2.5.9 User Screen 5: Analog Inputs & Outputs Status

User screen 5, shown in Figure 8 shows the analog input and output levels. Note that you may customise the descriptions for each input and output to make the values more meaningful. Refer to Sections 7.7.26—Analog Inputs and 7.7.29—Analog Output for more information.

Press the right arrow ▸ to go to the next display.

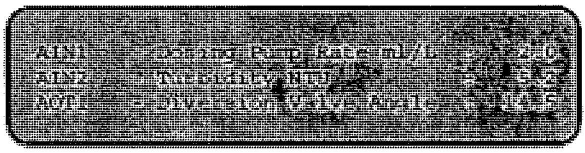


*Figure 8: Analog Inputs and Outputs Status*

### 2.5.10 User Screen 6: Voltage Monitoring

User screen 6 shows the three-phase voltages and the DC backup supply voltage, as measured by the MonitorPro, as well as the analog input to the MTxPC pump controller that is connected to the MonitorPro (PC Analog Input).
Press the right arrow ▸ to go to the next display.

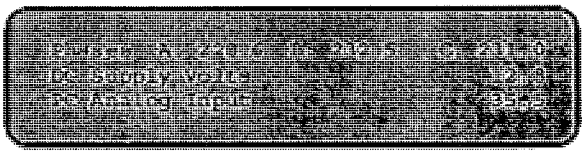



*Figure 9:Voltage Monitoring and MTxPC Input*

If there is one MonitorPro networked to several pump controllers, the value shown will be the input to the master MTxPC pump controller. If there are several MonitorPro's networked to several MTxPC pump controllers, the value shown will be the input to the pump controller that is at the same hierarchical level as the MonitorPro in question.

For example:

- The Master MonitorPro will show the input to the Master MTxPC,
- Slave 1 MonitorPro will show the input to Slave 1 MTxPC and
- Slave 2 MonitorPro will show the input to Slave 2 MTxPC.

### 2.5.11 User Screens 7 & 8: Status of the Digital Inputs

User screens 7 and 8 show the current status of the digital inputs. As with user screen 5, you may customise the descriptions to make the display more meaningful. See Section 7.7.25—Digital Inputs for information on configuring the descriptions.

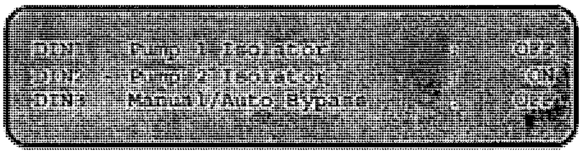



*Figure 10: Digital Input Status Screen 1*

Digital inputs can be configured as a "Pulsed" input. In this mode, they will accumulate, or count, pulses received from external equipment, to help display useful station information.

Press the right arrow ▸ to go to the next display.

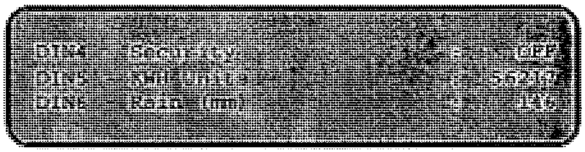



*Figure 11: Digital Input Status Screen 2*

### 2.5.12 User Screen 9: Digital Output Status

User screen 9 shows the statuses of the Digital Outputs. Again, you may customise the descriptions—refer to Section 7.7.27—Digital Outputs.

Press the right arrow ▸ to go to the next display.

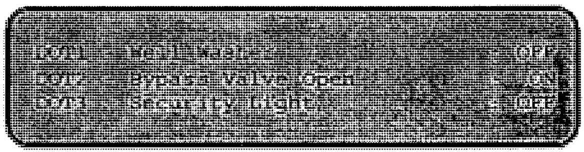



*Figure 12: Digital Output Status*

### 2.5.13 User Screen 10: Flow Summary

User screen 10 shows the flow summary for inflow and outflow at the station measured by the MonitorPro.

***Note:*** *These values will only be correct if Flow Rates have been calibrated, and are only updated after a complete fill and pump out cycle. See Section 7.5—Volume and Flow Rate Setup for more information.*

Press the right arrow ▸ to go to the next display.

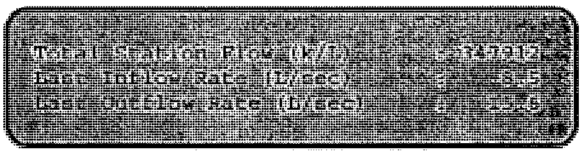



*Figure 13: Flow Summary*

### 2.5.14 User Screen 11: Levels

User screen 11 shows the current well level as measured by the MTxPC. If the MonitorPro is working in standalone mode, this value will show the current value of the Analog Input 1 on the MonitorPro, which is used as the level in standalone mode.

Press the right arrow ▸ to go to the next display.

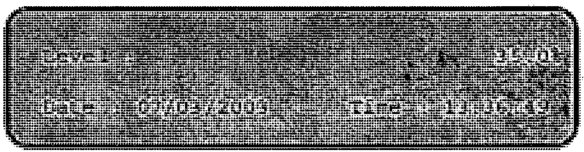



*Figure 14: Level Display*

### 2.5.15 User Screen 12: Last Overflow Summary

User screen 12 shows a summary of the last overflow recorded by the MonitorPro.

Press the right arrow ▸ to go to the next display.

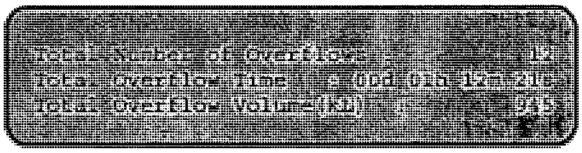


*Figure 15: Last Overflow Summary*

### 2.5.16 User Screen 13: Motor Status

The final user screen, User screen 13, shows the totals of all overflows recorded since the accumulators were last reset.

***Note:*** *The values shown on screens 12 and 13 will only be correct if Flow Rates have been calibrated. See Section 7.5—Volume and Flow Rate Setup for more information.*

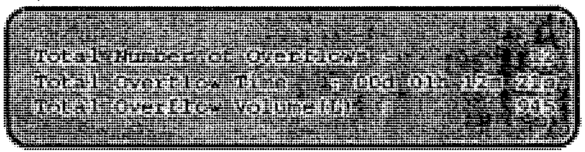


*Figure 16: Motor Status*

## 2.6 Using the User Screens

To enter the menu structure of the MonitorPro from any of the user screens, press ENTER. As long as security has not been enabled, pressing ENTER twice more will give access to the Main Menu screen.

The up and down arrows enable you to select a menu item, e.g. STATION SETUP.

Pressing ENTER when the cursor is on STATION SETUP invokes that menu option and gives a new sub-menu.

Pressing EXIT goes back up a level and eventually exits to the standard user display.

If security has been enabled, refer to Section 7.10—Security.

The MonitorPro has been designed to allow the operator to peruse configurations, settings, current values, fault levels/conditions, and data log information. The general structure is based on a logical progression of menus and sub-menus.

At any level of the menu hierarchy, you may press the HELP key to see a help screen for the selected setting or feature. These on-line help features make using and configuring the MonitorPro a simple step-by-step process, ensuring that the operator understands all of the process which he or she is configuring.

# 3 Faults Menu

The MonitorPro and the MTxPC have between them many built in fault detection methods. Through the Faults menu you can peruse the current or past faults and reset them if required.

The MonitorPro's fault menu can be found as part of the main menu. Press ENTER when the cursor is indicating the FAULTS menu to enter the Faults menu, and show the current fault status of the station, as illustrated in Figure 18

***Note:*** *In order to be able to see and reset the fault it must have occurred before you entered the faults menu on the MonitorPro. Note also that the fault indication on the MonitorPro will only disappear when you exit out to main menu and re-enter the 'Faults' menu.*

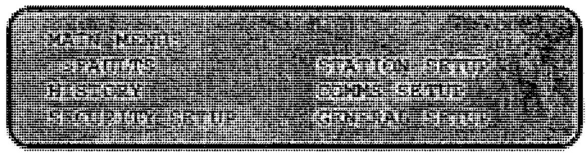


*Figure 17: Faults Menu*

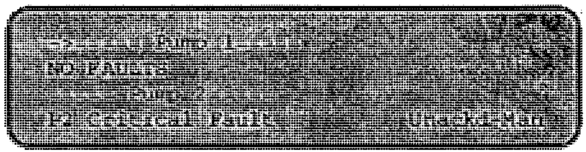


*Figure 18: Faults Display*

### 3.1.1 Example: Resetting a Fault

The following is an example showing how to reset an Unacknowledged Critical Fault on Pump 2.

Figure 19 shows the first screen of the faults menu, with pump 1 having no faults.

Press the ▼ key to scroll down the display and reveal pump 2 displaying the unacknowledged Critical Fault.

Press the ▼ key to scroll down further. When the cursor is on the line

Press ENTER to Reset Pump 2

The MonitorPro will prompt with a question confirming the reset. Choose the desired action, again using the cursor keys, and then press ENTER.

***Note:*** *It is not possible to reset a fault that is still present, i.e. you must resolve the fault condition first.*

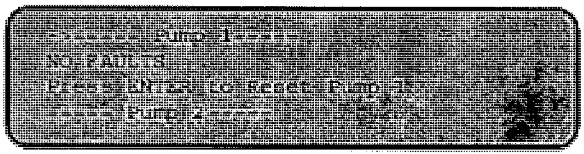



*Figure 19: Resetting a Fault 1*

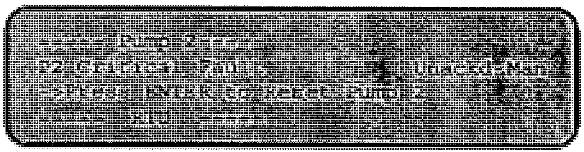



*Figure 20: Resetting a Fault 2*

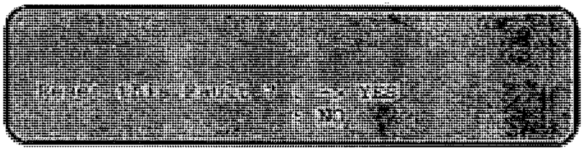



*Figure 21: Resetting a Fault 3*

## 3.2 History Menu

Reach the MonitorPro's History menu from the main menu. If the data logger function is not enabled, the MonitorPro history file contains only faults and configuration changes. If the data logger function is enabled, the history file contains the faults and configuration changes, along with all data recorded. For more information on the data logger, refer to Section 7.8.

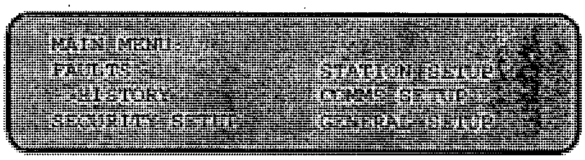



*Figure 22: Accessing the History Menu*

When the history menu is selected, the first history menu, shown in Figure 23 appears.
***Note:*** *There are two options. The first option View All Data displays all the logged data, while the second option, View Only Fault Events, filters out all logged events that are not related to faults, and only displays fault events.*

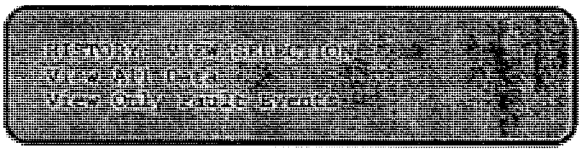



*Figure 23: Accessing the History Menu*

Once either of the view choices has been selected, the data log will be displayed. The top line of the display shows the most recent data log entry, and by moving down (using the direction keys) you can view the history in reverse chronological order.

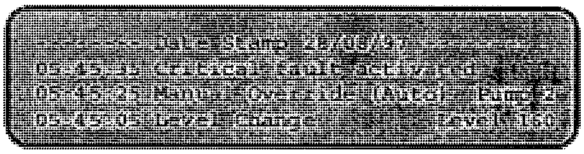



*Figure 24: History Display*

To increase the functionality of the data log history, the MonitorPro has an additional feature which allows you to jump the history list to a specific date and time (or the closest entry to the selected time/date stamp).

To take advantage of this feature, press the ENTER key when perusing the data log, and then enter the date and time you wish to jump to.

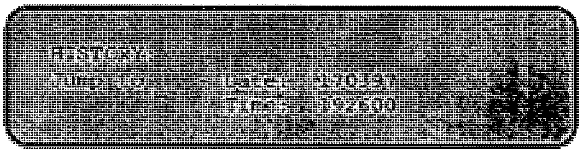


*Figure 25: Jumping the History List*

### 3.2.2 Downloading Data Logs to a Laptop Computer

MultiTrode has produced a software suite for laptops called MTCDS—MultiTrode Control and Diagnostics Software. By connecting your laptop to the MonitorPro, either directly with the cable provided in the MTCDS kit, or remotely via a phone line (with a modem at each end), you can:

- Upload (laptop to MonitorPro) or download (MonitorPro to laptop) settings
- Upgrade firmware versions
- Download data logs from MonitorPro for analysis on the laptop

Refer to the MTCDS manual for more information. Please contact your local MultiTrode distributor for more information on MTCDS.

# PART 2 – INSTALLATION & COMMISSIONING

# 4 Mounting the MonitorPro

## 4.1 Environmental Protection

The MonitorPro consists of two parts: the controller and the keypad.

The **controller** is rated at IP20, and therefore must always be mounted inside an approved enclosure.

The **keypad**, or the Panel Mount Assembly of the keypad and controller, is rated at IP65 when correctly installed with the gasket provided.

## 4.2 Installation Methods for the MonitorPro

As mentioned, the MonitorPro consists of a controller and a keypad. There are two methods for mounting the MonitorPro. In brief, these are:

### 4.2.1 DIN Rail-Mounted Controller and Remotely Mounted Keypad

The controller is mounted on a DIN rail within a switchboard, and the keypad is mounted elsewhere, such as on the outside of the switchboard's inner door, and the two parts are joined via the long keypad cable provided. This method is described in detail in Section 4.3.

### 4.2.2 Panel Mounting

The controller and keypad are joined by the optional short keypad cable (not normally provided), and then the controller is mounted on the back of the keypad, before the complete assembly is mounted through a panel. This method is described in detail in Section 4.4.

## 4.3 DIN Rail-Mounted Controller and Remotely Mounted Keypad

This method involves mounting the MonitorPro housing on industry standard symmetric 32mm DIN Rail, with the keypad unit mounted separately (typically on the switchboard's inner door). This simplifies wiring by not requiring large looms to the door. The following figures illustrate installation suggestions.

**NOTE:**
To minimise interference it is important not to route the cable to the MonitorPro keypad with mains cabling. The shield earth wire from the keypad must be connected to the earth terminal as shown in Figure 26. Also connect an earth to the Earth lug on the case, again as shown in Figure 26.

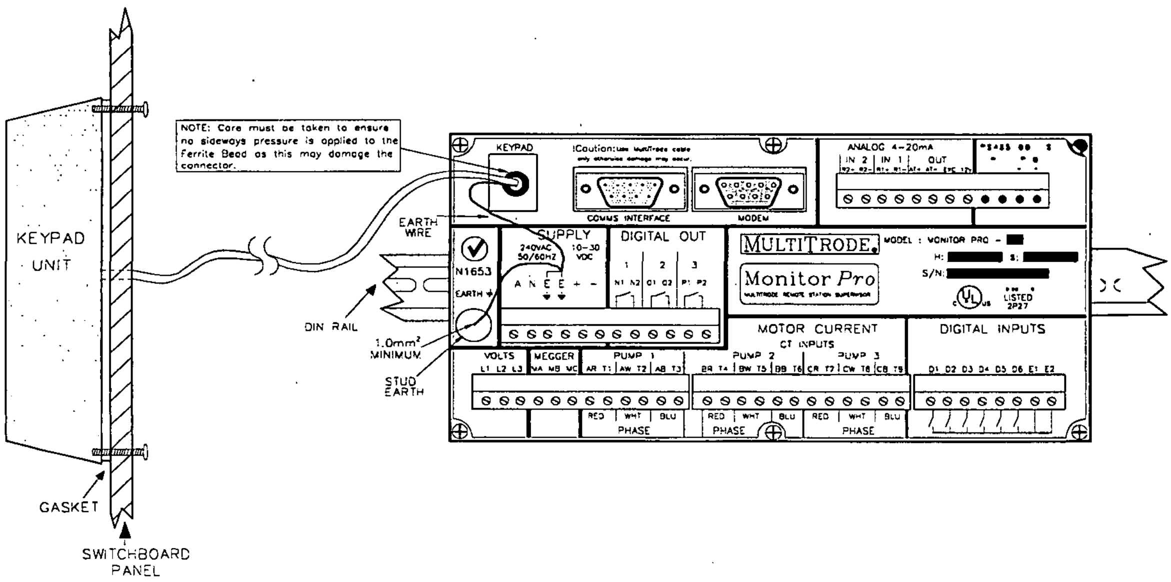



*Figure 26: Installation of MonitorPro when the keypad is separated from controller*

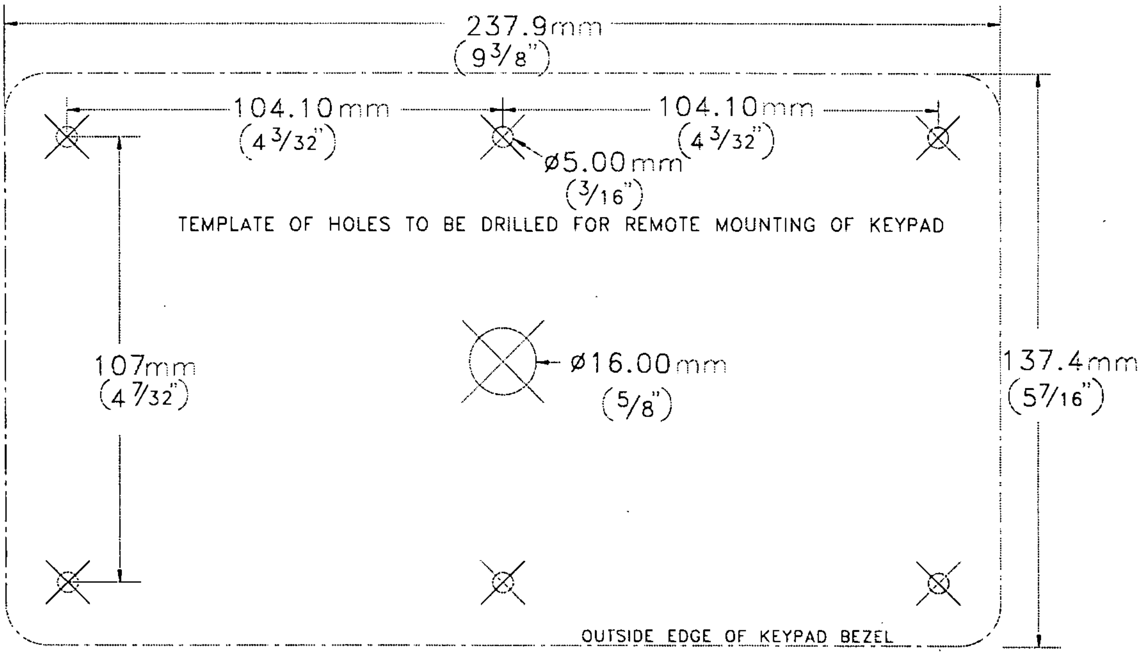



*Figure 27: Mounting Template for the Keypad (indicative only, not actual size)*

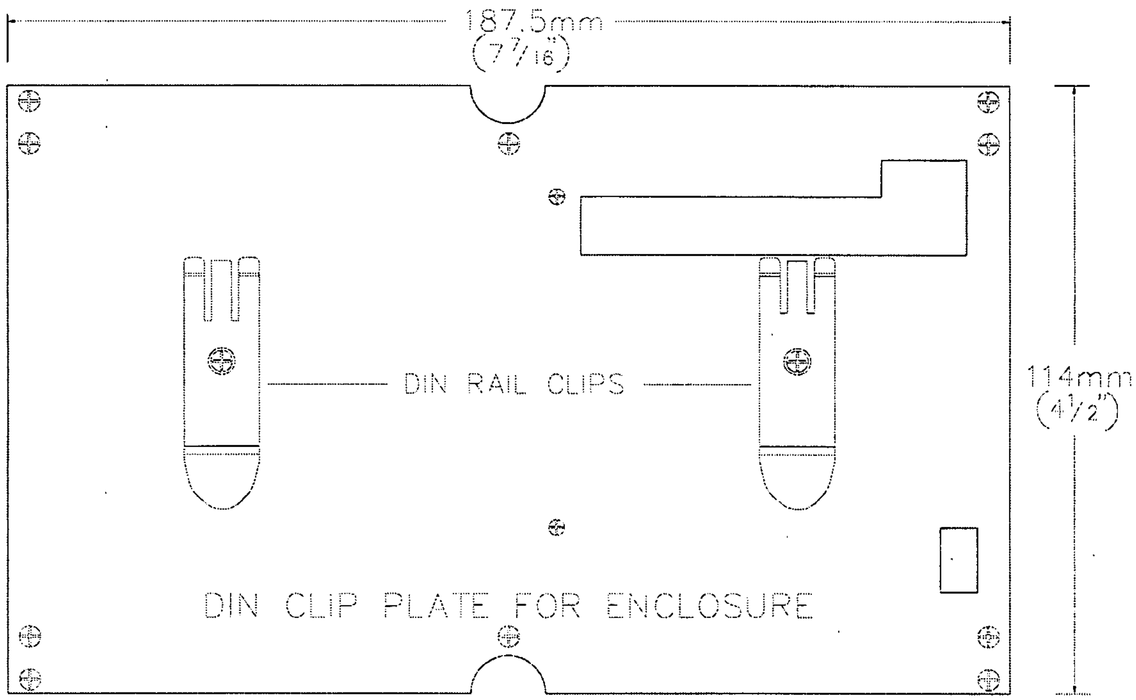



*Figure 28: Mounting Template for the DIN Mounting Clips (indicative only, not actual size)*

## 4.4 Panel Mounting the Controller

This method involves mounting the unit on the inner door of the panel. This method is generally **not** recommended as substantial cable harnesses must be hung to the inner door.

### 4.4.3 Attaching the Keypad

Prior to panel mounting the keypad and controller assembly, connect the short keypad cable (optionally supplied upon request) between the keypad and the controller, then mount the controller to the back of the keypad as shown in Figure 29.

The four screws supplied within the packaging are used to attach the keypad to the controller. The screw positions are visible when looking at the rear of the unit as illustrated in Figure 29. Once these screws are in place the keypad is secure and can be used in the panel-mounted fashion.

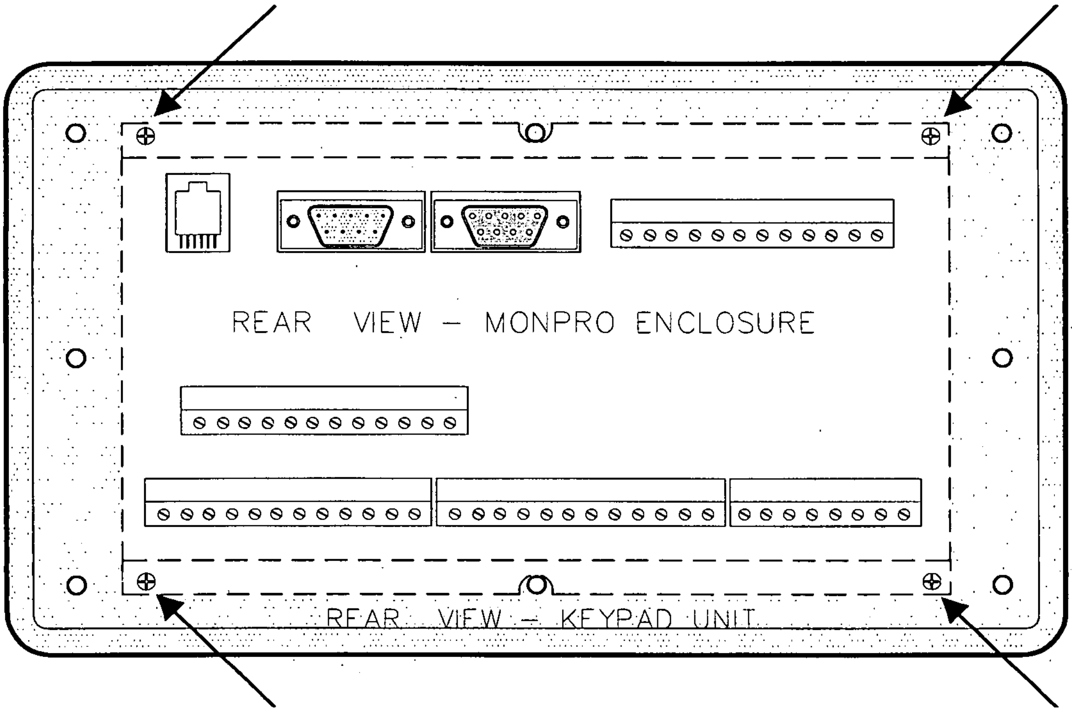



*Figure 29: Location of Screws for Keypad*

### 4.4.4 Mounting the Keypad and Controller Assembly

Once the keypad and controller have been assembled into one unit, place the gasket provided on the back of the keypad section, then pass the completed assembly through the panel cut-out and secure it with the 6 screws provided, as shown in Figure 30. Dimensions for the panel cut-out can be seen from Figure 30.

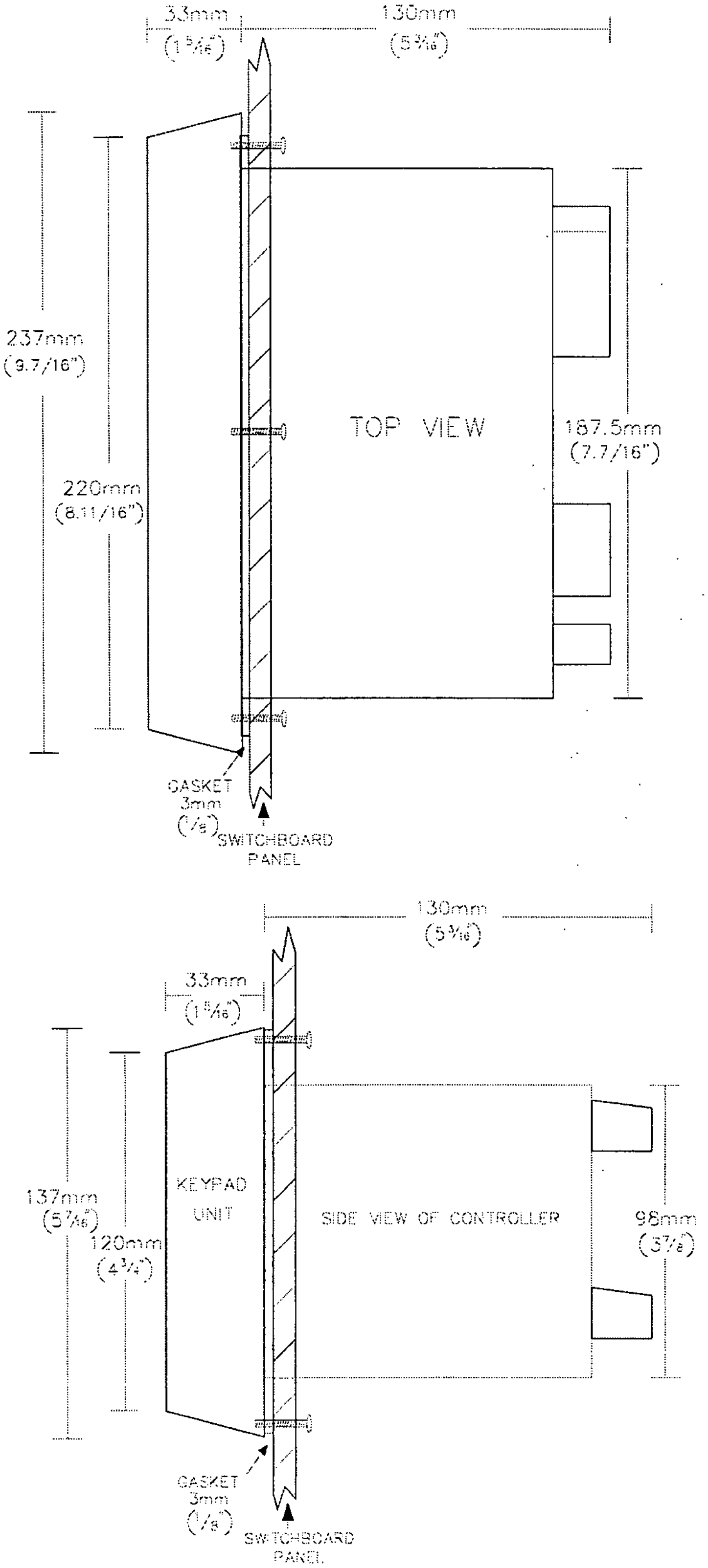



*Figure 30: Top and Side Views of a Panel Mounted MonitorPro*

# 5 Wiring the MonitorPro

**NOTE:**
If you are using an old controller, with hardware versions below 7.01, you must set certain DIP switches correctly in order for the unit to operate correctly. Please refer to MultiTrode's web site at www.multitrode.com for further information on configuring an old controller.

## 5.1 Rear Panel Layout—Overview

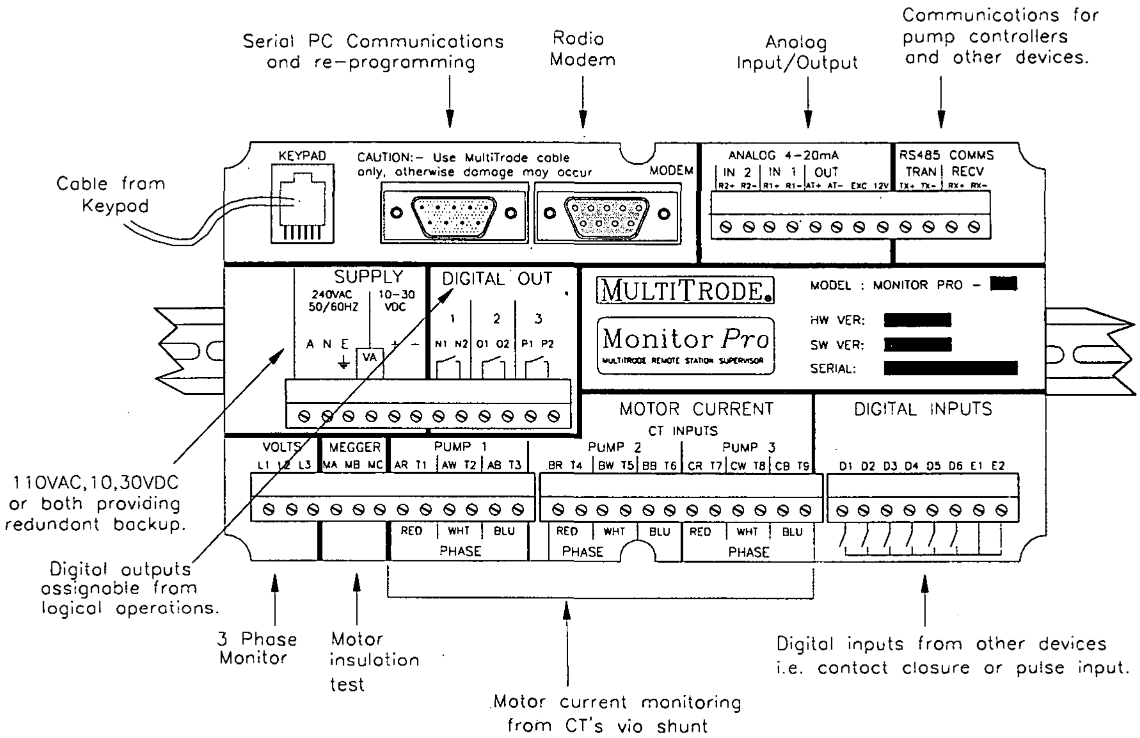



*Figure 31: Rear Panel Layout*

The following connections are available on the back panel of the MonitorPro, shown from left to right then top to bottom. Refer to the section of this manual as indicated for more information on any connection.

| | |
|---|---|
| Keypad Connector | Refer to Section 5.4 |
| 9 Pin Communications Interfaces | Refer to Section 5.13 and 5.14 |
| Analog Inputs and Outputs | Refer to Section 5.10 and 5.11 |
| RS485 Communications | Refer to Section 5.12 |
| Power Supply | Refer to Section 5.3 |
| Digital Outputs | Refer to Section 5.9 |
| Supply Voltage Monitoring connections | Refer to Section 5.5 |
| Insulation Resistance Testing Outputs | Refer to Section 5.6 |
| Motor Current Monitoring | Refer to Section 5.7 |
| Digital Inputs | Refer to Section 5.8 |

## 5.2 Wiring Diagrams

This section of the manual explains how to connect the wiring to the MonitorPro.

### 5.2.1 Standalone Wiring Diagram

Standalone mode is not commonly used. Refer to *Appendix D - Standalone Operation Mode* for information relating to standalone mode.

### 5.2.2 General Wiring Diagram

Figure 32 is the general wiring diagram when the MonitorPro is being used in the normal mode, with a pump controller. If a local area network of controllers is used, the same wiring diagram is used for each controller in the network.

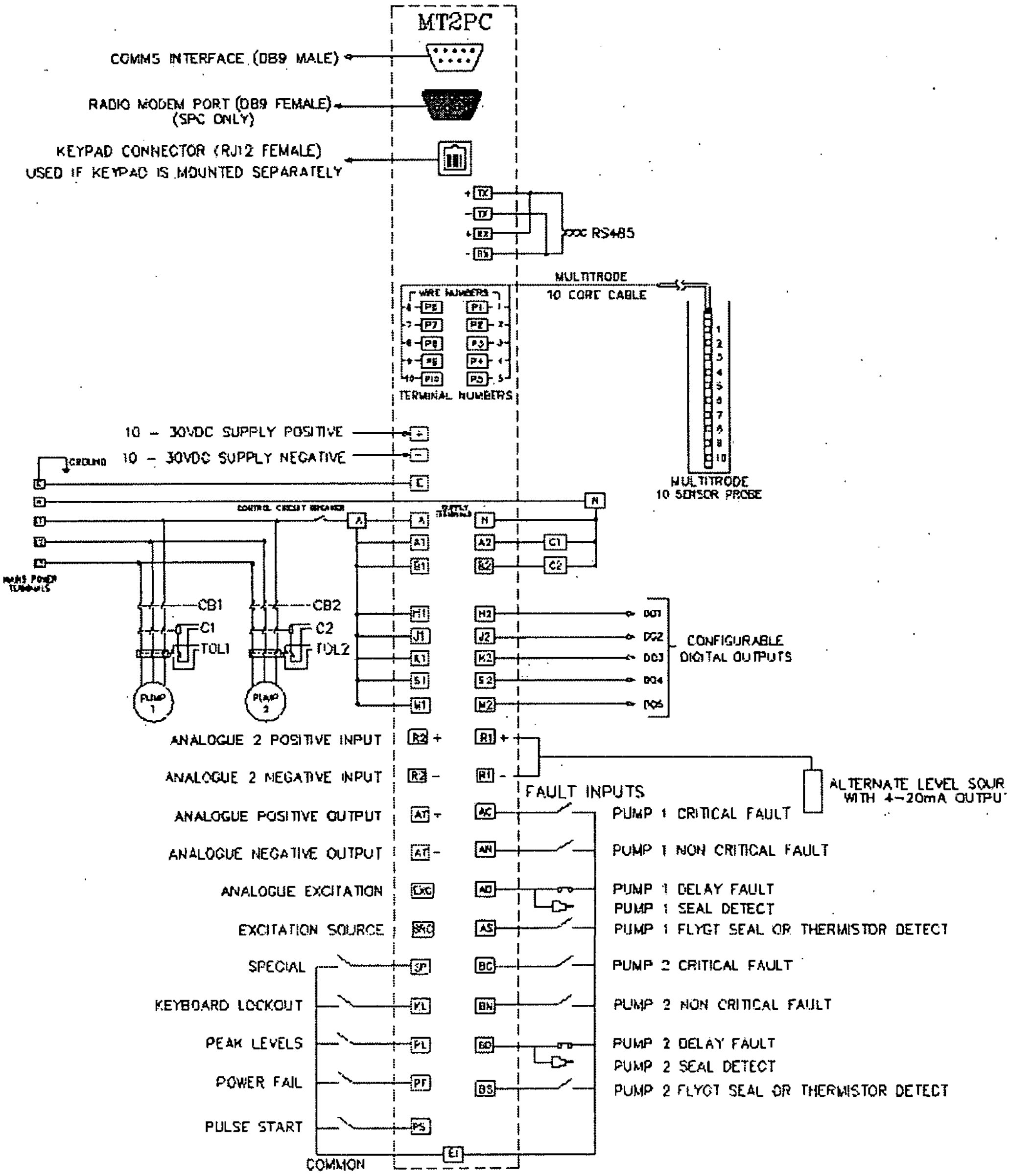
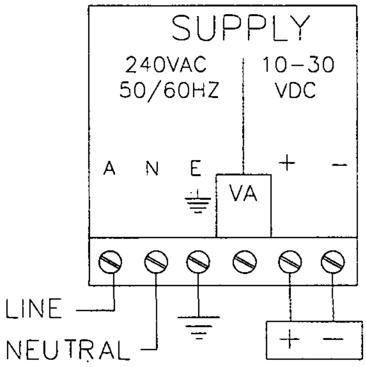



*Figure 32: General Wiring Diagram*

## 5.3 Power Supply

The MonitorPro is available in 240V (MonPro2) and 110V (MonPro3) versions, at 50/60Hz. Both may be optionally powered from a DC supply of between 10 and 30VDC.



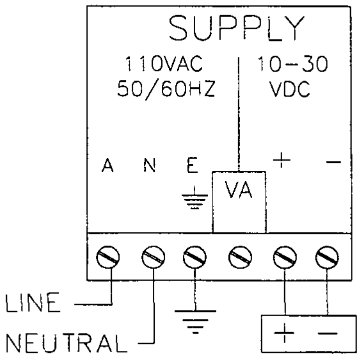




*Figure 33: Power Supply Connections*

Depending on what supplies are available, the MonitorPro can be powered by the AC or by the DC supply, or it may have both supplies connected simultaneously. If the DC supply is to be used as a backup, then use of a 12V battery is recommended, in conjunction with the MTTC Trickle Charger to keep the battery charged from the mains supply.

**NOTE:**
This is a negative-earth system. Ensure that the positive terminal of the battery, battery charger, and DC power supply are **not** earthed.

## 5.4 Keypad Connection

If the keypad is fitted to the controller for panel mounting, use the short cable supplied. If it is mounted separately, use the long shielded cable supplied.

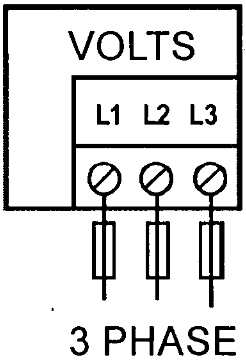



*Figure 34: Keypad Connections*

**NOTE:**
There is a connector on both the front and the rear of the controller; only one connector can be used at a time. Connect the shield earth wire from the keypad cable as shown in Figure 26. Also connect the earth terminal to the earth stud on the case as shown in Figure 26.

### 5.5 Three Phase Supply Connections

Connect each phase of the power line into these terminals. L1 refers to the RED phase, L2 the WHITE and L3 the BLUE.

These terminals are used for measuring the supply voltages to the pumps, not for powering the MonitorPro. The voltage measurements only work correctly if the supply frequency (50Hz or 60Hz) has been correctly configured. Refer to Section 7.9 for information on configuring the frequency.

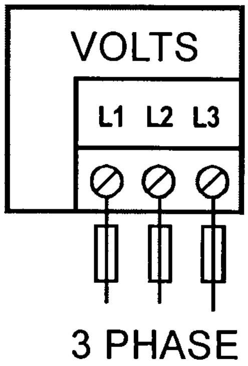



*Figure 35: Three Phase Supply Connections*

## 5.6 Motor Insulation Resistance Tester Connections

To allow the MonitorPro to measure the insulation resistance, wire one motor winding from each pump to these inputs.

The MonitorPro automatically performs insulation resistance measurements every time the motor is stopped. Therefore the motor must be configured so that when it is not running, the motor windings are connected in star or delta mode. If this is not the case, then some of the windings will not be tested.

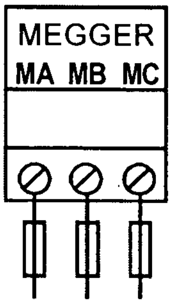



*Figure 36: Motor Insulation Connections*

**CAUTION:**
Follow manufacturers' guidelines regarding motor insulation testing where inverters and soft starters are used. If activated, the Insulation Resistance Tester will apply approximately 500VDC for a period of approximately 30 seconds each time the motor stops or shortly after. Refer to the MultiTrode web site at www.multitrode.com or contact MultiTrode for an Application Note that demonstrates methods to protect inverters in these conditions.

## 5.7 Motor Current Monitoring Inputs

To allow the MonitorPro to measure the phase currents, connect a MultiTrode SR1 or SR5 current shunt to an appropriate current transformer (CT). Then connect these to the corresponding pump terminals as shown.

For current transformers with a 1Amp secondary use an SR1.

For current transformers with a 5Amp secondary use an SR5.

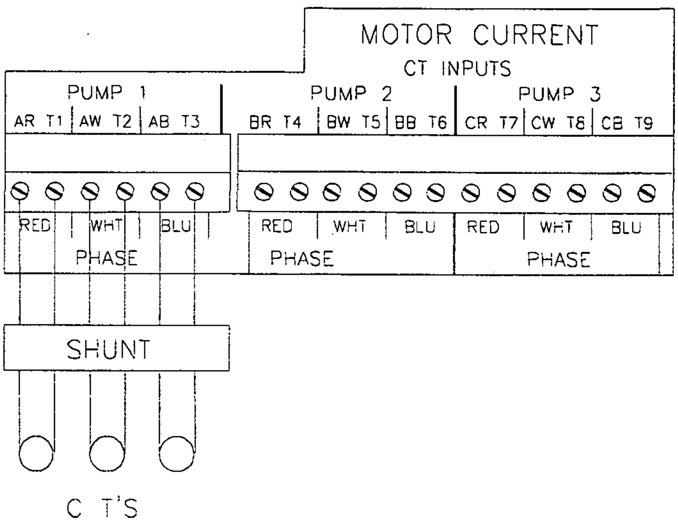



*Figure 37: Current Monitoring Connections*

**CAUTION:**
Mount the shunt (SR1 or SR5) as near as possible to the MonitorPro. It is recommended that the connections between the shunt and the MonitorPro be made with shielded twisted pair cable.

The current measurements only work correctly for 50Hz and 60Hz supply frequencies, and only when the MonitorPro has been configured to the correct frequency. Refer to Section 7.9—General Setup for information on configuring the supply frequency.

Refer to Section 7.3.4—CT Primary FLC for more information on choosing the appropriate Current Transformers. If Inverters are used, MultiTrode recommends placing the current transformers between the supply and the inverter, rather than between the inverter and the motors.

### 5.8 Digital Inputs

By wiring either Normally Open (N/O) or Normally Closed (N/C) inputs to these terminals, the MonitorPro can be configured to perform specific operations depending on the logical status of these inputs.

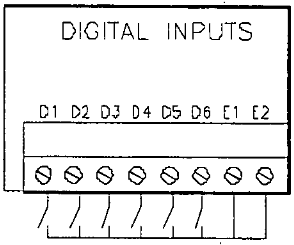



*Figure 38: Digital Inputs*

**NOTE:**
Voltage-free relay or switch contacts must be used for the inputs.

### 5.9 Digital Outputs

The MonitorPro can be used to control other devices by using the outputs. They are controlled individually depending on the configured operating conditions. These outputs are voltage-free relay contacts.

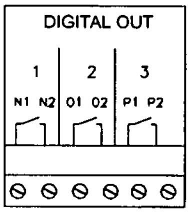



*Figure 39: Digital Outputs*

### 5.10 Analog Inputs

Industry standard 4–20mA inputs can be wired into the MonitorPro. The MonitorPro has two independent analog inputs. Two different methods are available for connecting analog devices. Select a method depending on the input device, and loop the power supply as shown in Figure 40.

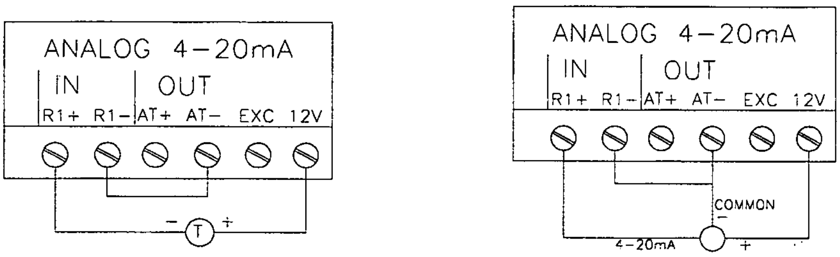



*Figure 40: Connecting Analog Inputs: MonitorPro Excitation*

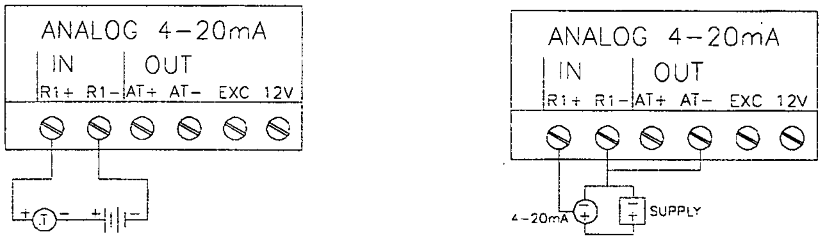



*Figure 41: Connecting Analog Inputs: External Excitation*

**NOTE:**

1. Analog input impedance = 75Ω.
2. If the analog input is to be wired as in Figure 41, it is preferable to earth the negative leg of the loop supply. Check the manuals of your transducer and power supply to determine if this will be acceptable.
3. For instruments using external excitation voltage, where the external source **is** tied to the controller ground (AT-), the excitation voltage of the device can be greater than 13.75VDC (e.g. 24VDC powered devices). If the external source **is not** tied to the controller ground (AT-), the positive analog input terminals (R1+, R2+) should not exceed 13.75V. In other words, the analog input common mode range is 0-13.75V referenced to ground, and the differential mode range is 1.5V (20mA x 75Ω).

**NOTE:**
If the device is connected in accordance with the two wire external excitation shown in Figure 41, then it may improve stability if the negative leg (R1-) of the supply is earthed.

### 5.11 Analog Outputs

Any external device which requires a standard 4–20mA analog input can be controlled from this output. As with the analog inputs, there are two different wiring configurations, depending on the application which is being used. If an external supply is used then it may not exceed 13.75V, as this could cause damage to the MonitorPro.

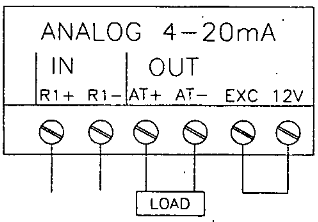



*Figure 42: Connecting Analog Outputs: MonitorPro Excitation*

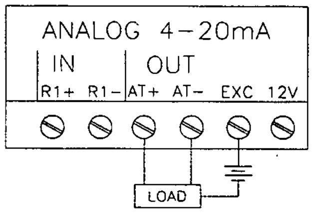



*Figure 43: Connecting Analog Outputs: External Excitation*

### 5.12 Connecting the MonitorPro on the RS485 LAN

To connect a MonitorPro on the RS485 LAN, tie the unit's TX+ and RX+ pins together and connect them to the TX+ and RX+ pins on all the other units. Connect the TX– and RX– pins similarly. Figure 44 illustrates this.

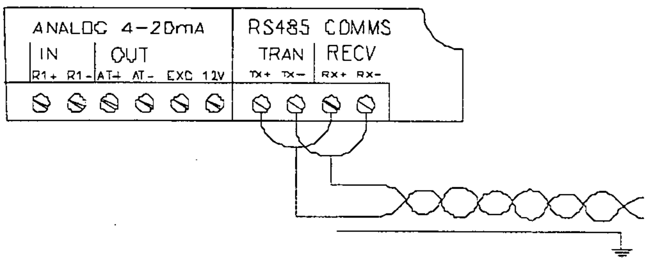



*Figure 44: Wiring Connections for the RS485 LAN*

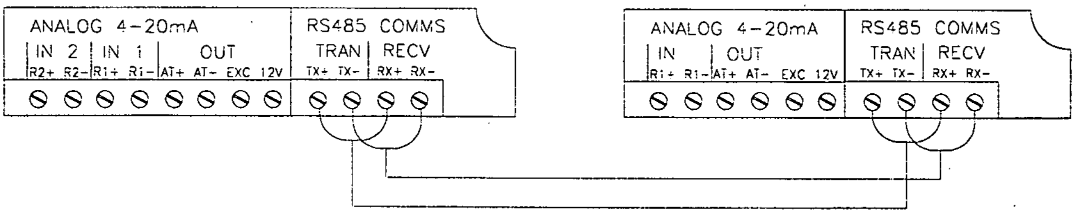



*Figure 45: Example of connection between a MonitorPro (left) and an MTxPC (right) via RS485*

## 5.13 Communications Interface Port

The Comms/RS232 port is used to:

- Upgrade the MonitorPro firmware (Section 8—Upgrading MonitorPro Firmware)
- Upload or download settings (Section 6.4—Settings Change Software Suite)
- Download data logs (Section 7.8—Data Logging)
- Connect to an approved digital radio for SCADA connectivity
- Connect to an approved PSTN modem for remote dial-in or alarm dial-out

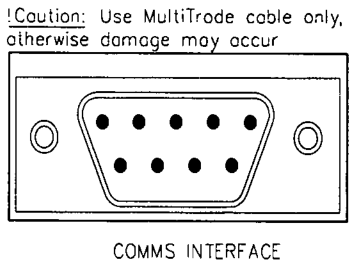



*Figure 46: Communications Interface Port*

**CAUTION:**
Using any cable other than the supplied MultiTrode connection cable may result in damage to the MonitorPro or laptop computer. Please refer to MultiTrode's web site at www.multitrode.com for further information on cables, including ordering information.

**NOTE:**
The Modem Port must not be connected to any devices while the Communications Interface Port is in use, or communications failures will result.

## 5.14 Modem Port

The Modem port is used to connect the MonitorPro to a MultiTrode-approved analog radio.

The following table shows the connection designations of the DB9 modem port. All wiring to the radio should be confirmed with the radio manufacturer.

| Pin Number | Function |
|---|---|
| 1 | Transmit—Audio out |
| 2 | Ground |
| 3 | Push to Talk—Tx Enable |
| 4 | Receive—Audio in |
| 5 | Not Connected |
| 6 | Not Connected |
| 7 | Not Connected |
| 8 | Not Connected |
| 9 | Not Connected |

*Figure 47: Table of Wiring Connections for the Radio Modem*

## 5.15 Port Configuration Options

The following diagrams show the possible options for use of the Communications Interface Port (CIP) and Modem Ports (MPs). Note that only one port can be connected at any one time. For example, at a radio-equipped site, the radio must be disconnected when the software upgrade or datalog download cable is connected.

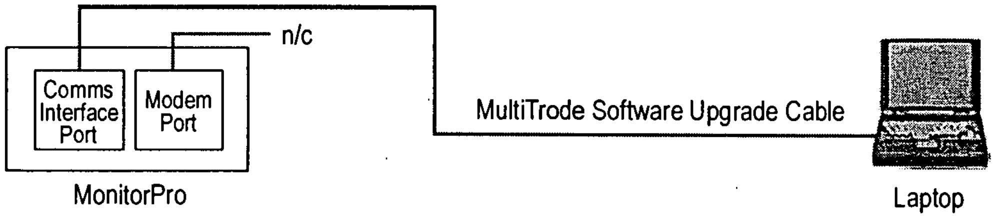



*Figure 48: Direct Connection of MonitorPro to Laptop for Settings Change or Datalog Download*

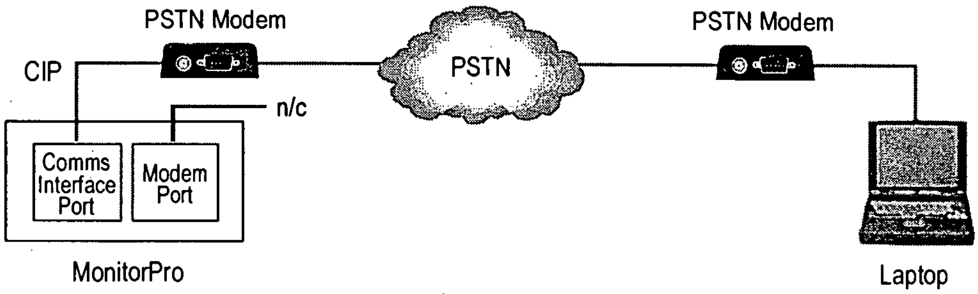



*Figure 49: Connection of MonitorPro to Laptop for Settings Change or Datalog Download, via phone lines with PSTN Modem at controller.*

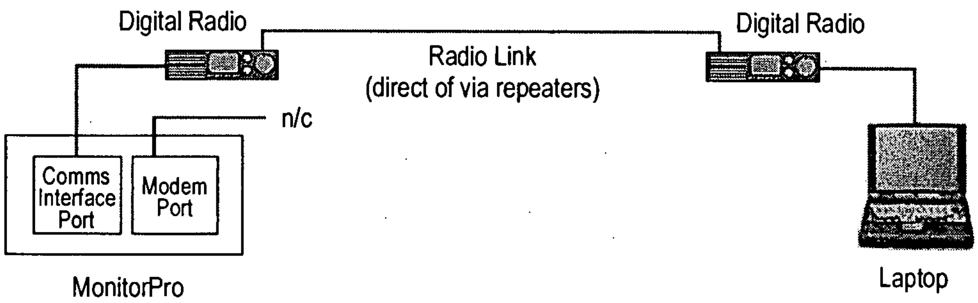



*Figure 50: Connection of MonitorPro to Central Monitoring Facility via Digital Radio.*

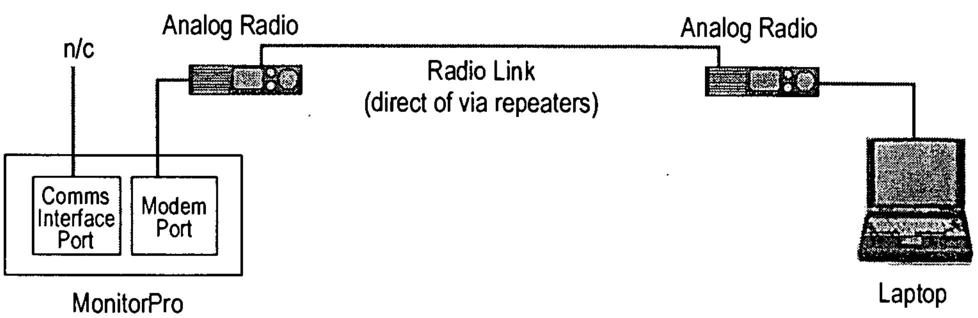



*Figure 51: Connection of MonitorPro to Central Monitoring Facility via Analog Radio.*

# 6 Menu Structure and Navigation

## 6.1 Changing and Saving Settings—Overview

There are three types of settings on the MonitorPro: Description, List and Numeric settings. Each of these setting types will be described separately in the following sections.

By way of example, the Digital Inputs screen, shown to the right, is a screen that has all three types of settings. (Further information about this menu can be found in Section 7.7.25—Digital Inputs.)

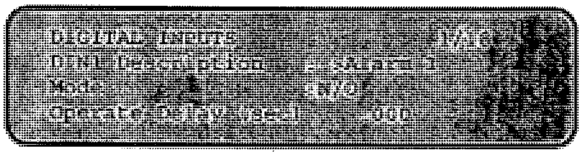


*Figure 52: Digital Inputs Screen, Illustrating Settings Types.*

### 6.1.1 Description Setting

The first setting in Figure 52, the DIN1 Description, is a description type setting. This setting contains user-entered text, used to describe a parameter for easier identification of events. To alter it, press ENTER. This example has the description "Alarm 1". By way of example to help describe how to edit this type of parameter, we show how to change it to "Alarm 2".

When you press ENTER, the parameter changes to edit mode with the first letter flashing. A flashing letter indicates the current location of the edit cursor. The left and right arrow keys (◂ and ▸) move the position of the edit cursor. The up and down arrow keys (▴ and ▾) alter the value of the character currently being edited.

For this example, since the first 6 characters are as required, press the right arrow until the "1" character is highlighted. To change this to the digit "2", just press the up arrow once. To complete this change and exit from editing the parameter, press the ENTER key once.

The available characters, in the order they will be displayed when you scroll through the characters in edit mode, are:

***space* # % & + , - / 0 1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z a b c d e f g h I j k l m n o p q r s t u v w x y z**

**NOTE:**
The list wraps around from "z" to space.

### 6.1.2 List Setting

The next setting in Figure 52, the mode, is a list setting. A list setting is a list of choices that you can select from. To change a list setting, press ENTER on the setting, then use the up and down arrows to browse through the displayed available options. When you have selected the desired option, press ENTER.

### 6.1.3 Numeric Setting

The final setting type in Figure 52 the operation delay, is a numeric setting. Numeric settings are similar to description settings, described above except you may only choose from the numerical characters. The size of the number that can be entered into some numerical fields is limited.

## 6.2 Saving a Setting Change

In any menu of the MonitorPro containing settings, returning to a higher level of menus produces the confirmation screen shown in *Figure 53* to the right.

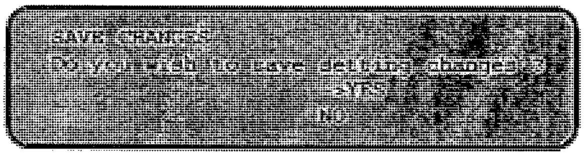


*Figure 53: Change Confirmation*

This menu gives you a last chance to undo any changes that have been made in the menu that was just exited from, or to confirm them by selecting the YES option. You select YES, then the unit will automatically reset when you return to the default display screens. The unit performs this reset to ensure that all calculations use the new configured values. The default selection is NO.

## 6.3 Common Functions

This section describes functions which are used throughout the range of MonitorPro features. They are listed here to reduce the complexity of the explanations through the remainder of the manual.

### 6.3.4 Operation Delay

The operation delay is measured in seconds. After initial detection, a fault must be present for this amount of time to be registered. This delay is intended to ensure that the fault detection is not due to electrical noise or an over-sensitive measuring device.

### 6.3.5 Reset Mode

The Reset Mode option allows you to determine the reset procedure for a fault. Options include allowing the pump to automatically reset after a configurable delay or to be manually reset. The complete list of options is:

- Auto Reset
- Auto—1 minutes
- Auto—5 minutes
- Auto—10 minutes
- Auto—30 minutes
- Auto—1 hour
- Manual Reset

## 6.4 Settings Change Software Suite

MultiTrode has produced a software suite for laptop computers called MTCDS—MultiTrode Control and Diagnostics Software. By connecting your laptop to the MonitorPro with the cable provided in the MTCDS kit, you can:

- Upload (From Laptop to MonitorPro) and Download (From MonitorPro to Laptop) settings.
- Upgrade your firmware version.
- Download data logs from MonitorPro for analysis on Laptop.

Refer to the MTCDS manual for more information. Please contact your local MultiTrode distributor for more information on MTCDS.

## 6.5 Menu Structure

Refer to section 2—MonitorPro Basics for information on how to navigate through the menu system.

If a sub-menu contains more items than can be displayed on the screen at one time, the first 3 settings are displayed, as shown in Figure 54.

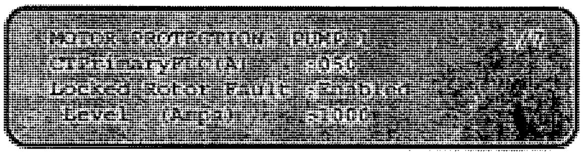


*Figure 54: First screen of multi-screen menu*

If the bottom parameter is selected and the down arrow key is pressed, the display will show the next screen in this menu, as shown in Figure 55.

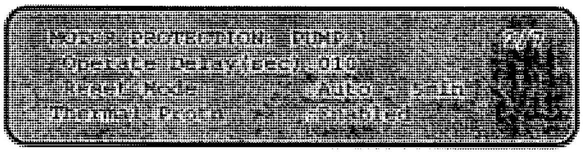


*Figure 55: Second screen of multi-screen menu*

**NOTE:**
The current screen and the number of available screens in this menu are shown in the top right corner of the display as shown above.

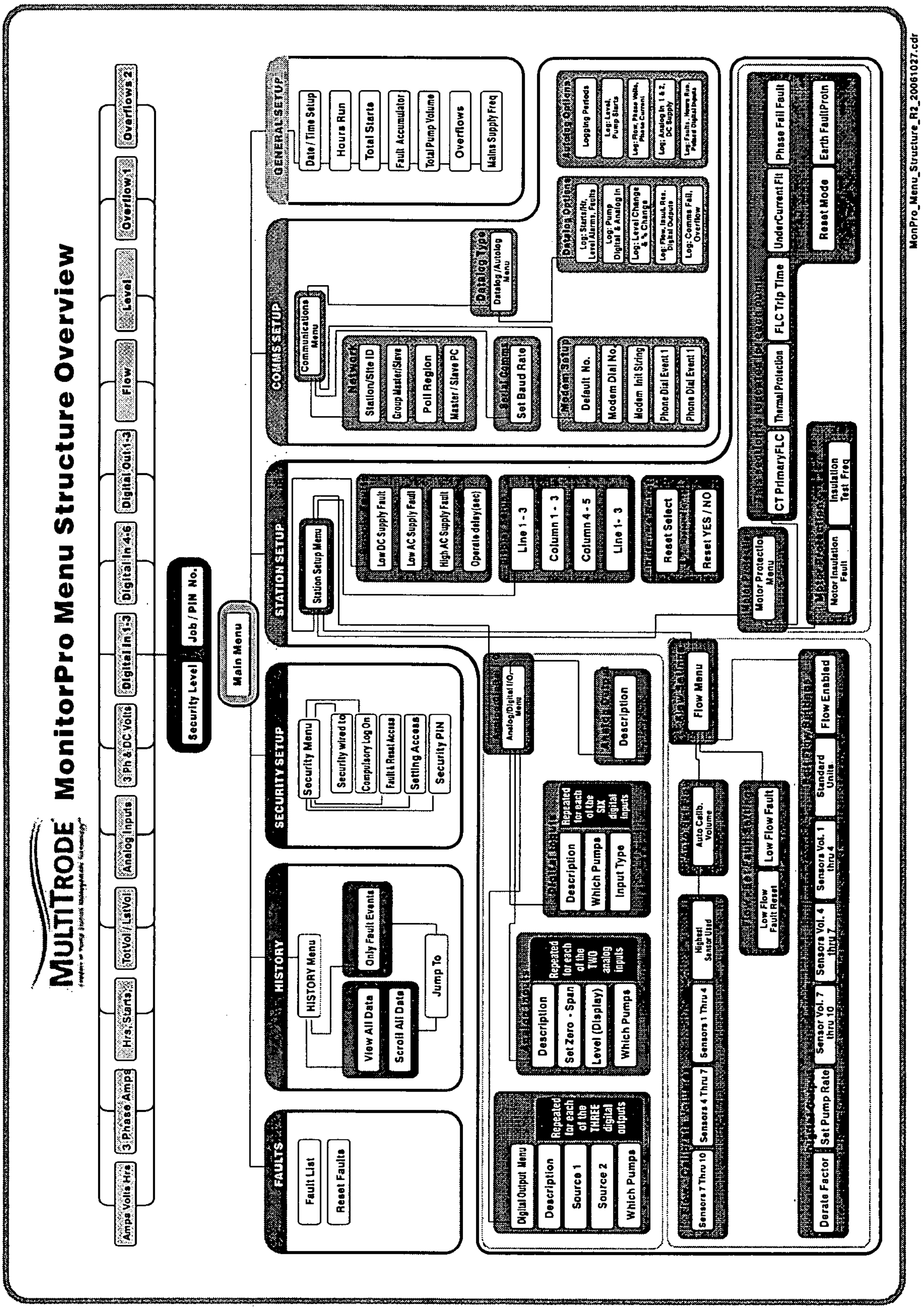



*Figure 56: Full MonitorPro Menu System Layout*

# 7 Commissioning

This chapter describes how to commission a MonitorPro when it is connected to an MTxPC pump controller.

**NOTE:**
Ensure you have read and understood all of the section Important Information, at the start of this manual before proceeding with commissioning.

**NOTE:**
For the MonitorPro to make accurate measurements of voltage and current, the correct mains frequency must be set. Refer to Section 7.9—General Setup for more information.

## 7.1 Modes of Operation

The MonitorPro is capable of a variety of modes of operation, by connecting to other MultiTrode MonitorPro's, MTxPC Pump Controllers, and SCADA systems. For more information on the advanced and less common modes of operation please refer to the MultiTrode web site at www.multitrode.com.

The desired mode of operation must be selected in the communications menu – again, refer to the MultiTrode web site for more information.

### 7.1.1 MonitorPro with Pump Controller

This is the most common mode of operation, and consists of one MonitorPro connected via an RS485 Local Area Network (LAN) to one MTxPC pump controller. This combination then may optionally be connected to a SCADA CMF via radio or modem. This manual deals primarily with this mode of operation. If this is your intended setup, proceed to Section 7.2.

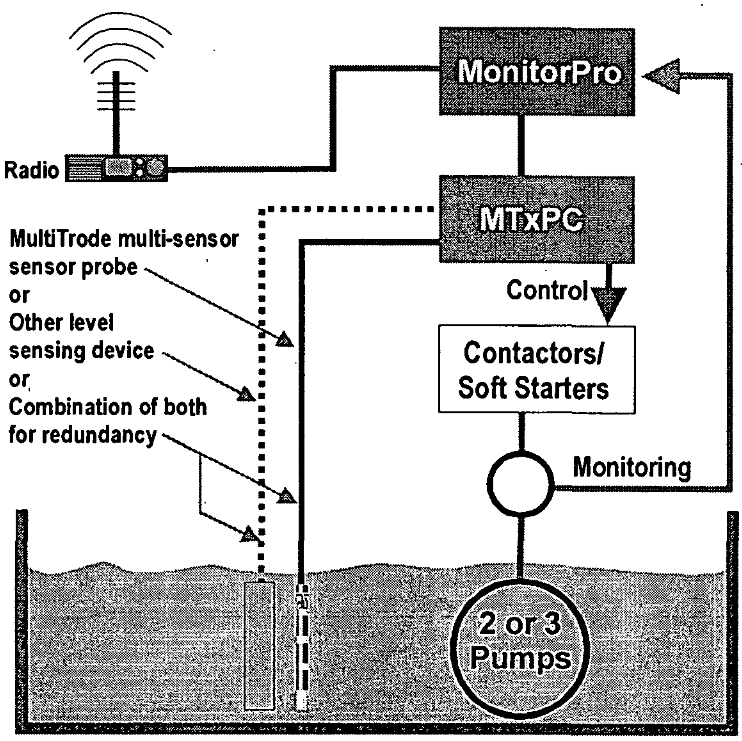



*Figure 57: Single Group Containing one MTxPC and one MonitorPro*

### 7.1.2 Group Operation of Multiple MonitorPro's & Pump Controllers

Up to 3 MTxPC units and 3 MonitorPro's can be connected on one LAN to allow pump control and motor protection for up to 9 pumps. All of the controllers work together in a hierarchical system, so only one radio is required, on the master MonitorPro, to connect the entire LAN group to the SCADA system. Additional controllers can be added, and controllers sorted into up to 3 groups, for complex operation. Please refer to the MultiTrode web site at www.multitrode.com for more information.

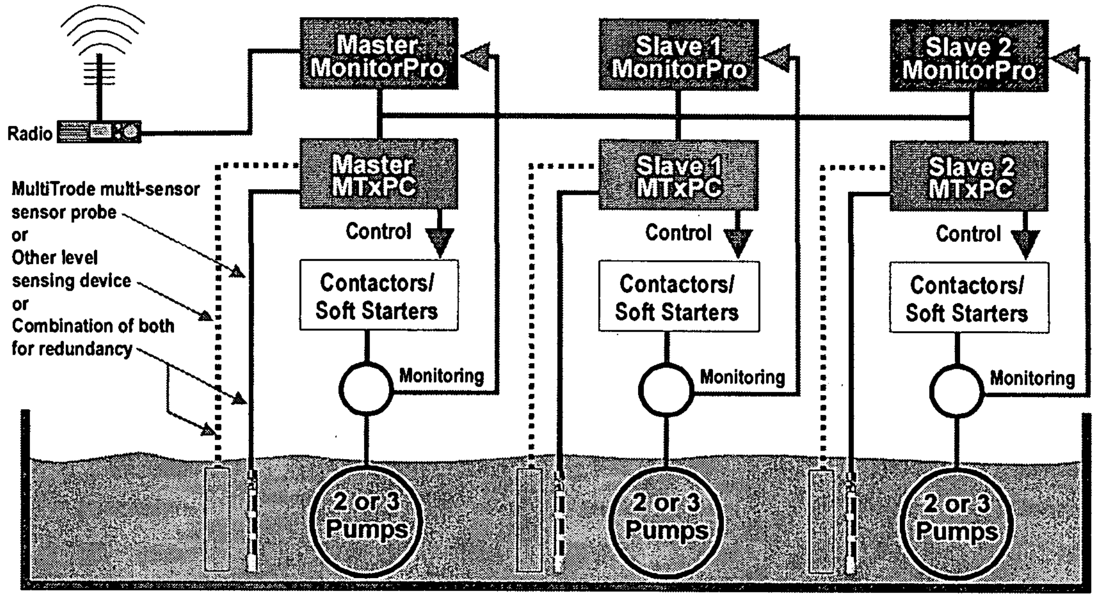



*Figure 58: Single Group Containing Master and Slave MTxPC units and MonitorPros*

### 7.1.3 Standalone Operation

In this mode the MonitorPro can provide all of the motor protection functionality, but without the need for an MTxPC pump controller controlling the pumps. This is the least common mode of operation, and as such is outside the context of the standard commissioning section of this manual. Most of the setup is standard in accordance with the rest of this manual. Refer to Appendix D for information relating to standalone mode.

## 7.2 Motor Insulation Resistance Testing

**NOTE:**
To allow the MonitorPro to test the insulation resistance of each motor, the MA, MB and MC terminals must be wired to the motors, as described in section 5.6—Motor Insulation Resistance Tester Connections

The insulation tests are operator configurable. To set them up, follow the menu selection sequence shown in Figure 59 through Figure 61 to enter the "General" menu for motor protection, shown in Figure 62.

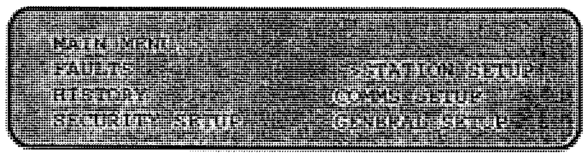



*Figure 59: Station Setup Menu*

## 7.3 Motor Protection

To access the individual motor protection functions, enter the Motor Protection Menu as in Section 7.2, but this time enter the "Pump 1" sub-menu.

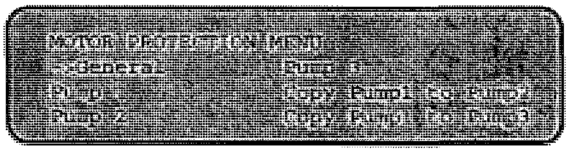



*Figure 65: General Motor Protection*

Each pump has motor protection individually configured. However, if two or three pumps are the same size, the values can be copied from one pump to the next. To do this, set up Pump 1 first, and then use the "Copy Pump1 to Pump2" or "Copy Pump1 to Pump3" menu options.

The following seven screens show the parameters you need to set up for each pump.

**CAUTION**:
MonitorPro only protects a motor against a given condition if:

- the condition is enabled for the motor concerned, and
- suitable parameters have been entered.

The parameters which may be entered are described in the following sections.

### 7.3.4 CT Primary FLC

CT Primary FLC is the effective Full Load Current of the Primary coil of the current transformer. In a standard installation where the CT and the shunt are matched and the motor cable is only passed through the CT once, this is read directly from the CT. If the installation is non-standard, use the following formula to calculate the value for this parameter:

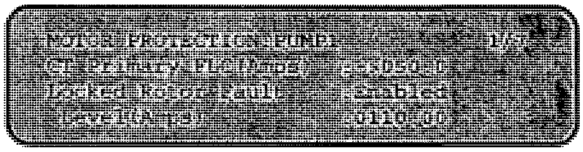



*Figure 66: Motor Protection Screen 1*

$$\text{CTPrimaryFLC} = \frac{1}{\text{Nr Passes}} \times \frac{\text{CT Primary}}{\text{CT Secondary}} \times \frac{\text{Shunt Input}}{\text{Shunt Output}} \times 50 \text{ mV}$$

Figure 67 –Non-standard installation formula

***Where:***

Nr Passes = Number of times the motor cable passes through the CT

CT Primary = CT Primary Coil FLC

CT Secondary = CT Secondary Coil FLC

Shunt Input = Shunt Input FLC. This is 5A for the MultiTrode SR5, and 1A for the MultiTrode SR1

Shunt Output = Shunt Output in millivolts. This is 50mV for all MultiTrode Shunts

e.g.: A motor with a low current draw has its cables passed twice though a 50A to 5A CT, which is connected to a 1A to 50mV shunt.

***The correct value to enter for the CTPrimaryFLC is:***

$$\text{CTPrimaryFLC} = \frac{1}{2} \times \frac{50}{5} \times \frac{1}{50} \times 50$$

Figure 68 –CTPrimary FLC formula

***That is, 5 amps.***

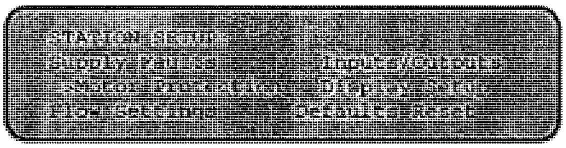


*Figure 60: General Motor Protection Menu*

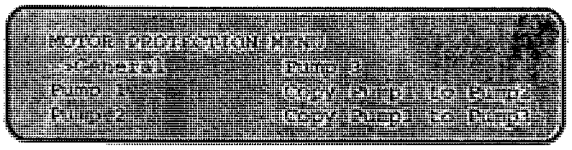


*Figure 61: Motor Protection Submenu*

The Motor Insulation Resistance Testing measurement measures the resistance between the motor windings and earth. Tests will only be performed if the first parameter on this screen, Motor Insuln Fault, is set to "Enabled".

The Level parameter sets the fault level for the Insulation Resistance Test. If a test is performed and the measured resistance is less than the level set in the Level (MOhm) parameter, a fault is registered.

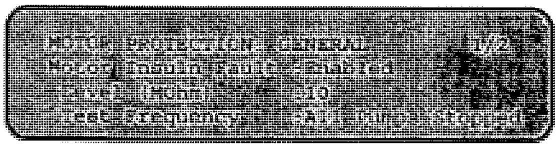


*Figure 62: Insulation Resistance Tester Screen 1*

The Test Frequency determines how often this test is performed, with the choices being:

- All Pumps Stopped (1 minute after each instance of all pumps being stopped)
- Daily (1 minute after the first time the pumps are all stopped after the current time each day)
- Weekly (1 minute after the first time the pumps are all stopped after the current day and time each week)

Once the Reset Mode is selected on screen 2/2 you have the option of performing an insulation test immediately. To do this, select Immediate Test.

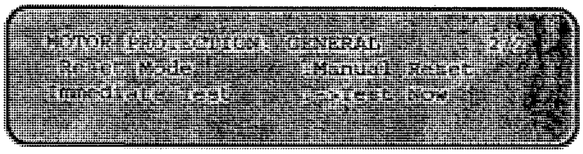


*Figure 63: Insulation Resistance Tester Screen 2*

Figure 64 shows the Immediate Test screen.

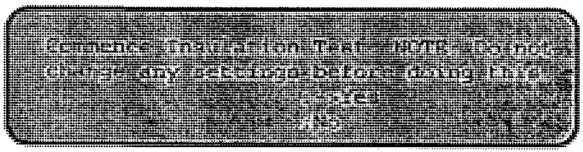


*Figure 64: Immediate Test*

**NOTE:**
When you perform a test, ensure that the pumps are not running, otherwise false readings will be obtained.

### 7.3.5 Locked Rotor Fault

Locked Rotor Fault enables or disables this condition.

If it is enabled, Level (Amps) is the current at locked rotor (and startup) condition. It should be read off the motor faceplate and in general is around $6\times\mathrm{FLC}$ (where FLC is the full load current).

The Operate Delay is the time for which the measured motor current must be above the value in the "Motor FLC" parameter, before the MonitorPro stops the motor. Remember to set the "Locked Rotor Fault" to "Enabled".

The Reset Mode enables the motor to restart after a specified time. The advantages of having automatic resetting of faults must be weighed against the risk of damaging the motor.

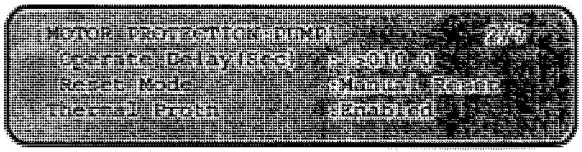


*Figure 69: Locked Rotor Protection Parameters.*

### 7.3.6 Thermal Protection

The MonitorPro Thermal Protection feature effectively works by measuring the total amount of energy going into the motor windings. Two values are entered and the MonitorPro uses these to calculate the thermal characteristics. These values are Motor FLC and 6xFLC Trip Time.

The Motor FLC should be read off the faceplate and is simply the current at full load. The time should come from the manufacturer's details. If this is not available in the form of a 6xFLC value (e.g., shown as 7.5xFLC), refer to the discussion of thermal motor protection theory on the MultiTrode web site at www.multitrode.com

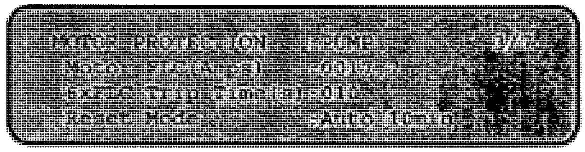


*Figure 70: Thermal Protection Parameters.*

### 7.3.7 Undercurrent

The undercurrent condition occurs when there is no pressure, for example, either because the well is pumped dry or the impeller has broken. In both these instances, the pump can be damaged. The Level (Amps) value should be around half of full load current, and the operate delay around 10 seconds. The Reset Mode for the undercurrent fault is set on screen 5/7, shown in Figure 72.

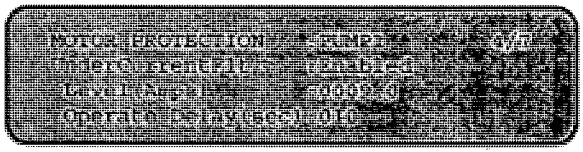


*Figure 71: Undercurrent Protection Parameters*

### 7.3.8 Phase Asymmetry

Phase magnitude symmetry is monitored on the MonitorPro. A phase asymmetry condition occurs when the difference between any two phases exceeds the set percentage of the thermal overload current. Once the phase asymmetry condition is met the relative magnitude of the phases indicates the type of fault condition, phase failure or earth fault.

These two fault conditions use a common trip level and trip time setting, which are set on the phase failure screen. They are displayed on the earth fault screen but may not be changed there.

Around 10–15% is the preferred deviation, but this may cause nuisance trips where the supply is variable.

### 7.3.9 Phase Asymmetry—Phase Failure Protection

If the phase asymmetry condition is met and one of the phases has **dropped** relative to the other two phases then a phase failure condition is present.

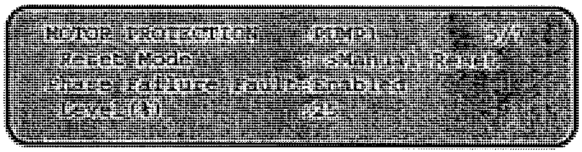


*Figure 72: Undercurrent and Phase Failure Parameters.*

Example: A motor has a full load current of 10A, and the level (%) is set to 25. When a single phase drops in current from 10A to 6A with the other two phases equal to 9A the Phase Asymmetry, Phase Failure Fault is tripped. 25% of 10A represents a 2.5A margin which is exceeded by the 3A difference in this case.

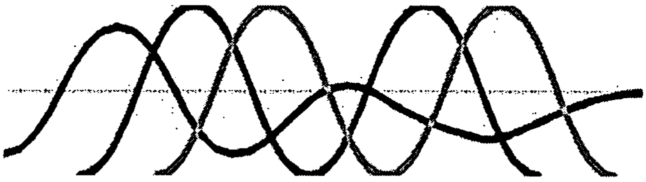


*Figure 73: Illustration of Current Levels during a Phase Failure Fault*

### 7.3.10 Phase Asymmetry—Earth Fault Protection

If the phase asymmetry condition is met and one of the phases has **increased** relative to the other two phases then an earth fault condition is present. Remember that Level (%) and Operate Delay (sec) are set on screens 5/7 and 6/7 but are displayed on screen 7/7 for information.

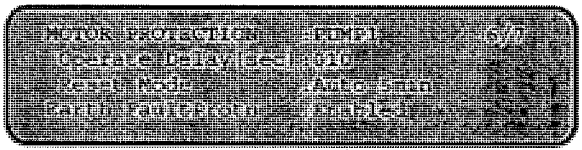


*Figure 74: Phase Failure Parameters*

Example: A motor has a full load current of 10A, and the Level (%) is set to 25%. If a single phase increases in current from 9A to 15A with the other two phases still equal to 9A, the Phase Asymmetry Earth Fault is tripped. 25% of 10A represents a 2.5A margin which is exceeded by the 6A difference in this case.

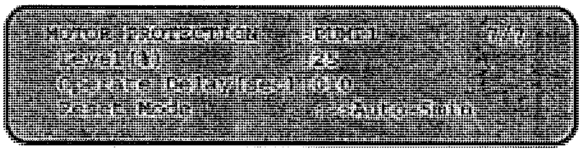


*Figure 75: Earth Fault Parameters*

### 7.3.11 Example for 11kW motor

Suppose an installation has an 11kW motor and suppose the windings are connected via a CT050 and an SR5. The following screen shots illustrate a typical set of appropriate parameters.

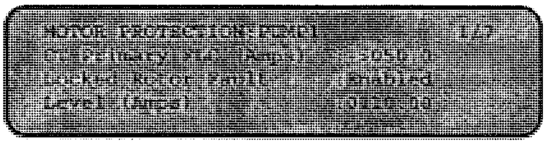



*Figure 76: Motor Protection screen 1*

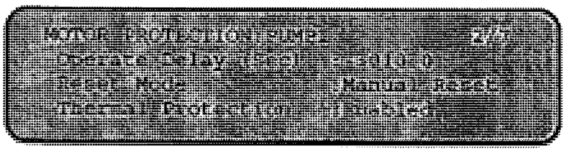



*Figure 77: Motor Protection screen 2*

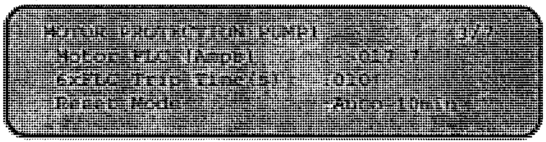



*Figure 78: Motor Protection screen 2*

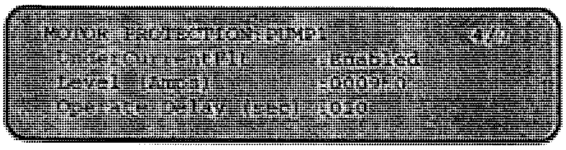



*Figure 79: Motor Protection screen 2*

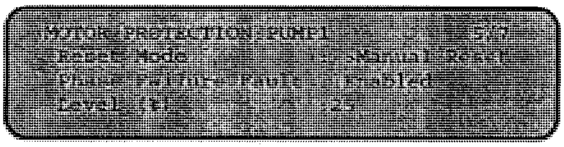



*Figure 80: Motor Protection screen 2*

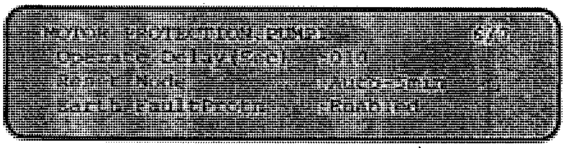



*Figure 81: Motor Protection screen 2*

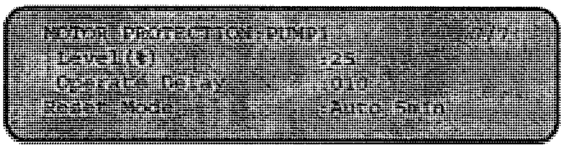



*Figure 82: Motor Protection screen 2*

## 7.4 Supply Fault Protection

The MonitorPro continually monitors the three-line voltages and the backup DC battery voltage. The Supply Faults menu under STATION SETUP allows protection against under voltage, over voltage and low battery (i.e., DC) voltage conditions.

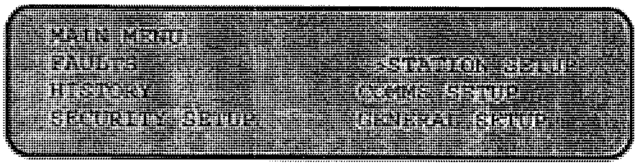



*Figure 83: Main Menu*

The MonitorPro has the ability to monitor the three line voltages and the backup DC battery voltage. To set up these options first enter the Station Setup Menu from the main menu. Then select the Supply Faults sub-menu.

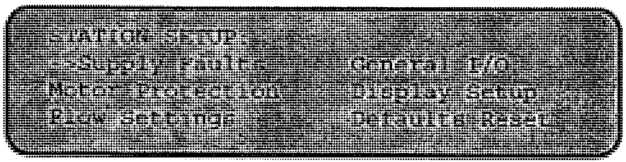



*Figure 84: Station Setup Menu*

### 7.4.12 Supply Faults 1: Low DC Supply

The first screen determines whether a Low DC Supply Fault can be registered.
If so, it also requires a voltage level. If the supply drops below this voltage, a DC supply fault condition is registered.

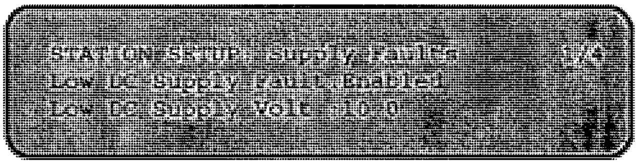



*Figure 85: Low DC Fault Protection*

### 7.4.13 Supply Faults 2: Low and High AC Supply

**NOTE:**
The voltage measurements only work correctly for 50Hz and 60Hz supply frequencies, and the MonitorPro must be configured for the correct frequency. Refer to Section 7.9 for information on configuring the frequency.

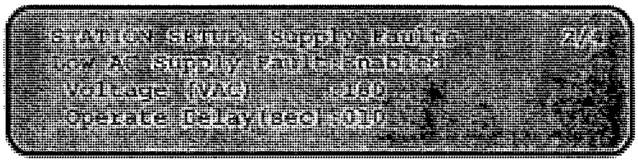



*Figure 86: Main Menu*

Screens 2/4 and 3/4 determine trigger points for Low and High AC Supply Faults.

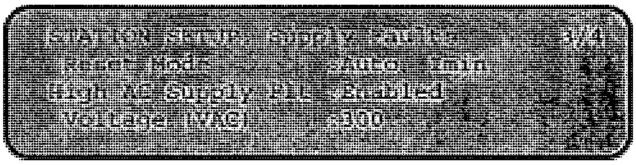



*Figure 87: Station Setup Menu*

The format of parameters for Low AC Fault, shown in Figure 86, is as follows:

`Low AC Supply Fault:` Enabled or Disabled.

`Voltage (VAC):` If the voltage falls below this value, a fault is registered.

The format of parameters for High AC Fault, shown in Figure 87 corresponds exactly. Low and High AC Supply Faults both require Operate Delay and Reset Mode (for the High AC Supply Fault, these are on screen 4/4, not shown). For information on configuring these see Sections 6.3.4—Operation Delay and 6.3.5—Reset Mode.

## 7.5 Volume and Flow Rate Setup

The MultiTrode MonitorPro performs volume and flow rate calculations without the need for an external flow meter. There are two general methods for doing this.

### 7.5.14 Method 1 – Volume based flow calculations

This method times the level changes in the well and, based on the volume contained in the level sensor differentials, estimates the inflow and outflow rates and the volumes pumped. This method only operates in discharge mode. This will be the preferred method for sewer pump stations.

**NOTE:**
When volume based flow measurements are set up for the first time, the MonitorPro requires 2 complete uninterrupted fill and empty cycles before it is able to display measurement results.

### 7.5.15 Method 2 – Standard flow rates

Where the level changes are very slow, such as in water reservoirs, a second method can be used. This method is based on the user entering the standard flow rates for the pump and simply multiplying the time that the pump is on by the flow rate to estimate volume. As well, there are de-rating factors, which can be entered to set the amount by which the flow rate is reduced when multiple pumps are running. This method will operate in both charge and discharge modes and will be the preferred method for water applications.

**NOTE:**
From Version 7.7 onwards (release date December 2002), the volumetric calculations include an averaging function, the user sets the number of pump cycles over which to average the flow calculations.

### 7.5.16 Flow Setup

This section of the manual will only cover the procedure required to set up Flow Rates on the MonitorPro. For the theory on how the MonitorPro flow calculations work, and examples on the calculations, refer to the MultiTrode web site at www.multitrode.com.

To enter the flow calculations menu, go to the Main Menu, select Station Setup and press ENTER.

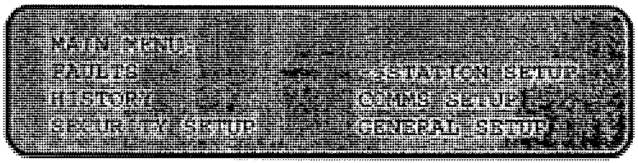



*Figure 88: Main Menu*

Select Flow Settings and press ENTER.

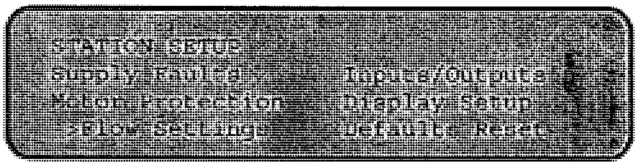



*Figure 89: Main Menu*

Then select Edit Flow Settings and press ENTER.

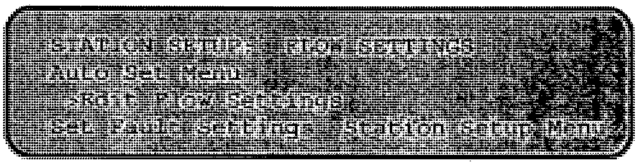



*Figure 90: Main Menu*

### 7.5.17 Volumetric Flow—Sewer Applications

In order to calculate flow rates using the volumetric method, the MonitorPro only requires the well dimensions. The seven screens in Figure 91 through Figure 97 show the setup required.

Set Flow Enabled to "Enabled – Normal" and set Use Set Rates to "Disabled" as shown in Figure 91.

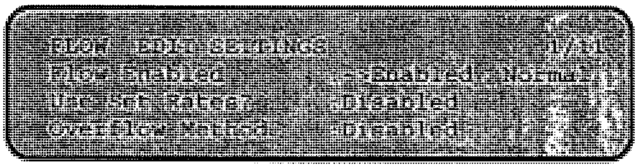



*Figure 91: Flow Settings for a Sewer Application*

Then enter the volumetric information, as illustrated in the remaining screens.

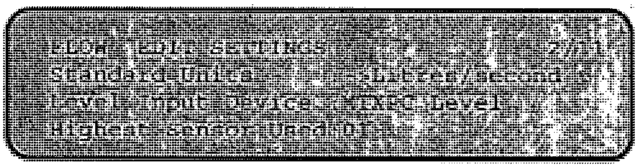



*Figure 92: Sewer Application Flow Settings - Screen 2*

Calculate the volumes by multiplying the cross-sectional area by the distance between sensors.

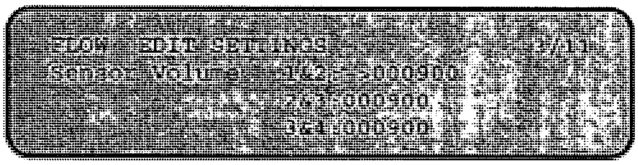



*Figure 93: Sensor Volumes – Screen 1*

For example, with a 3m x 3m square well, and a standard MultiTrode probe (0.1m between sensors), the volume between sensors 1 and 2 is: **3.0 x 3.0 x 0.1 = 0.9m$^3$**
That is, 900 litres, as entered for Sensor Volume 1&2 on screen 3/7.

Examining this screen further, and screens 4/7 and 5/7, we note that this figure of 900 litres is constant for most of the well depth, until it tapers in towards the bottom, to 820 litres, 780 litres and 700 litres.

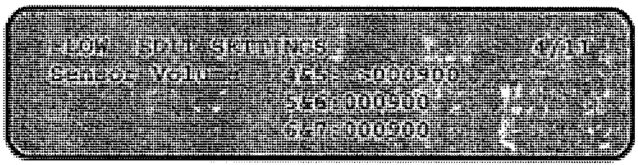



*Figure 94: Sensor Volumes – Screen 2*

The de-rating factors are not used for volumetric calculations.

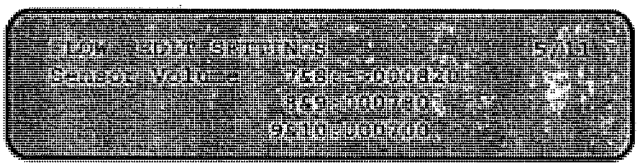



*Figure 95: Sensor Volumes – Screen 3*

In version 7.7 and later the Outflow Avg (cycles) is required. This parameter is used to average the flow rates across a user-defined number of cycles.

*Note: This screen is repeated for Pumps 4-6 and Pump 7-9.*

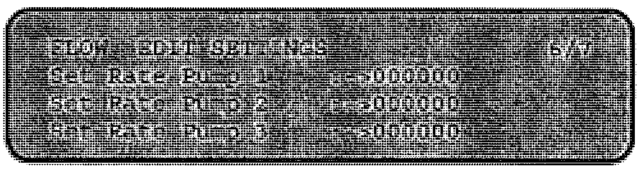



*Figure 96: Set Rates*

MultiTrode recommends averaging flow rates over 10 to 20 cycles.

*Note: Screens 10 and 11 are not applicable in volumetric calculations.*

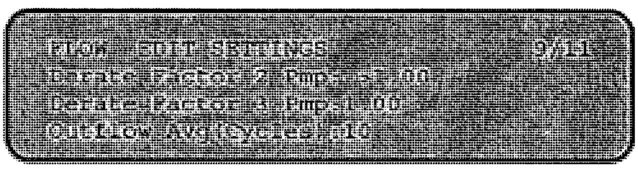



*Figure 97: De-rating Factors*

### 7.5.18 Set Rates—Water Applications

For a water application, use the "Set Rates" function. The first screen is set up slightly differently from a sewer application: Flow enabled is set to "Enabled – Fixed Rate", and Use Set Rates is set to "Enabled".

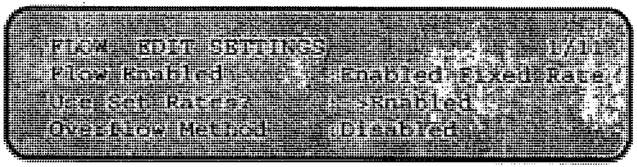



*Figure 98: Water Application Flow Settings – Screen 1*

The volume entries are not used for the "Fixed Rate" calculations. Notice that they are zero in these sample screens.

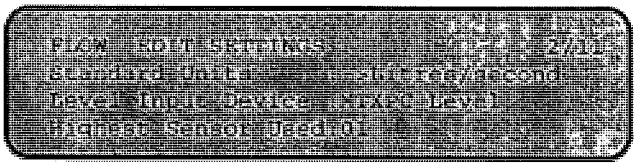



*Figure 99: Water Application Flow Settings – Screen 2*

In screen 6 the flow rates of the pumps are set up. If required, the derating factors for multiple pumps running can be set up in screen 7.

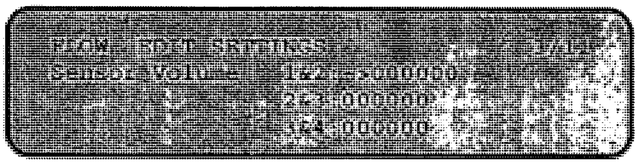



*Figure 100: Sensor Volumes*

The derating factor is the multiplier that will be applied to each pump when one or more pumps are running. When only one pump is running, the system will assume that it will pump at the set rate programmed.

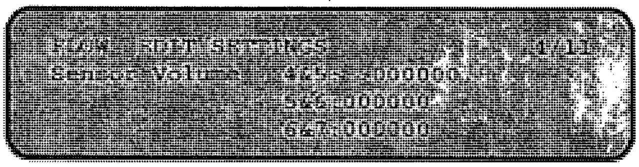



*Figure 101: Sensor Volumes*

If two pumps are running, due to restrictions imposed by the hydraulic network, the total pump rate will not be the sum of the two individual pump rates, but instead will be the sum of the individual pump rates, multiplied by the Derate Factor 2 Pmp parameter.

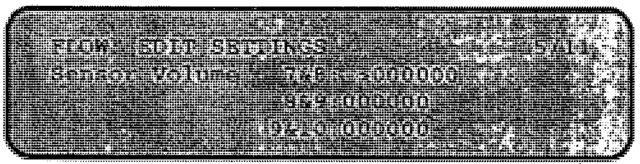



*Figure 102: Sensor Volumes*

Similarly, when three pumps are running, the total pump rate will be the sum of all three pump rates, multiplied by the Derate Factor 3 Pmp parameter.

*Note: This screen is repeated for Pumps 4-6 and Pump 7-9.*

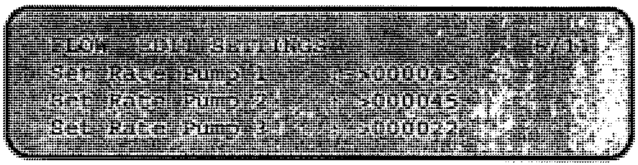



*Figure 103: Set Rates*

For version 7.7 and later the Outflow Avg (cycles) is required. This parameter is used to average the flow rates across a user-defined number of cycles.

*Note: The derating factor for Pumps 4-6 and Pumps 7-9 are contained in screens 10 and 11.*

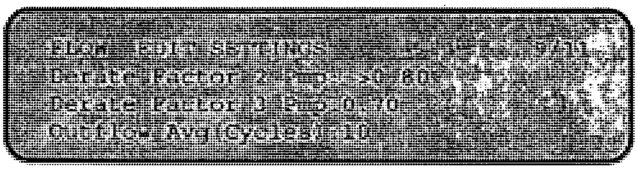



*Figure 104: Derating Factors*

### 7.5.19 Important Notes Regarding Flow Measurements

#### 7.5.19.1 Note 1 – Removing MultiTrode Probes for Cleaning

If you remove a probe (for cleaning or maintenance) from a pit that is using the flow calculations you must follow one of these procedures:

Pump out the pit and make sure it is empty (below the lowest sensor) before removing or inserting the probe; or

Disable the flow calculations (in the menus) before removing the probe and re-enable them after re-inserting the probe.

If you do not follow one of these methods then inaccurate flow calculations could be recorded due to the apparently rapid change in level.

#### 7.5.19.2 Note 2 – Value Logging

The MonitorPro keeps track of the rate at which each pump, and combination of pumps, are running. At some instant of time the MonitorPro might have the following values:

- Pump 1, 170 litres/second
- Pump 2, 220 litres/second
- Pump 3, 160 litres/second
- Pump 1&2, 300 litres/second
- Pump 1&3, 260 litres/second
- Pump 2&3, 0 litres/second
- Pump 1&2&3, 0 litres/second

A combined pump rate of 0 indicates that the site has never had this combination of pumps running.

For the three individual pump rates the first time these values are calculated (which is actually an average over 16 sensor volumes) it will store them as benchmarks. At any time in the future the current rate can be read by SCADA and compared against this initial value to check on degradation in pump performance over time.

Whenever the station changes status from no pumps running to a pump running the MonitorPro will data log the current station inflow (if flow data logging is enabled). These values can be used to check the inflow at various times during the day and for long term station trending of the inflow.

When a pump or combination of pumps stop, the MonitorPro will log the last volume pumped out by each of the pumps that turned off as well as the station outflow (if flow logging is enabled). From these values a complete picture of the pump station performance can be re-constructed.

#### 7.5.19.3 Note 3: Flow Calculations on Networked Controllers

All flow calculations operate with up to three pumps. The flow calculations are not suitable for use with slave MonitorPro's and Pump Controllers.

#### 7.5.19.4 Note 4: Analog Input Level Device

If an analog (4–20mA) device is used as the level sensing device on the MTxPC, the MonitorPro will scale the analog range into appropriate probe sensor points.

#### 7.5.19.5 Note 5: Flow Faults

Select the Flow Settings sub-menu and then the Set Fault Settings option.

In this sub menu, configure values of all pumps for their Low Flow Level and choose if the Low Flow Rate Fault should be enabled or not. The fault has an Operation Delay and a Reset Mode option.

#### 7.5.19.6 Note 6: Indication of Flow Status

On the default display, various statuses can be displayed:

| | |
|---|---|
| Station total volume | Total volume pumped out of the station |
| Station total inflow | All pumps are off, as each sensor was passed, the inflow rate is calculated over that sensor |
| Station total outflow | The Station outflow as each sensor is passed (while the pumps are off, last calculated outflow is displayed) |
| Pump total volume | Total volume pumped for the particular pump |
| Pump last volume | Volume pumped out during last activation |
| Pump rate | Rate at which the last volume was pumped |

## 7.6 Communications Setup

### 7.6.20 MultiTrode Networking Basics

MultiTrode controllers have the ability to communicate with other MultiTrode controllers, and to a Central Monitoring Facility (CMF), to allow a network to be constructed for monitoring and control.

For detailed information on MultiTrode networking, Appendix C – The Communications Network.

#### 7.6.20.1 Basic Concept

The CMF communicates with all sites, and can monitor and control all sites via the communications link, either radio or phone lines. Most information available on site is visible at the CMF, and all control functions, apart from resetting critical faults, are available to the CMF operator.

#### 7.6.20.2 Definitions

| | |
|---|---|
| CMF | Central Monitoring Facility—the personal computer running the MultiTrode Outpost software package, which monitors and controls all sites on the network |
| Site ID | Each site on the network must have a unique identifier, the Site ID. The Site ID is a number between 0011 and 9999. |
| Group ID | Within a Local Area Network, individual controllers can be separated into Groups, to allow complex functionality. |
| Master / Slave | The primary MonitorPro at a site is designated the "Master". This is the MonitorPro that will have the radio or modem connected to it. The other two (maximum) MonitorPro's at that site will be designated as "Slave 1" and "Slave 2", and have no radio or modem communications abilities, and limited control functionality. |

### 7.6.21 The Communication Menus

The Communications menu can be found as a sub-menu of the main menu. Each sub-menu will be discussed individually. A brief explanation and recommended value for each setting will be given

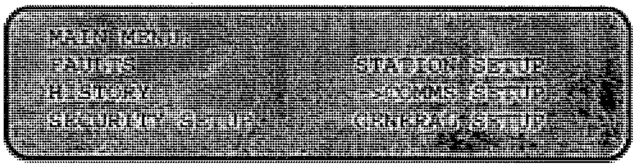



*Figure 105: Main Menu*

These settings will allow a single group of MonitorPro's and Pump Controllers to communicate with the CMF. For more complex arrangements of groups, refer to the MultiTrode web site at www.multitrode.com.

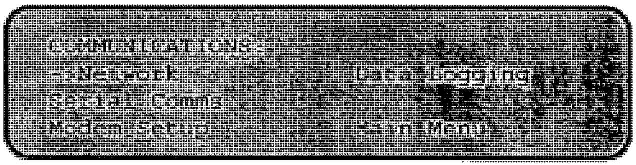



*Figure 106: Communications Menu*

### 7.6.22 Network Setup

The Network Menu contains all the settings which configure the way the MonitorPro in question is to be connected to the rest of the pumping network.

Station/Site ID should be set to the ID assigned by the network plan. This will be a 4-digit number between 0011 (default), and 9999 . Refer to the MultiTrode Outpost manual for more information.

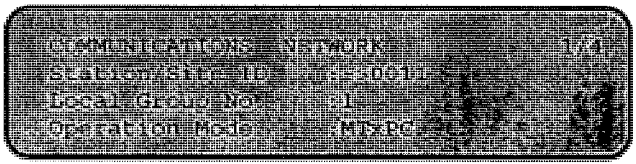



*Figure 107: Network Setup Screen 1*

For a normal installation with one MonitorPro and one MT2PC connecting to the CMF via a radio link, the Station/Site ID is the only parameter that must be set up to enable the MonitorPro to communicate on the Outpost SCADA network. If an MT3PC is used with the MonitorPro, set the Master PC to "3 Pumps" on screen 4/4 (Figure 110).

Proceed to Section 7.6.23 below if your installation is standard, or continue in this section for specific communications parameters.

Local Group No. should be set to 1 for a basic network. For more information on groups, refer to the MultiTrode web site at www.multitrode.com.

Operation Mode can be selected as either "MTxPC" (default), "Standalone", or "MTxPC with Backup". For a normal installation, this should be set to "MTxPC". For more information on "Standalone" and "MTxPC with Backup" modes of operation, refer to Appendix D and the MultiTrode web site at www.multitrode.com.

Group Master/Slave will determine whether this MonitorPro is the Master, the Slave 1 or the Slave 2 within its group. Only one of each type can be present in a single group. For a single MonitorPro, or for the MonitorPro that is connected to the radio in a group system, this should be set to "Master" (default)

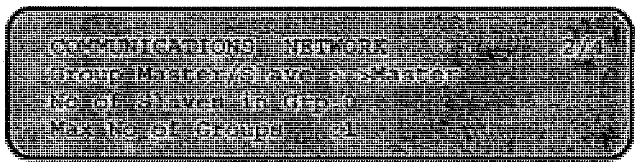



*Figure 108: Network Setup Screen 2*

For a network of MonitorPro's, set the first controller to "Master", the second to "Slave 1" and the third (if present) to "Slave 2".

No of Slaves in Grp tells the Master MonitorPro how many Slave MonitorPro's are connected to it on this LAN, either 0 (default), 1 or 2. Max No of Groups should be set to the highest group number present in the LAN connected to the MonitorPro being programmed.

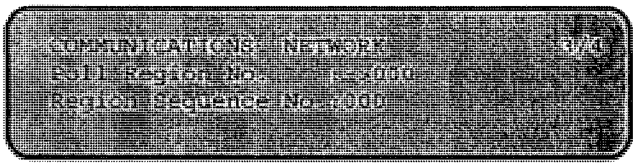



*Figure 109: Network Setup Screen 3*

Poll Region No. will determine the Polling Region for quick-poll scans by the CMF. If quick-polling has been enabled at the CMF, refer to the CMF administrator to determine whether this site has been put into a quick poll region, and the region number if applicable.

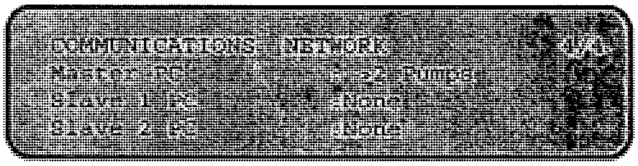



*Figure 110: Network Setup Screen 4*

Region Sequence No. is the sequence of this site within the quick poll region. If either this parameter or the Poll Region Number is set incorrectly, communications errors will occur.

The Master PC, Slave 1 PC, and Slave 2 PC parameters determine what sort of Pump Controllers are connected to the MonitorPro on the LAN. Valid options are "2 Pumps" (for an MT2PC), "3 Pumps" (for an MT3PC), or "None" for no controller connected for each hierarchical location on the LAN.

### 7.6.23 Serial Communications Setup

The Serial Comms menu allows you to configure the communications speed for the communications ports. These settings are used by the RS232 port, the RS485 port, and the analog radio modem port.

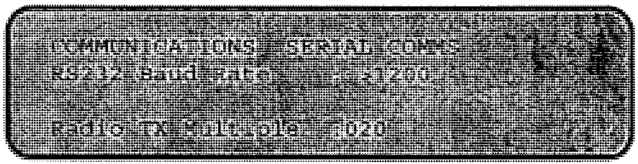



*Figure 111: Serial Communications Setup Screen*

RS232 Baud Rate determines the fixed baud rate at which the MonitorPro will communicate with other devices on the RS232 and RS485 ports. This may be set to 1200bps, 2400bps or 4800bps.

Radio Tx Multiple sets the delay in milliseconds for the initial radio transmission. This delay (in units of 20ms) is the radio power up delay on transmission to SCADA, e.g. a multiple of "020" will cause the MonitorPro to wait 20x20ms=400ms after resetting or turning on before attempting any communications with the radio.

### 7.6.24 Modem Setup

In a dial-up SCADA system, the MonitorPro has the ability to inform the Central Monitoring Facility of an alarm before the CMF polls the MonitorPro in its normal polling sequence. In the event of a dial-out alarm, the MonitorPro will initiate a call to the CMF to register the alarm, and then the CMF will initiate a call back to the MonitorPro to retrieve all of the details and display the status at the CMF. The user can then initiate a call to the site to reset faults or to change settings to compensate for a fault.

Use the Modem Setup menu to set up all of the parameters required to enable the MonitorPro to use dial-out alarming. Default Number and Backup Number are features reserved for specialist advanced functionality, and are not used in the normal installation. These both should be left at their default value of "00000000".

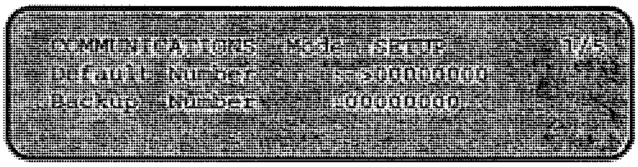



*Figure 112: Modem Setup Screen 1*

Modem Dial In No. is the phone number that the MonitorPro will attempt to dial when a dial-out event is triggered. If the system routes through a PABX system or similar, remember to add a 0 or other required digit at the start of the number. This number should be set to the line number for the dial-in modem at the CMF.

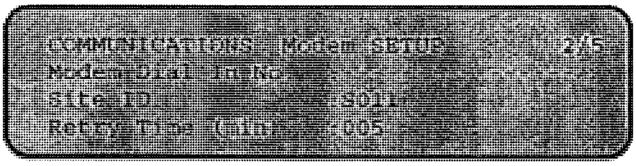



*Figure 113: Modem Setup Screen 2*

The number entered can contain the digits 0 through 9.

**– (hyphen)**
This does nothing, and so can used for padding to make the number more readable, e.g. "01-1234-5678" is easier to read than "012345678".

**/ (slash)**
This is a special feature for some specialist modems or phone systems, and should not normally be used.

**, (comma)**
This represents a standard pause, which is required with some PABX systems, e.g. if your PABX requires a 0 and a pause and then the phone number 12345678, enter "0,01-1234-5678".

Site ID is the identifier that the MonitorPro will provide to the CMF to enable the CMF to initiate the return call. This number should be "S" followed by the three digit site number set in the Network Menu as detailed in Section 7.6.22 e.g. for a Network SiteID of "0014", set the Modem SiteID to "S014".

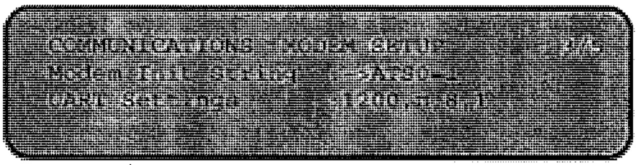


*Figure 114: Modem Setup Screen 3*

Retry Time (min) is a time delay in minutes. After a failed dial attempt the MonitorPro will wait this time before re-attempting the call.

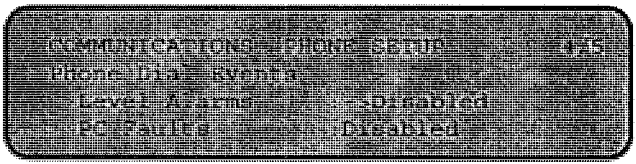



*Figure 115: Modem Setup Screen 4*

Modem Init String is the string that will be used to initialise the modem prior to attempting a dial-out. This string can be set to suit the modem in use, by entering any of the characters available as shown in Section 6.1.1. This setting is normally not required as the modems should be initialised prior to installation. A harmless string should be entered, such as ATS0=1, which sets the number of rings before auto-answer to 1.

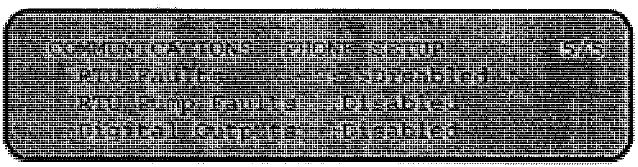



*Figure 116: Modem Setup Screen 5*

The UART settings are in the standard format of baud rate, parity, data bits, stop bits, and have the following options:

- 1200,n,8,1 (i.e. 1200 baud, no parity, 8 data bits, 1 stop bit)
- 1200,e,7,1 (i.e. 1200 baud, even parity, 7 data bits, 1 stop bit)
- 2400,n,8,1 (i.e. 2400 baud, no parity, 8 data bits, 1 stop bit)
- 2400,e,7,1 (i.e. 2400 baud, even parity, 7 data bits, 1 stop bit)

Screens 4 and 5 of the Modem Setup allow you to determine which types of faults will trigger a dial-out.

## 7.7 I/O Configuration

The MonitorPro has been designed with two analog inputs, one analog output, six digital inputs and three digital outputs. Each input or output can be configured individually by using the Inputs/Outputs sub menu.

To find the Inputs / Outputs menu from the main menu, first select the Station Setup Menu.

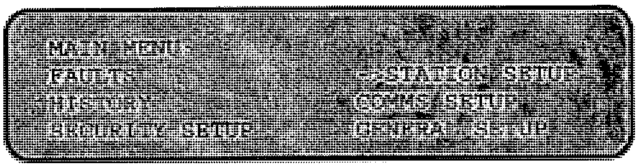



*Figure 117: Main Menu*

Then select the Inputs / Outputs sub-menu.

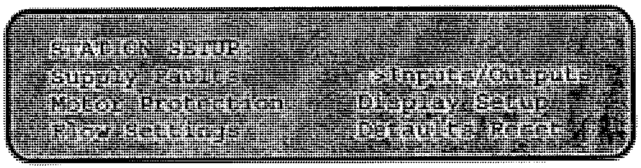



*Figure 118: Station Setup Menu*

### 7.7.25 Digital Inputs

To alter a digital input, select the Digital Input sub-menu. There are six Digital Inputs and this section discusses the process of configuring digital input number one.

The rest of the digital inputs are configured in the same manner. Each digital input has 6 parameters relevant to its operation.

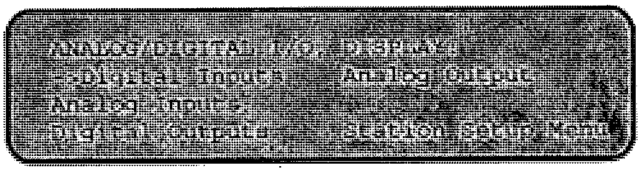



*Figure 119: Selecting the Digital Inputs Submenu*

DIN1 Description is a description, which you may define, which appears on the default display (see Section 7.11—Customising the Default Display) and for displaying the event in the fault display menus (see Section 3—Faults Menu).

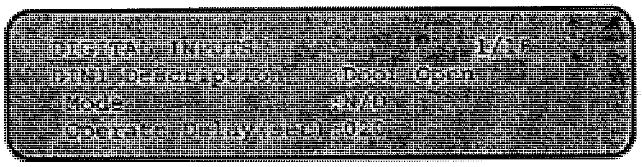



*Figure 120: Digital Inputs Setup Screen 1*

The Mode is used to specify the "Active" state of the digital input, or the state in which an activation condition is determined to have occurred. The choices are:

**N/O:**
The input is **active** when the digital input **is connected** to the ground terminal, and inactive when the input is not connected to the ground terminal.

**N/C:**
The input is **active** when the digital input **is not connected** to the ground terminal, and inactive when the input is connected to the ground terminal.

**Operate Delay:**
Is the standard MultiTrode parameter that determines how long the input must be in the active state before it is recognised as being active. Refer to Section 6.3.4—Operation Delay for more information.

Press the down arrow to display parameters four through six:

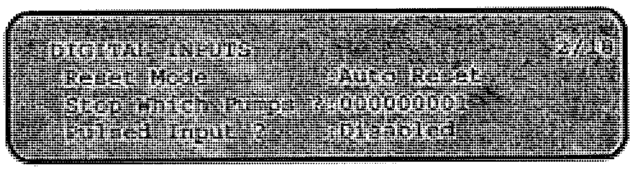



*Figure 121: Digital Inputs Setup Screen 2*

**Reset Mode**
Is the standard MultiTrode parameter that determines how the condition should be reset. Refer to Section 6.3.5—Reset Mode for more information.

**Stop Which Pumps**
Is a list of the pumps which are affected by the fault condition. The left-most digit corresponds to pump 1 in the Local Area Network, through to the right-most digit corresponding to pump 9. Setting a particular digit to a 1 means that the selected pump is affected by the fault condition, while a 0 means it is not.

**NOTE:**
The Stop Which Pumps parameter is only relevant for the Master MonitorPro. Slave MonitorPro's can not use their digital inputs to fault any pumps.

Configuration parameters seven to nine for Digital Input 1 are shown on screen 3/18, illustrated in Figure 122, and refer to configuring the input as a pulsed input.

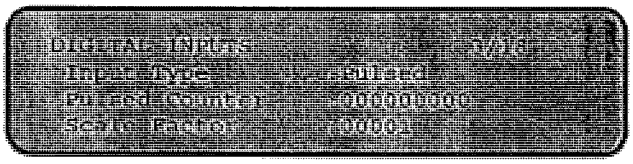



*Figure 122: Digital Inputs Setup Screen 3*

**Input Type**
Determines whether the input is a "Toggle" type input, or a "Pulsed" type input. This parameter is only relevant if the input has been enabled as a "Pulsed" input on the previous screen.

If the input is configured as "Pulsed", then the pulse counter will increment with each high to low transition on the digital input.

If the input is configured as "Toggled", then the pulse counter will increment with every low to high or high to low transition on the digital input.

**Pulsed Counter**
Is the current accumulated count of pulses into this input. You may set the counter to a starting value or it reset by editing this parameter.

**Scale Factor**
Is a multiplier for the input counter, such that each event recorded on the digital input (low to high transition or high to low transition, dependent on the Input Type) will increment the accumulated Pulsed Counter value by the value entered. E.g. if a Rain Gauge is connected to this input, and the gauge gives one pulse output for every 25mL that is sensed, setting the Scale Factor to 25 will mean the Pulsed Counter will display the actual reading in mL that has been measured by the Rain Gauge, removing any confusion about the values both at the site and at the CMF.

The remaining menu screens 4/18 through 18/18 repeat the three screens shown, to configure Digital Inputs 2 through 6.

**NOTE:**
Any single digital input may be used as **either** a condition for a fault **or** a counter for indication purposes.

### 7.7.26 Analog Inputs

To alter an analog input, select the Analog Inputs sub-menu.

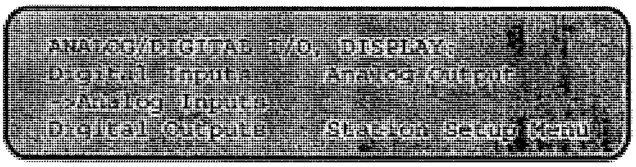



*Figure 123: Inputs/Outputs Setup Menu*

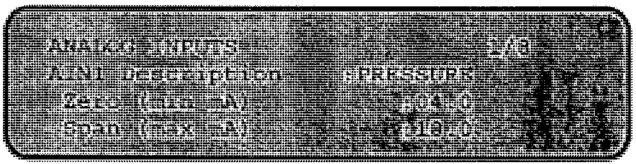



*Figure 124: Analog Inputs Setup 1*

AIN1 Description (Analog Input Description) is a description, which you may define, which appears on the default display (see Section 7.11—Customising the Default Display), and for displaying the event in the fault display menus (see Section 3—Faults Menu).

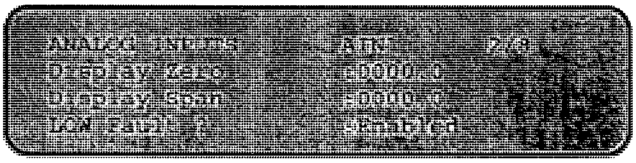



*Figure 125: Inputs/Outputs Setup 2*

The Zero and Span settings are used for setting the ranges of the analog input signal, while the DisplayZero and DisplaySpan is the range which is to be displayed, i.e. the MonitorPro will scale values between the Zero and Span to 0 to 100.0% for calculation purposes, then re-scale the 0 to 100% result to a figure between DisplayZero and DisplaySpan before displaying the value on any displays.

Figure 126 shows an example of a pressure transducer where the input analog signal between 4 and 18mA is to be displayed as 0–35 atmospheres. Figure 126 illustrates the situation graphically.

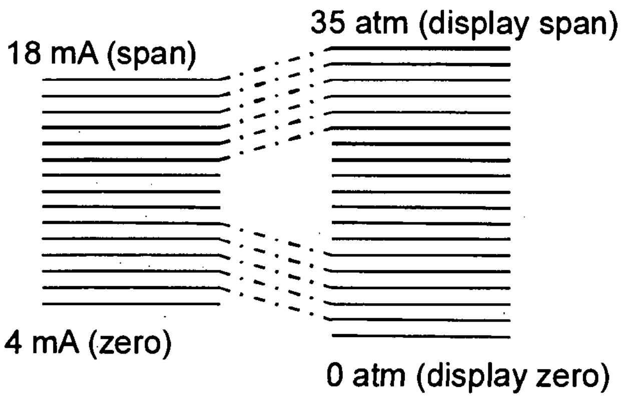



*Figure 126: Example of Scaling Between Current Input and User-Defined Output*

Low Fault and High Fault parameters determine whether a fault condition is triggered if the input exceeds the thresholds set by the Level (Display) parameters. As the name suggests, these levels are compared to the input value when it has been scaled to the display values as set on the previous screen. The first "Level" parameter on screen 3/8 is the Low Fault level, and the second is the High Fault level.

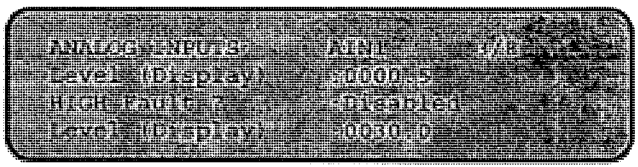



*Figure 127: Inputs/Outputs Setup Menu 3*

Screen 4/8 shows the Operate Delay, Reset Mode and Stop Which Pumps parameters, which will operate in the same manner as these parameters did for the digital inputs.

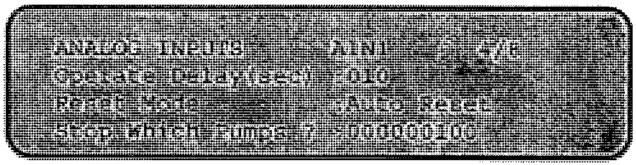



*Figure 128: Inputs/Outputs Setup Menu 4*

**NOTE:**
If **either** type of fault (low or high) is activated, the designated pumps will be stopped.

### 7.7.27 Digital Outputs

To alter a digital output, select the Digital Outputs sub-menu. There are three digital outputs on the MonitorPro. This section discusses Digital Output1.

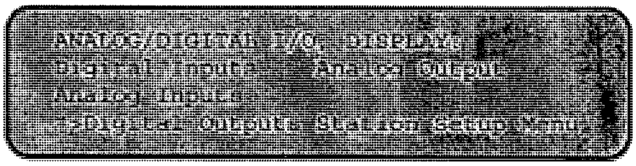



*Figure 129: Inputs/Outputs Setup Menu 4*

For each output there are two associated sub-menus. Firstly, we configure Digital Output1 (DOT 1) by selecting the sub-menu for Digital Output1.

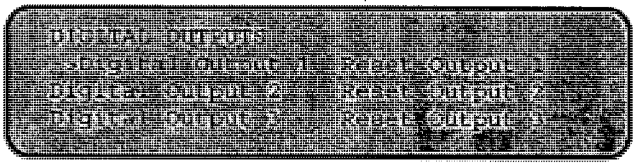



*Figure 130: Inputs/Outputs Setup Menu 4*

DOT1 Description (Digital Output Description) is a description, which you may define, which appears on the default display (see Section 7.11—Customising the Default Display) and for displaying the event in the fault display menus (see Section 3—Faults Menu).

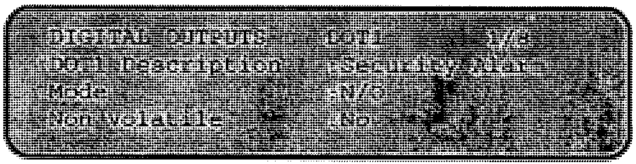



*Figure 131: Digital Outputs Parameters Screen 1*

Mode determines the state to which the output will be set when the source conditions are determined to be true. The options are Normally Open (N/O) and Normally Closed (N/C):

| | |
|---|---|
| N/O | The contacts are open when the input condition is not present, and will close if the input condition becomes true. |
| N/C | The contacts are closed when the input condition is not present, and will open if the input condition becomes true. |
| N/O with delay | The contacts are open when the input condition is not present, and will close if the input condition has been present for the time period set in the Operate Delay parameter on the following screen. If the contacts are closed and the input condition is removed, the contacts will open immediately. |
| N/C with delay | The contacts are closed when the input condition is not present, and will open if the input condition has been present for the time period set in the Operate Delay parameter on the following screen. If the contacts are open and the input condition is removed, the contacts will close immediately. |

**NOTE:**
A Normally Closed output will open if the MonitorPro loses power. This is useful as a fail-safe mechanism.

The third setting, Non Volatile, will be discussed separately in the next section, 7.7.28—Non Volatile Digital Outputs.

Screen 2/8 for the Digital Outputs sets the Operate Delay, Stop Which Pumps and the Reset Mode, as previously described in Section 7.7.25.

*Note that the Operate Delay will only have an effect if the Mode is set to either Normally Open (N/O) with delay or Normally Closed (N/C) with delay.*

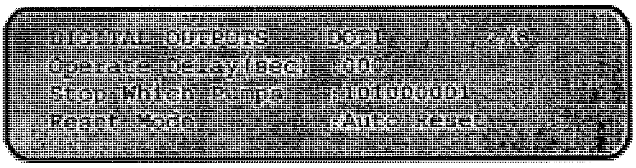



*Figure 132: Digital Outputs Parameters Screen 1*

The next six screens, 3/8 through 8/8, set up the conditions which will logically determine the status of the digital output. The resulting status can be a logical combination of a large range of conditions relating to different pumps. Each of these six screens defines a condition relating to a group of pumps.

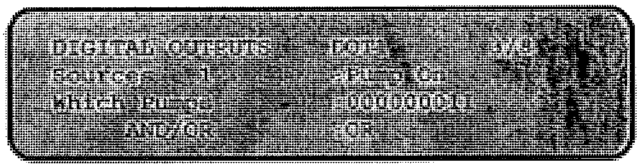



*Figure 133: Digital Outputs Source Logic*

**7.7.27.1 Sources are chosen from this table and define a condition:**

| | |
|---|---|
| 0 None | 1 Pump On |
| 2 Pump Off | 3 Pump Unavailable |
| 4 Pump Crit Flt | 5 Pump NonCrit Flt |
| 6 Pump Seal Flt | 7 Pump Delay Flt |
| 8 Pump Flygt Seal Flt | 9 Pump Cntlr Ther Flt (Includes Thermistor and Flygt Thermal Faults) |
| 10 Pump Max Sts/Hr Flt | 11 Pump Contrlr Flt |
| 12 Pump Lock Rotor Flt | 13 Pump Thermal Flt |
| 14 Undercurrent Flt | 15 Phase Fail |
| 16 Motor Insulation Flt | 17 Earth Flt |
| 18 Pump Under Volts Flt | 19 Over Volts Flt |
| 20 Low DC Supply Flt | 21 Low Flow Flt |
| 22 Low Flow Warning | 23 Level Alarm 1 On |
| 24 Level Alarm 1 Off | 25 Level Alarm 2 On |
| 26 Level Alarm 2 Off | 27 DIN1 |
| 28 DIN2 | 29 DIN3 |
| 30 DIN4 | 31 DIN5 |
| 32 DIN6 | 33 AIN1 Flt |
| 34 AIN2 Flt | 35 DOUT1 |
| 36 DOUT2 | 37 DOUT3 |
| 38 Comms Fail | 39 Remote Comms(OUTPST) |
| 40 Security Alarm | 41 Remote DIN1(OUTPOST) |
| 42 Remote DIN2(OUTPOST) | 43 Remote DIN3(OUTPOST) |
| 44 Remote DIN4(OUTPOST) | 45 Remote DIN5(OUTPOST) |
| 46 Remote DIN6(OUTPOST) | 47 Overflow |
| 48 Level from RRM (Remote Reservoir Monitor) | |

#### 7.7.27.2 Pump Conditions Which May Be Used as a Source

Which Pumps determines which pumps to take into account. The left-most digit corresponds to pump 1 in the Local Area Network, through to the right-most digit corresponding to pump 9. Setting a particular digit to a 1 means that the selected pump is included in the condition, while a 0 means it is not.

Figure 133 shows a screen that checks pumps 8 and 9 for the condition 1—Pump On. If either pump satisfies the condition, then this screen returns TRUE.

AND/OR is a logical connector: you choose "AND" or "OR". It connects this screen with the next in the sequence. That is, the screens 3/8 through 8/8 can all define logical conditions and you may connect them with ANDs and ORs. If you do not need six screens to define your digital output, pad by setting Sources to 0 and Which Pumps to 000000000 on the unused screens.

The logical calculation which determines the resulting output first processes all the "AND" connectors, then processes the "OR" connectors.

For example, suppose S1–S6 are sources defined on screens 3/8 through 8/8. In our example, S1 is "pump8 or pump9 is on". Then suppose we have:

S1 AND S2 OR S3 AND S4 AND S5 OR S6

This is treated as...

(S1 AND S2) OR (S3 AND S4 AND S5) OR S6

So consider the case where S1 = TRUE, S2 = TRUE, S3 = FALSE, S4 = TRUE, S5 = TRUE, S6 = FALSE. The first part of the expression, (S1 AND S2), reduces to (TRUE AND TRUE), which is TRUE. The complete expression becomes:

TRUE OR FALSE OR FALSE

This is TRUE, therefore in this example there will be an activation.

### 7.7.28 Non Volatile Digital Outputs

The third setting on screen 1/8 of the digital outputs menu specifies whether the digital output is non-volatile. If the setting is set to "Yes", and a SCADA system is being used to control the status of the digital output, then if power is lost, when it returns the digital output will return to the state which it was in before the power loss.

To enable the SCADA communications, one of the sources must be set to "Remote Comms".

If power is regained and the Non-volatile option was set to Yes, the state may return to activated. To reset this state, press the Reset Digital Output 1 (for this example) to reset the fault.

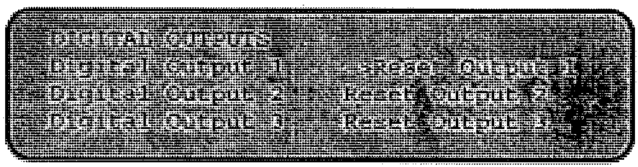



*Figure 134: Digital Outputs Source Logic*

### 7.7.29 Analog Output

There are only two settings in the Analog Output sub-menu.

AOUT Description (Analog Output Description) is used to define a description, along similar lines to the method discussed under Inputs and Outputs.

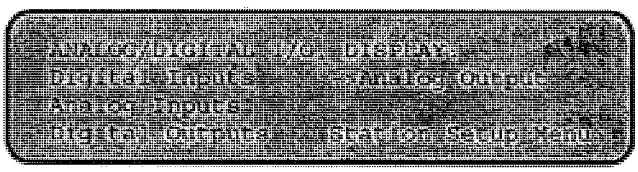



*Figure 135: Inputs/Outputs Menu*

The Analog Output parameter determines what value the analog output will have. The Analog Output can be set to "Disabled", where it can only be set from the SCADA CMF, or to "Current Level", where it will output 4.0mA for 0% level and 20.0mA for 100% level.

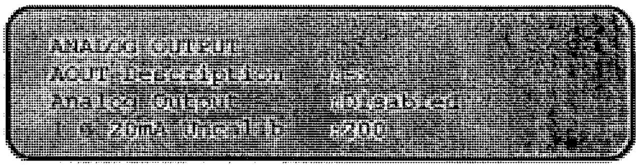



*Figure 136: Analog Output Parameters*

## 7.8 Data Logging

The MonitorPro can record the values of a wide range of parameters and faults for analysis of possible problems. The data log can be displayed on the screen (see Section 3.2—History Menu) or downloaded to a laptop for further analysis and report generation. Data log downloading is available directly with a MultiTrode cable, or remotely via phone or radio link.

### 7.8.30 Enabling the Data Logging of Specific Events

Overseeing the entire data log process are menus which enable or disable the logging of particular events or groups of events. These menus can be found in the "Comms Set-up" menu. Select the sub-menu "Data Logging".

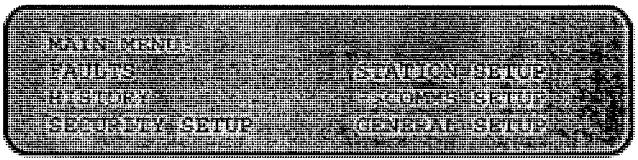



*Figure 137: Main Menu*

From this sub-menu (Figure 139), you may choose to enter the Data Log and Auto Log menus. These are discussed separately below.

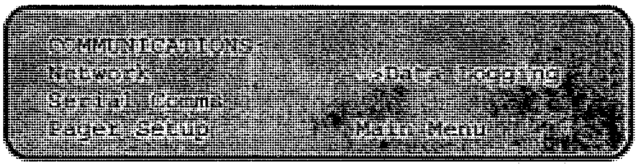



*Figure 138: Comms Setup Sub Menu*

Log Full Flag is the percentage of the available memory for the data log that must be full before the SCADA CMF is notified.

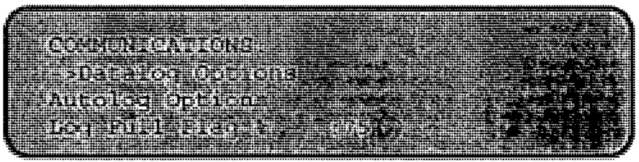



*Figure 139: Data Logging Sub Menu*

### 7.8.31 Data Log Options: Change of State, or Event Based Data Logging

Many events can be chosen to be logged when they occur, i.e. when the parameter concerned changes state. Each event can be individually enabled or disabled.

These events are:

| | |
|---|---|
| Level Alarms | Faults |
| Pump Starts and Stops | Digital Inputs |
| Analog Inputs and its % change between logs | Level Change and its % change between logs |
| Flow | Motor Insulation Resistance |
| Digital Outputs | Communications Failures |
| Starts/Hour | Overflow |

### 7.8.32 Auto Log Options: Automatic Time Based Data Logging

The auto log features on the MonitorPro cause the unit to log events on a periodic basis.

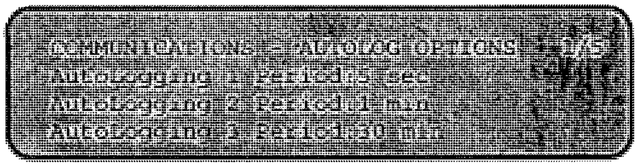



*Figure 140: Autologging Periods*

Three time intervals can be set up for the autologging, corresponding to three groups of events. These groups are called AutoLogging 1, AutoLogging 2, and AutoLogging 3. Each event in a group is logged at that group's frequency. You assign the events to the groups.

The events that may be assigned are:

| | |
|---|---|
| Level | Hours Run |
| Fault Accumulator | Flow |
| Starts/Pump | Pulsed Digital Input Accumulators |
| Phase Currents | Phase Voltage |
| DC Supply | Analog Input 1 & 2 |

The time periods available are:

| | |
|---|---|
| 5 seconds | 10 seconds |
| 30 seconds | 1 minute |
| 5 minutes | 10 minutes |
| 30 minutes | 1 hour |
| 6 hours | 12 hours |
| 24 hours | Disabled |

## 7.9 General Setup

The General Setup menu configures the MonitorPro so that it continues monitoring with values measured from now obsolete equipment. It also allows you to set the date and time. There are seven screens of data which can be entered.

The Date is in the format day-month-year, with no delimiting characters, e.g. enter 16th of March 1997 as 16031997. The Time is in the format hour-minute-second, with no delimiting characters and using a 24hour clock, e.g. enter 11:27:08 pm as 232708.

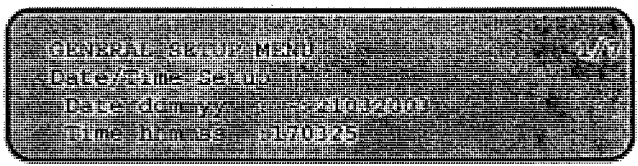



*Figure 141: Date and Time Settings*

The Hours Run figures are the total hours run (to the nearest 6 minutes or 0.1hour) from old accumulators, (i.e. when the MonitorPro is being installed in an old pump station).

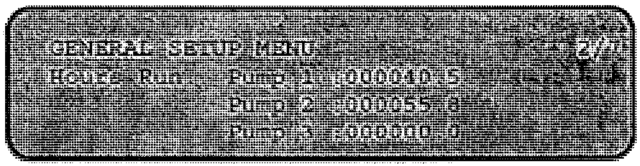



*Figure 142: Hours Run Accumulators*

Likewise, the Starts figures are from old accumulators

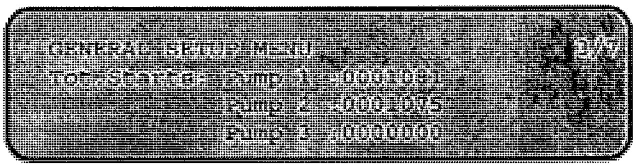



*Figure 143: Starts Accumulators*

Likewise, the Faults figures are from old accumulators.

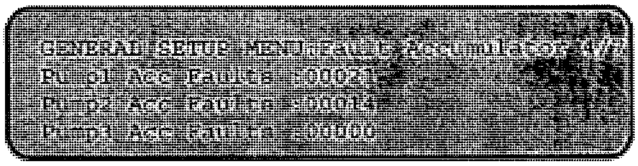



*Figure 144: Faults Accumulators*

Likewise, pump volumes if known.

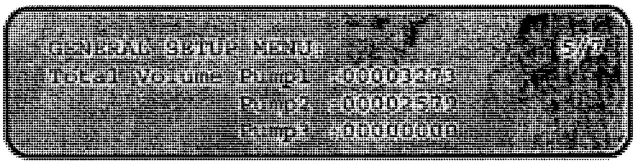



*Figure 145: Pump Volume Accumulators*

Likewise, past overflow volumes.

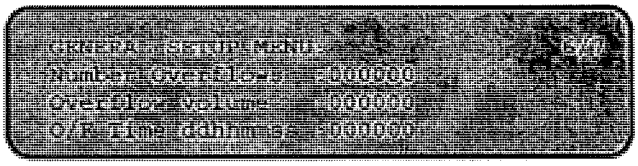



*Figure 146: Overflow Accumulators*

Enter the frequency of your mains supply (50Hz or 60Hz) at Mains Supply Freq. The default is 50Hz.

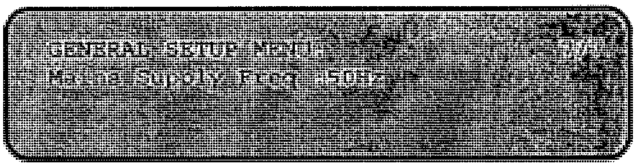



*Figure 147: Overflow Accumulators*

**NOTE:**
If the frequency is not set correctly, voltage and current measurement inaccuracies may occur.

## 7.10 Security

The importance and degree of security from installation to installation varies greatly; therefore the MonitorPro has been designed with four levels of security access, each with their own ranges of Personal Identification Numbers (PIN's). By enabling MonitorPro Security, the Master User can restrict access by other users to certain functions and menus. At the highest level of security, a user must enter a valid PIN within one minute; otherwise an alarm will be activated both locally and at the CMF.

Please refer to the MultiTrode web site at www.multitrode.com for more information on how to set up security.

## 7.11 Customising the Default Display

The default display is the information that the MonitorPro shows at start up. It contains measured or calculated data which the MonitorPro has or is monitoring. Since different installations have their own requirements, this display can be configured to show the information which is most important to your installation.

To enter this menu, firstly select the Station Setup option from the Main Menu.

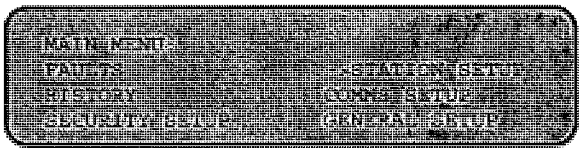



*Figure 148: Main Menu: Selecting the Station Setup Menu*

Then select the Display Setup sub-menu.

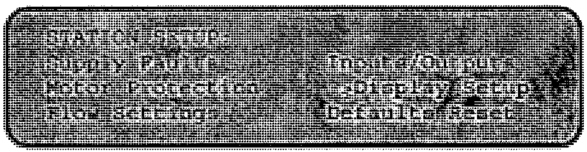



*Figure 149: Display Setup Sub-menu*

On the screen 1/1 of the menus, you select whether the display lines are to contain pump data or other data. At this stage, just select which type of data satisfies the requirements of the particular installation.

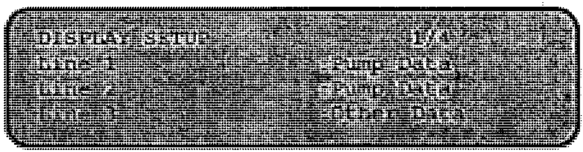



*Figure 150: Display Setup Screen 1*

The choices for the Pump Data option are:

| | |
|---|---|
| Amps Phase A | Amps Phase B |
| Amps Phase C | Amps Average |
| Total Flow | Last Flow |
| Hours Run | Minutes Last Run |
| Starts per Hour | Flow Rate (in units / second) |
| Insulation Resistance | Supply Volts |
| Volts—Average | Total Faults |
| Starts per Pump | Nothing |

The choices for the Other Data option are:

| | |
|---|---|
| Analog In (AIN1) | Digital Inputs (DIN1–6) |
| DC Supply | Date and Time |
| Analog In—xPC | Last Oflow Time |
| Digital Outputs (DOUT1–3) | Last Oflow Volume |
| Phase Voltages | Last Oflow Rate |
| Last Oflow Duration | Total Oflow Time |
| Total Oflows | Level |
| Total Oflow Volume | Total Flow |
| Analog In (AIN2) | Last Inflow Rate (in units / second) |
| Analog Out (AOT) | Nothing |

The format of the default display allows five columns of pump data to be displayed simultaneously. These example screens are the default options for each column. Adjust them as your application requires.

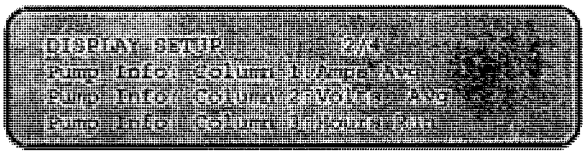



*Figure 151: Display Setup Screen 2*

Screen 4/4 (not illustrated) sets up the other data options. The defaults for the three display lines are AnalogIn1, AnalogIn2 and the Date/Time respectively.

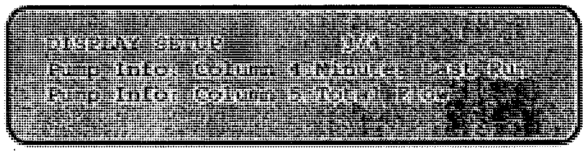


*Figure 152: Display Setup Screen 3*

# 8 Upgrading MonitorPro Firmware

The MultiTrode research and development team is continually adding new functions into the MonitorPro. As a MultiTrode customer, you can install these upgrades by simply connecting a laptop or personal computer to the rear of the installed MonitorPro. The programming cable must be obtained from MultiTrode to minimise the risk of damage to the laptop, personal computer or to the MonitorPro itself.

If you are upgrading a networked controller, you must ensure that the MonitorPro is still compatible with the other devices on the network after the upgrade, or upgrade all MultiTrode controllers on the network to the same firmware version number. See Section 0—Software compatibility for further information.

**NOTE:**
Versions 7.x.x and above software is only compatible with hardware versions 7.x.x and above. See the back of your controller for the hardware version. Version 7.x.x hardware was released in December 1999. Please refer to your local MultiTrode distributor for hardware upgrades.

## 8.1 Loading Software on to your Computer

The MTCDS software package comes on a CD with an automatic installer that will be initiated when the CD is inserted into the computer. Refer to the MTCDS manual for more information.

## 8.2 Loading New Firmware into MonitorPro

To perform upgrades to firmware, connect a PC or laptop to the rear of the installed MonitorPro using the MultiTrode upgrade lead.

**WARNING:**
Only MultiTrode approved cables are to be used for connecting to the communications port. Hardware damage may occur if other cables are used. Please refer to MultiTrode's web site at www.multitrode.com for further information on cables, including ordering information.

### 8.2.1 Step 1

Determine the unit's version number. To do this, reset the MonitorPro by pressing the Reset Key Combination of left arrow, right arrow and HELP keys simultaneously, and observe the version number that is displayed during the countdown sequence.

### 8.2.2 Step 2

Connect the upgrade cable between the COM1 port on the PC and the Communication Interface on the MonitorPro. If using the older MTCIU rather than the upgrade cable, set the switch on the box to Software Upgrade. Newer cables do not have the switch box and are used as they are. The newer cable consists of two cables connected together, the MultiTrode Modem Cable and the Software Upgrade Cable. Both cables must be joined together for the upgrade to work.

### 8.2.3 Step 3

Run the "TinyMon" program from MultiTrode CDS software package from within the Windows operating system. After a normal installation, this is found in the Start Menu -> Programs -> MultiTrode -> Control & Diagnostics Software program group.

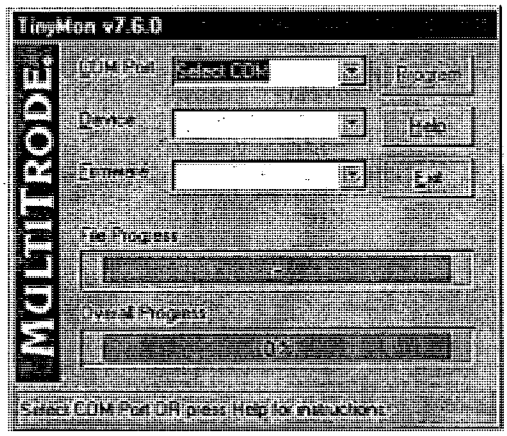



*Figure 153: TinyMon Program*

### 8.2.4 Step 4

From the top drop-down selection box, select the communications port on the laptop or PC that the MultiTrode Software Upgrade Cable is connected to.

### 8.2.5 Step 5

Within 10 seconds of making your selection, reset the MonitorPro. To do this, press the Reset Key Combination of left arrow, right arrow and HELP keys simultaneously.

### 8.2.6 Step 6

After the communications have been established, (a dialog box will inform you of success), select the field device you have connected to from the second drop-down selection box labelled "Device".

### 8.2.7 Step 7

Select the firmware version you wish to install to the MultiTrode device from the drop-down selection box labelled "Firmware".

### 8.2.8 Step 8

Press the "Program" button.

### 8.2.9 Step 9

When the programming is complete, disconnect the programming cable and restart the controller. For more information, refer to the MTCDS Manual.

### 8.2.10 Step 10

Reset the MonitorPro as described in Step 5 above. The new version number will be displayed during the reset sequence. Using a marker pen, write this number on the rear panel, replacing the old software version number.

# 9 Troubleshooting

This chapter contains information on some of the more common conditions. For more extensive troubleshooting information, refer to the MultiTrode website at www.multitrode.com.au.

| Symptom | Possible Cause | Suggested Solution | Reference |
|---|---|---|---|
| Display is blank but power LED is on. | Screen Contrast is incorrect. | Press the CONTRAST key and hold it down until the text is visible on the screen. | Section 2.3 |
| Display shows no text but instead shows two dark horizontal lines. | Display cable has bad connection. | Check that the plug is securely in the socket at both ends of the keypad cable – at the controller and at the display. | Section 5.4 |
| MonitorPro display shows "Com Fail LAN" | The MonitorPro cannot communicate with the MTxPC. | Check that EDS 44 is set to "On" on the MTxPC | MultiTrode MTxPC Manual |
| | | Check the RS485 LAN cable between the MonitorPro and the MTxPC controller. | Section 5.12 |
| | | Check that the MonitorPro has been set up to communicate to the correct combination of MTxPC controllers. | Section 7.6.22 |
| The MonitorPro display shows "Initialising Modem" and appears to stop. | This usually occurs when the MonitorPro cannot communicate with the modem. | Ensure that the modem is turned on and that the cable is connected from the MonitorPro to the modem. | Section 5.14 |
| The MonitorPro display shows "Dialling Pager Network" but the modem does not dial. | This usually occurs when the phone line is not correctly plugged into the modem. | Check all phone line connections. | |

# 10 Restoring MonitorPro Default Settings

To enter the Default Reset menu, first select the Station Set-up Menu from the main menu. Then select the Default Reset sub-menu.

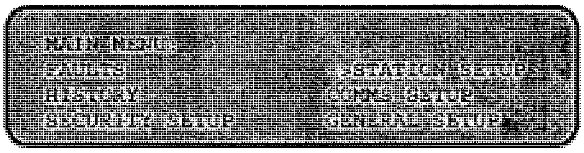



*Figure 154: Display Setup Screen 3*

The MonitorPro has various levels for resetting defaults, Full, Cumulative Data, Partial, Descriptions, Data Log, Initial Flow Rates. These are described below.

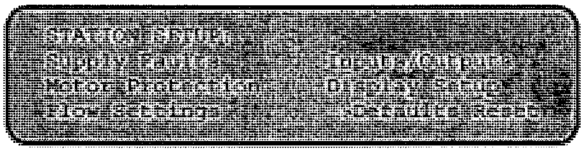



*Figure 155: Defaults Reset Sub-Menu*

If you choose any of the default reset options, you will be asked to confirm the reset **twice**, because this operation cannot be reversed.

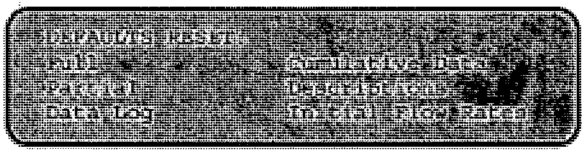



*Figure 156: Default Reset Options*

## 10.1 Full Reset

A Full Reset restores all of the factory defaults for all settings and values with the exception of:

- cumulative values
- mains supply frequency

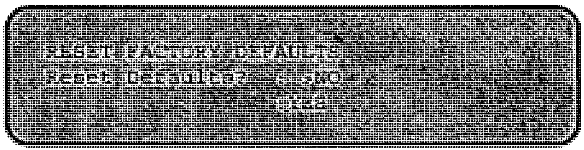



*Figure 157:Confirmation of Change*

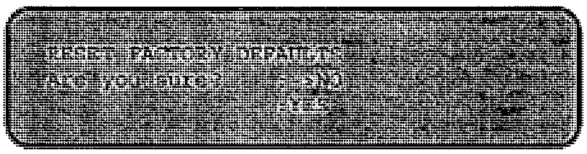



*Figure 158:Re-confirmation of Change*

**NOTE:**
Please note the extra confirmation screen in Figure 159. This operation cannot be reversed.

## 10.2 Partial Reset

A Partial Reset is the same as a full reset, except that these items are not reset:

- security PIN's
- communication settings
- descriptions
- initial flow rates

## 10.3 Data Log

A Data Log reset clears the entire data log history.

## 10.4 Cumulative Data

A Cumulative Data reset returns these cumulative measurements back to zero:

- Total Hours Run
- Fault Accumulators
- Total Starts
- Pulse Counters
- Total Faults
- Total Flow

## 10.5 Descriptions

A Descriptions reset only clears the descriptions set on the MonitorPro.

## 10.6 Initial Flow Rates

An Initial Flow Rates reset only clears the initial flow rates on the MonitorPro.

# PART 3 – TECHNICAL GUIDE

# 11 Electrical Specifications

| | |
|---|---|
| Supply Voltage (MonPro2) - 10–30 VDC | 240 VAC at 50/60 Hz |
| Supply Voltage (MonPro3) - 10–30 VDC | 110 VAC at 50/60 Hz |
| Power Consumption | DC 8 W Max |
| | AC 18 VA Max |
| Relays | $10^5$ operations |
| Contacts | 2 A inductive, 5 A resistive at 250 VAC |
| | 5 A at 30 VDC |
| Inputs | 6 Digital Inputs |
| | 2 Analog (4–20mA) |
| | 9 Current Transformer Inputs |
| | 3 Supply Line Inputs |
| Outputs | 3 Digital |
| | 1 Analog (4–20mA) |
| | 3 500 VDC Insulation Test |
| Operating Temperature | –10° to +60°C (+14° to +140 F) |
| Communications | RS232 |
| | RS485 |
| | RS422 |
| Terminal Socket | 2.5 $mm^2$ |

# 12 Settings List for MonitorPro

## 12.1 General Settings

| | |
|---|---|
| General Information: | |
| Job Description: | |
| Job No: | |
| Site No: | |
| Site Description: | |
| | |
| | |
| | |

## 12.2 Site Information

| Commissioning List—Major Functions of This Site | Passed |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

## 12.3 Revisions History

| Date | Notes | Version |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |

# 13 Communications (Comms Setup)

| # | Setting | Value | Default | Notes |
|---|---|---|---|---|
| | NETWORK (main menu / comms setup / network) | | | |
| 1 | Station/Site ID | | 0011 | |
| | Local Group No. | | 1 | |
| | Operations Mode | | MTxPC | |
| 2 | Group Master / Slave | | Master | |
| | No of Slaves in Group | | 0 | |
| | Max No of Groups | | 1 | |
| 3 | Poll Region No. | | 000 | |
| | Region Sequence No. | | 000 | |
| 4 | Master Pump Controller | | 2 Pumps | |
| | Slave 1 Pump Controller | | None | |
| | Slave 2 Pump Controller | | None | |

| # | SERIAL COMMS (main menu / comms setup / serial comms) | | | |
|---|---|---|---|---|
| 1 | RS232 Baud Rate | | 1200 | |
| | Radio TX Delay Multiple | | 20 | Multiple of 20ms |

| # | PAGER SETUP (main menu / comms setup / modem setup) | | | |
|---|---|---|---|---|
| 1 | Default Number | | 000000000 | |
| | Backup Number | | 000000000 | |
| 2 | Modem Dial In No. | | | |
| | Site ID | | S011 | |
| | Retry Time(min) | | 005 | |
| 3 | Modem Init String | | ATS0=1 | |
| | UART Settings | | 1200,n,8,1 | |
| 4 | Level Alarms | | Disabled | |
| | PC Faults | | Disabled | |
| 5 | RTU Faults | | Disabled | |
| | RTU Pump Faults | | Disabled | |
| | Digital Outputs | | Disabled | |

| # | Setting | Value | Default | Notes |
|---|---|---|---|---|
| | **DATA LOGGING (main menu / comms setup / data logging)** | | | |
| 1 | Datalog Options | | | |
| | Autolog Options | | | |
| | Log Full Flag % | | 75 | |

| # | DATA LOG OPTIONS (main menu / comms setup / data logging / datalog options) | | | |
|---|---|---|---|---|
| 1 | Starts per Hour | | **Disabled** | |
| | Level Alarms | | **Enabled** | |
| | Faults | | **Enabled** | |
| 2 | Pump Start/Stop | | **Disabled** | |
| | Digital Inputs | | **Disabled** | |
| | Analog Inputs | | **Disabled** | |
| 3 | AIN % Change | | **00** | |
| | Level Change | | **Disabled** | |
| | Level % Change | | **00** | |
| 4 | Flow | | **Disabled** | |
| | Motor Insul. Res. Disabled | | **Disabled** | |
| | Digital Outputs Disabled | | **Disabled** | |
| 5 | Comms Fail | | **Disabled** | |
| | Overflow | | **Disabled** | |

| # | PAGER SETUP (main menu / comms setup / modem setup) | | | |
|---|---|---|---|---|
| 1 | AutoLogging 1 Period | | **5 seconds** | |
| | AutoLogging 2 Period | | **5 seconds** | |
| | AutoLogging 3 Period | | **5 seconds** | |
| **2** | **Logged Events** | | | |
| | Level | | **Disabled** | |
| | Starts/Pumps | | **Disabled** | |
| 3 | Flow | | **Disabled** | |
| | Phase Voltage | | **Disabled** | |
| | Phase Currents | | **Disabled** | |
| 4 | Analog Input 1 | | **Disabled** | |
| | Analog Input 2 | | **Disabled** | |
| | DC Supply | | **Disabled** | |
| 5 | Fault Accumulator | | **Disabled** | |
| | Hours Run | | **Disabled** | |
| | Pulsed Digital Inputs | | **Disabled** | |

# 14 Data Logging

| Setting | Value | Default | Notes |
|---|---|---|---|
| Log Full Flag % | | 75 | |
| Starts per Hour | | Disabled | |
| Level Alarms | | Disabled | |
| Faults | | Enabled | |
| Pump Start/Stop | | Disabled | |
| Digital Inputs | | Disabled | |
| Analog Inputs | | Disabled | |
| AIN % Change | | 00 | |
| Level Change | | Disabled | |
| Level% Change | | 00 | |
| Flow | | Disabled | |
| Motor Ins. Res. | | Disabled | |
| Digital Outputs | | Disabled | |
| Comms Fail | | Disabled | |
| Overflow | | Disabled | |
| AutoLogging 1 Period | | 5 sec | |
| AutoLogging 2 Period | | 5 sec | |
| AutoLogging 3 Period | | 5 sec | |
| Level | | Disabled | |
| Starts/Pump | | Disabled | |
| Flow | | Disabled | |
| Phase Voltage | | Disabled | |
| Phase Currents | | Disabled | |
| Analog Input 1 | | Disabled | |
| Analog Input 2 | | Disabled | |
| DC Supply | | Disabled | |
| Fault Accumulator | | Disabled | |
| Hours Run | | Disabled | |

# 15 Supply Fault / Miscellaneous

| # | (main menu / comms setup / modem setup) | | | |
|---|---|---|---|---|
| | **Setting** | **Value** | **Default** | **Notes** |
| 1 | Low DC Supply Fault | | **Disabled** | |
| | Low DC Supply Volts | | **10.0** | |
| 2 | Low AC Supply Fault | | **Disabled** | |
| | Voltage (VAC) | | **180** | |
| | Operate Delay (sec) | | **010** | |
| 3 | Reset Mode | | **Auto — 1min** | |
| | High AC Supply Fault | | **Disabled** | |
| | Voltage (VAC) | | **300** | |
| 4 | Operate Delay (sec) | | **010** | |
| | Reset Mode | | **Auto — 1min** | |

# 16 Motor Protection

## 16.1 General

| # | (main menu / station setup / motor protection / general) | | | |
|---|---|---|---|---|
| | **Setting** | **Value** | **Default** | **Notes** |
| 1 | Motor Insulation Fault | | **Disabled** | |
| | Level (MOhm) | | **01.0** | |
| | Test Frequency | | **All Pumps Stopped** | |
| 2 | Reset Mode | | Auto — 1min | |
| | Immediate Test | | Test Now | |

## 16.2 Pump m (m = 1, 2 or 3)

| # | (main menu / station setup / motor protection / pumps) | | | | |
|---|---|---|---|---|---|
| | **Setting** | **Pump 1** | **Pump 2** | **Pump 3** | **Default** |
| 1 | CT PrimaryFLC(A) | | | | **050.00** |
| | Locked Rotor Fault | | | | **Disabled** |
| | Level (Amps) | | | | **0250.0** |
| 2 | Operate Delay(sec) | | | | **010** |
| | Reset Mode | | | | **Auto—5min** |
| | Thermal Protection | | | | **Disabled** |
| 3 | Motor FLC (Amps) | | | | **0050.0** |
| | Trip Time (sec) | | | | **010** |
| | Reset Mode | | | | **Auto—5min** |
| 4 | UnderCurrent Flt | | | | **Disabled** |
| | Level (Amps) | | | | **0025.0** |
| | Operate Delay (sec) | | | | **010** |
| 5 | Reset Mode | | | | **Auto—5min** |
| | Phase Failure Fault | | | | **Disabled** |
| | Level (%) | | | | **25** |
| 6 | Operate Delay (sec) | | | | **010** |
| | Reset Mode | | | | **Auto—5min** |
| | Earth Fault Protn | | | | **Disabled** |
| 7 | Level (%) | | | | **25** |
| | Operate Delay (sec) | | | | **010** |
| | Reset Mode | | | | **Auto Reset** |

# 17 Flow Settings

## 17.1 Calibrate Volumes

**(main menu / station setup / flow settings /auto set menu / auto calib. volume)**

| Setting | | Value | Default | Notes |
|---|---|---|---|---|
| 1 | Highest Sensor Used | | **01** | |
| | Standard Units | | **Litres/second** | |
| | Calibration Mode | | **Standard** | |
| 2 | Sensor Volume 1 &2 | | **000000** | |
| | Sensor Volume 2 & 3 | | **000000** | |
| | Sensor Volume 3 & 4 | | **000000** | |
| 3 | Sensor Volume 4 & 5 | | **000000** | |
| | Sensor Volume 5 & 6 | | **000000** | |
| | Sensor Volume 6 & 7 | | **000000** | |
| 4 | Sensor Volume 7 & 8 | | **000000** | |
| | Sensor Volume 8 & 9 | | **000000** | |
| | Sensor Volume 9 &10 | | **000000** | |

## 17.2 Set Fault Settings

**(main menu / station setup / flow settings / set fault settings)**

| Setting | | Value | Default | Notes |
|---|---|---|---|---|
| 1 | Low Flow Rate Fault | | **Disabled** | |
| | Low Flow Warning % | | **050** | |
| | Low Flow Fault | | **025** | |
| 2 | Reset Mode | | **Auto Reset** | |

## 17.3 Edit Flow Settings

**(main menu / station setup / flow settings / edit flow settings)**

| Setting | | Value | Default | Notes |
|---|---|---|---|---|
| 1 | Flow Enabled | | **Disabled** | |
| | Use Set Rates? | | **Disabled** | |
| | Overflow Method | | **Disabled** | |
| 2 | Standard Units | | **Litres / second** | |
| | Level Input Device | | **MTxPC Level** | |
| | Highest Sensor Used | | **01** | |
| 3 | Sensor Volume 1&2 | | **000000** | |
| | Sensor Volume 2&3 | | **000000** | |
| | Sensor Volume 3&4 | | **000000** | |
| 4 | Sensor Volume 4&5 | | **000000** | |
| | Sensor Volume 5&6 | | **000000** | |
| | Sensor Volume 6&7 | | **000000** | |
| 5 | Sensor Volume 7&8 | | **000000** | |
| | Sensor Volume 8&9 | | **000000** | |
| | Sensor Volume 9&10 | | **000000** | |
| 6 | Set Rate Pump 1 | | **00000** | |
| | Set Rate Pump 2 | | **00000** | |
| | Set Rate Pump 3 | | **00000** | |
| 7 | Set Rate Pump 4 | | **00000** | |
| | Set Rate Pump 5 | | **00000** | |
| | Set Rate Pump 6 | | **00000** | |
| 8 | Set Rate Pump 7 | | **00000** | |
| | Set Rate Pump 8 | | **00000** | |
| | Set Rate Pump 9 | | **00000** | |
| 9 | Derate Factor 2 Pumps | | **1.00** | |
| | Derate Factor 3 Pumps | | **1.00** | |
| | Outflow Avg (Cycles) | | **8** | |
| 10 | Derate Factor 4 Pumps | | **1.00** | |
| | Derate Factor 5 Pumps | | **1.00** | |
| | Derate Factor 6 Pumps | | **1.00** | |
| 11 | Derate Factor 7 Pumps | | **1.00** | |
| | Derate Factor 8 Pumps | | **1.00** | |
| | Derate Factor 9 Pumps | | **1.00** | |

# 18 Digital Inputs

**(main menu / station setup / inputs/outputs/ digital inputs)**

| Setting | DIN1 | DIN2 | DIN3 | DIN4 | DIN5 | DIN6 | Default |
|---|---|---|---|---|---|---|---|
| Description | | | | | | | |
| Mode | | | | | | | N/O |
| Operate Delay (sec) | | | | | | | 000 |
| Reset Mode | | | | | | | Auto Reset |
| Stop Which Pumps | | | | | | | 000000000 |
| Pulsed Input? | | | | | | | Disabled |
| Input Type | | | | | | | Pulsed |
| Pulsed Counter | | | | | | | 000000000 |
| Scale Factor | | | | | | | 00001 |

# 19 Analog Inputs

**(main menu / station setup / inputs/outputs/ analog inputs)**

| Setting | AIN1 | AIN2 | Default |
|---|---|---|---|
| AINx Description | | | |
| Zero (min mA) | | | 04.0 |
| Span (max mA) | | | 20.0 |
| Display Zero | | | 0000.0 |
| Display Span | | | 0100.0 |
| Low Fault ? | | | Disabled |
| Level (Display) | | | 0004.0 |
| High Fault? | | | Disabled |
| Level (Display) | | | 0020.0 |
| Operate Delay (sec) | | | 010 |
| Reset Mode | | | Auto Reset |
| Stop Which Pumps | | | 000000000 |

# 20 Digital Outputs

**(main menu / station setup / inputs/outputs/ digital outputs)**

| Setting | DOT1 | DOT2 | DOT3 | Default |
|---|---|---|---|---|
| Description | | | | |
| Mode | | | | N/O |
| Non Volatile | | | | No |
| Operate Delay(sec) | | | | 000 |
| Stop Which Pumps | | | | 000000000 |
| Reset Mode | | | | Auto Reset |
| Sources 1 | | | | 0 None |
| Which Pumps | | | | 000000000 |
| AND/OR | | | | Or |
| Sources 2 | | | | 0 None |
| Which Pumps | | | | 000000000 |
| AND/OR | | | | Or |
| Sources 3 | | | | 0 None |
| Which Pumps | | | | 000000000 |
| AND/OR | | | | Or |
| Sources 4 | | | | 0 None |
| Which Pumps | | | | 000000000 |
| AND/OR | | | | Or |
| Sources 5 | | | | 0 None |
| Which Pumps | | | | 000000000 |
| AND/OR | | | | Or |
| Sources 6 | | | | 0 None |
| Which Pumps | | | | 000000000 |

# 21 Analog Output

**(main menu / station setup / inputs/outputs/ analog outputs)**

| Setting | Value | Default |
|---|---|---|
| AOUT Description | | |
| Analog Output | | SCADA |
| I @ 20mA Uncalibr | | 200 |

# 22 Display Setup

**(main menu / station setup / display setup)**

| # | Setting | Value | Default |
|---|---|---|---|
| 1 | Line 1 | | **Pump Data** |
| | Line 2 | | **Pump Data** |
| | Line 3 | | **Other Data** |
| 2 | Pump Info: Column 1 | | **Amps Avg** |
| | Pump Info: Column 2 | | **Volts — Avg** |
| | Pump Info: Column 3 | | **Hours Run** |
| 3 | Pump Info: Column 4 | | **Minutes Last Run** |
| | Pump Info: Column 5 | | **Starts/Pump** |
| 4 | Other: Line 1: | | **Anlg In AIN1** |
| | Other: Line 2: | | **Anlg In AIN2** |
| | Other: Line 3: | | **Date/Time** |

# 23 General Setup

**(main menu / general setup)**

| # | Setting | Value | Default |
|---|---|---|---|
| 1 | Date | | |
| | Time | | |
| 2 | Hours Run Pump 1 | | **0000000.0** |
| | Hours Run Pump 1 | | **0000000.0** |
| | Hours Run Pump 1 | | **0000000.0** |
| 3 | Total Starts Pump 1 | | **00000000** |
| | Total Starts Pump 1 | | **00000000** |
| | Total Starts Pump 1 | | **00000000** |
| 4 | Pump 1 Acc Faults | | **00000** |
| | Pump 2 Acc Faults | | **00000** |
| | Pump 3 Acc Faults | | **00000** |
| 5 | Total Volume Pump 1 | | **00000000** |
| | Total Volume Pump 1 | | **00000000** |
| | Total Volume Pump 1 | | **00000000** |
| 6 | Number Overflows | | **00000** |
| | Overflow Volume | | **00000000** |
| | O/F Time dddhhmmss | | **000000000** |
| 7 | Mains Supply Freq | | **50 Hz** |

## 24 Connections to MonitorPro

| Terminal | Description | No | Notes | OK |
|---|---|---|---|---|
| KeyPad | | | | |
| Rs232 | | | | |
| Modem | | | | |
| R2+ | AIN 2 +ve | | | |
| R2- | AIN 2 –ve | | | |
| R1+ | AIN 1 +ve | | | |
| R1- | AIN 1 –ve | | | |
| AT+ | AOT +ve | | | |
| AT- | AOT –ve | | | |
| EXC | AOT Excitation In | | | |
| 12V | +12V out (13.8V) | | | |
| TX+ | RS485 / LAN | | | |
| TX- | | | | |
| RX+ | | | | |
| RX- | | | | |
| A | AC Power | | | |
| N | | | | |
| E | | | | |
| E | | | | |
| + | DC Power | | | |
| - | | | | |
| N1 | DOUT 1 | | | |
| N2 | DOUT 1 | | | |
| O1 | DOUT 2 | | | |
| O2 | DOUT 2 | | | |
| P1 | DOUT 3 | | | |
| P2 | DOUT 3 | | | |
| L1 | PHASE VIN | | | |
| L2 | | | | |
| L3 | | | | |
| MA | Insulation test P1 | | | |
| MB | Insulation test P2 | | | |

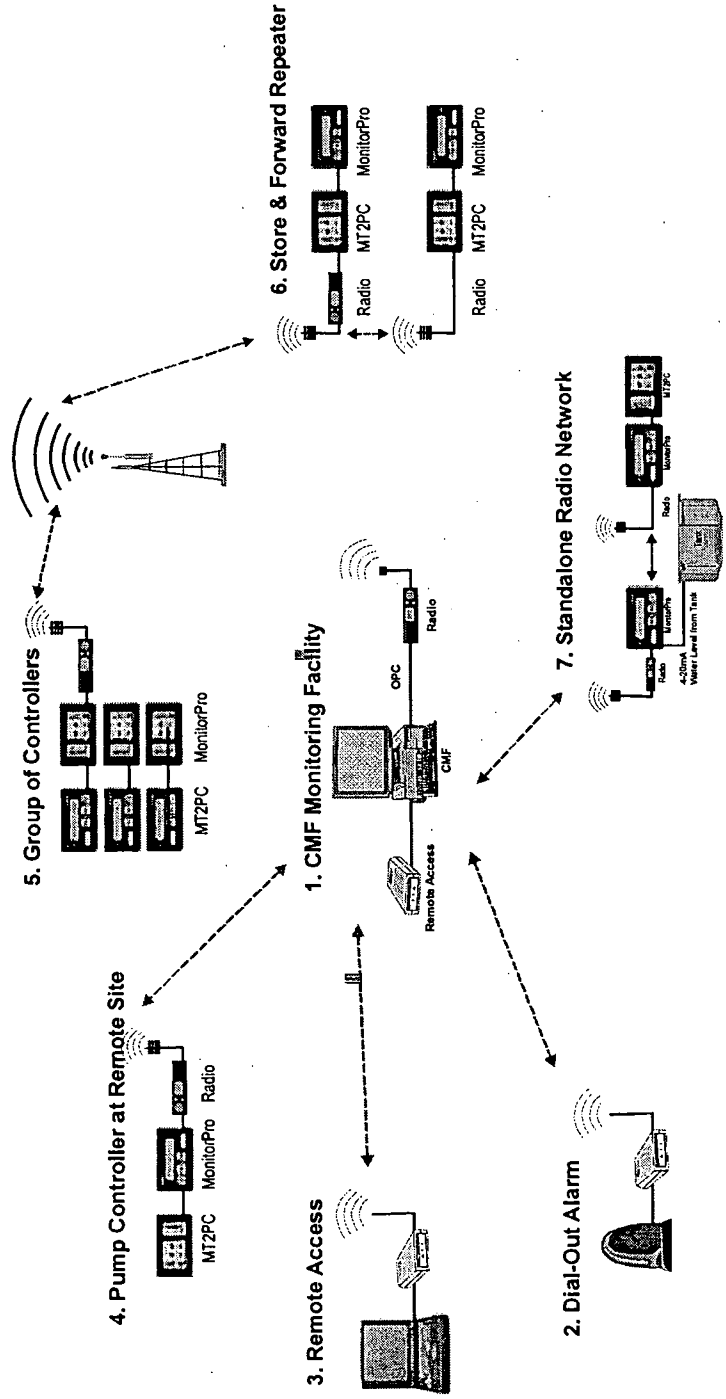
| Terminal | Description | No | Notes | OK |
|---|---|---|---|---|
| MC | Insulation test P3 | | | |
| AR | CT P1 Red | | | |
| T1 | CT P1 Earth | | | |
| AW | CT P1 White | | | |
| T2 | CT P1 Earth | | | |
| AB | CT P1 Blue | | | |
| T3 | CT P1 Earth | | | |
| BR | CT P2 Red | | | |
| T4 | CT P2 Earth | | | |
| BW | CT P2 White | | | |
| T5 | CT P2 Earth | | | |
| BB | CT P2 Blue | | | |
| T6 | CT P2 Earth | | | |
| CR | CT P3 Red | | | |
| T7 | CT P3 Earth | | | |
| CW | CT P3 White | | | |
| T8 | CT P3 Earth | | | |
| CB | CT P3 Blue | | | |
| T9 | CT P3 Earth | | | |
| D1 | Dig In DIN 1 | | | |
| D2 | Dig In DIN 2 | | | |
| D3 | Dig In DIN 3 | | | |
| D4 | Dig In DIN 4 | | | |
| D5 | Dig In DIN 5 | | | |
| D6 | Dig In DIN 6 | | | |
| E1 | Earth | | | |
| E2 | Earth | | | |

# 25 The Communications Network

The MonitorPro is an integral part of the MultiTrode SCADA system. It has many features which have been designed to interact directly with MTxPC's and with MultiTrode's Outpost SCADA system.

When setting up the communications network on the MonitorPro, you must consider many factors to ensure its integration does not harm the operation of other units.

To understand the basics of MultiTrode networking, please refer to the following diagram and descriptions.




| Item | Description |
|---|---|
| 1 | Central Monitoring Facility. |
| 2 | Dial-out Alarm. |
| 3 | Remote Access via PC-Anywhere Dial-in. |
| 4 | Pump Controller connected to CMF via phone lines. |
| 5 | Group of Pump Controllers connected to CMF via radio link. |
| 6 | Pump Controller working as Store and forward repeater. |
| 7 | Reservoir Monitor stand-alone radio network. |

*Figure 159: Communications Network*

## 25.1 Central Monitoring Facility

The CMF is a Personal Computer located in a control station, running MultiTrode *Outpost* SCADA software. The CMF gathers information from all of the remote sites via either a radio link or a dial-up connection to each site, and allows the user to view all information and change control functions on remote sites.

## 25.2 Dial-out Alarm

The Outpost system at the CMF is capable of recognizing faults in the system, and when they occur, dialling a telephone number and playing a pre-recorded message that details the fault that has occurred. The system can organize many phone numbers in a hierarchical schedule, so that the correct personnel that are on duty are contacted, and if they are not reachable, the next contact person in the hierarchy is also contacted.

## 25.3 Remote Access via PC-Anywhere Dial-in

A user with a personal computer or laptop, and a phone connection and modem, can connect to the CMF and have monitoring and control functions over the network as if that user were working directly on the CMF computer. This is very useful when combined with the dial-out alarm, because upon receiving an alarm call, personnel can dial into the system to rectify the problem, or determine whether extra actions are required.

## 25.4 Pump Station connected to CMF via phone lines

The CMF can connect to remote sites by radio network, phone lines, or modems. Phone line connection can be advantageous in areas where the radio network is difficult to implement, or where all available radio channels have already been used, such as in high-density city areas.

## 25.5 Group of Controllers connected to CMF via radio link

A site with several MultiTrode controllers connected to each other on a LAN will appear as one site to the CMF, and only requires one radio.

## 25.6 MonitorPro working as "Store and forward" repeater

If a site is out or range of the normal radio transmitter, but is within range of another pump station, the pump station that does have radio contact to both the CMF and the remote site can act as a "store and forward repeater", passing messages between the CMF and the remote station.

## 25.7 Reservoir Monitor stand-alone radio network

The MultiTrode Reservoir Monitor is a dedicated controller for reservoir sites. The Reservoir Monitor monitors the level in a reservoir, and transmits the information back to the CMF, which then passes the information on to the designated pumping site. However, if the CMF fails for any reason, the Reservoir Monitor will communicate directly with the pumping station, ensuring the system keeps running. Please contact MultiTrode for more information on the Reservoir Monitor.

# 26 Standalone Operation Mode

## 26.1 Standalone Operation

The MonitorPro can operate as part of the MultiTrode digital network or it can be configured as a standalone device. When configured for standalone mode there is no MTxPC attached. In this mode the MonitorPro can still be used for motor protection, data logging and as a flow calculation device.

When operating in standalone mode the MonitorPro relies on digital inputs 1, 2 and 3 to determine whether the pumps are running. When wiring the MonitorPro for standalone operation wire digital input 1 so that it registers as ON when pump 1 is running. Set up digital inputs 2 and 3 in the same way for pumps 2 and 3 respectively. When running in this mode do not use digital inputs 1, 2 or 3 for any other purpose.

When it is connected in this manner the MonitorPro will be able to monitor the pump on/off information and provide all of the normal motor protection functionality. To force the pumps to stop when a fault is detected; configure the digital outputs on the MonitorPro as follows, (see Section 7.7.27—Digital Outputs).

Set the digital outputs to activate on the required fault condition and wire them so that the activation of the output will cause the required pump to stop. Select the desired mode of operation in the Communications menu. Refer to section 7.6.22—Network Setup for more information.

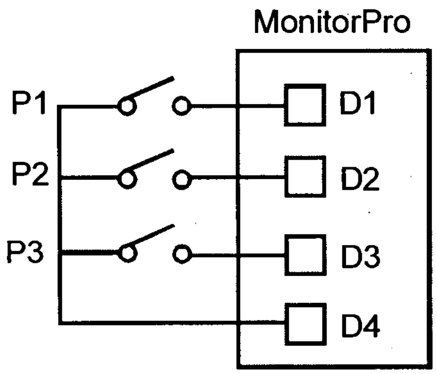



*Figure 160: Standalone Mode Schematic*

## 26.2 MTxPC with Standalone Backup

The MonitorPro can also be configured to operate normally with a pump controller, but to change to standalone mode if an operator needs to run the pumps without the pump controller. This operation mode requires that the digital inputs 1, 2 and 3 be set up to activate on a manual override of pumps 1, 2 or 3 respectively.

**NOTE:**
This manual override is not the same as the manual override on the pump controller, but is a separate switch to turn on the pump in an emergency.

While any of the digital inputs (1, 2 or 3) are active the MonitorPro will switch to standalone mode and will ignore all pumps on/off messages from the MTxPC. Configure the digital outputs to fault out the pumps in the same way as for normal standalone operation. When the digital input is returned to the off state then the MonitorPro will return to normal operation. The desired mode of operation needs to be selected in the Communications menu. Refer to section 7.6.22—Network Setup for more information.

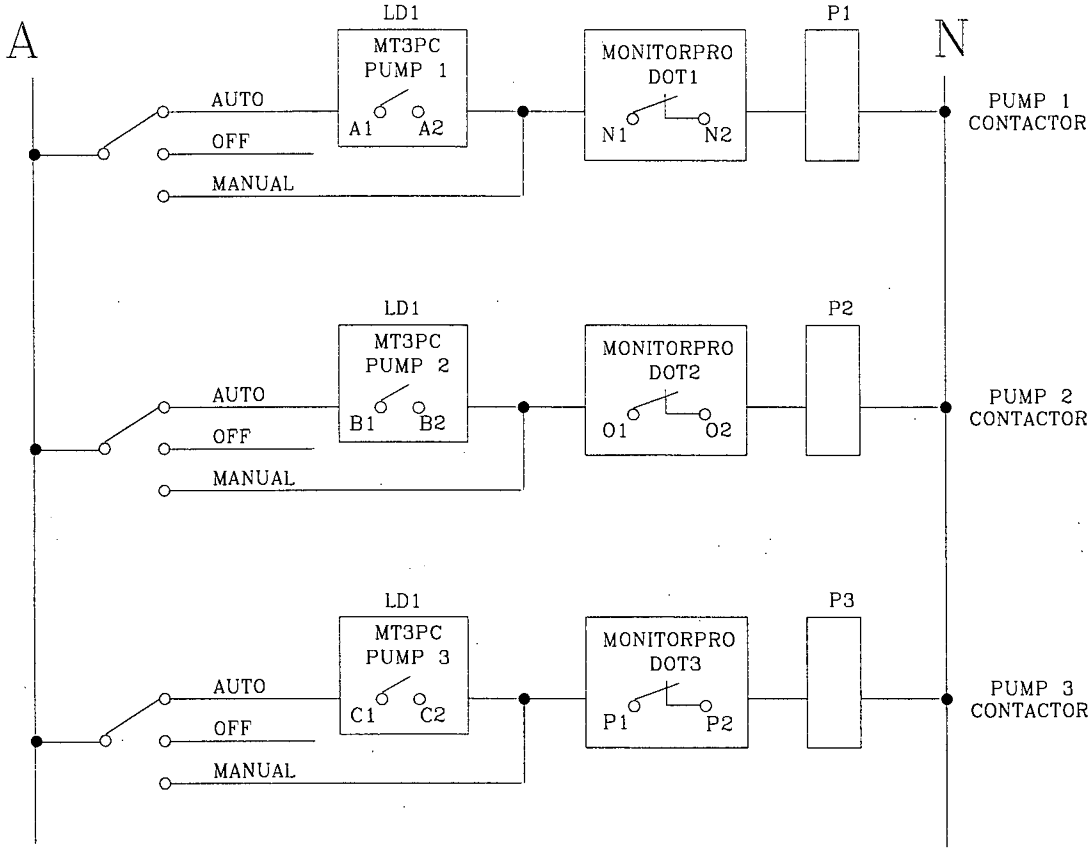



*Figure 161: Standalone Backup Mode Schematic*

# 27 Setting Up Analog Inputs & Outputs

(Application Note AN91-02)

## 27.1 Introduction

The MonitorPro provides 2 Analog Inputs and an Analog Output which can be calibrated and scaled to suit many applications. Version 8.0.5 of the MonitorPro software contains a number of changes to the way the Analog Inputs and Outputs are set up and used. This Application note describes how the analog inputs and output are initially set up using examples.

- Standard Settings
- Standard Settings with Custom Displays
- Customised Zero, Span, and Display
- Customised Zero and Span with Manual Calibration

## 27.2 Setup Examples

The following set of examples show a number of methods for configuring the Analog Inputs and Outputs depending on what features are required.

- Read through the descriptions of each example
- Decide which example suits your application best
- Substitute your desired Zero/Span, Display, and AOUT values as required.
- Follow the steps to set up your unit.

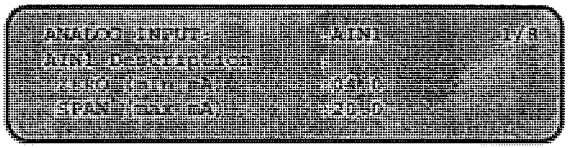
## 27.3 Standard Settings – Example 1

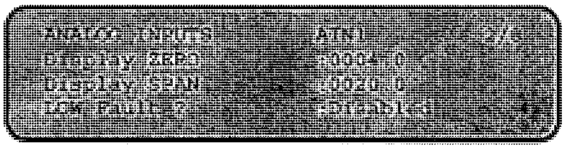
The following settings should be used in an application where a 4-20 mA device is connected to the MonitorPro, and the milliamp value of the device is to be displayed. Both analog inputs function in the same manner. The unit is automatically calibrated to reasonably accurate values.

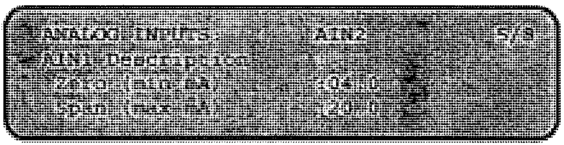
If greater accuracy is required see Example 4 (requires more setup time and equipment). The analog output can be set remotely through SCADA (e.g. MultiTrode Outpost).

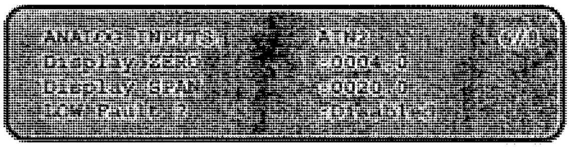
- AIN 1 Zero: 4mA, Span: 20mA
- AIN 2 Zero: 4mA, Span: 20mA
- AIN 1 Display Zero: 4, Span: 20
- AIN 2 Display Zero: 4, Span: 20
- Auto Calibrated values used
- AOUT Following SCADA

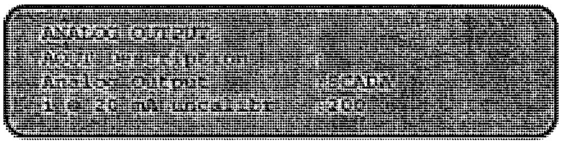
These settings are the default setup for the unit. The unit will come from the factory with these settings. Nothing needs to be changed or calibrated if these settings are suitable.



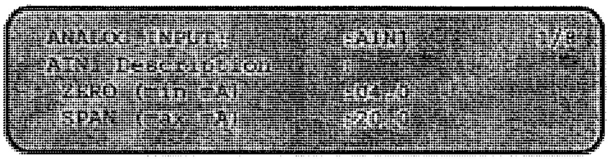




## 27.4 Standard setup with Custom Display Values – Example 2

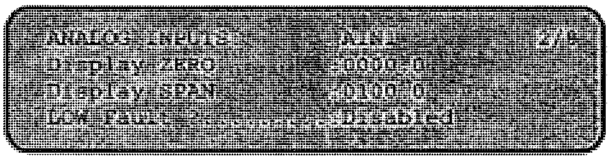
This set of settings should be used if a 4-20mA device is to be used, however a more meaningful display is required than the raw 4-20mA value. The following example shows how to scale AIN1 to display 0 – 100 (e.g. a liquid level percentage) and AIN 2 to 50 – 500 (e.g. flow meter). The unit is automatically calibrated to reasonably accurate values (both AIN and AOUT). If greater accuracy is required see Example 4 (requires more setup time and equipment). Different display values can be substituted to suit your application.

- AIN 1 Zero: 4mA, Span: 20mA
- AIN 2 Zero: 4mA, Span: 20mA
- AIN 1 Display Zero: 0, Span: 100
- AIN 2 Display Zero: 50, Span: 500
- Auto Calibrated values used
- AOUT Following Liquid Level

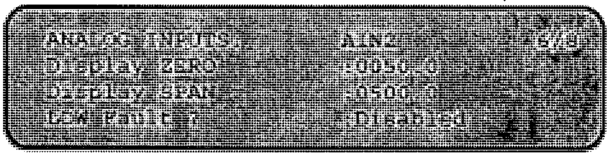
1 Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Inputs menu.



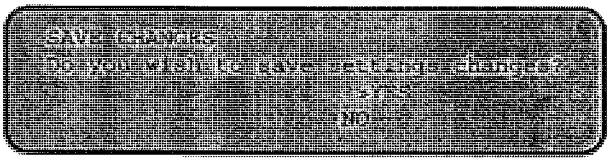

2 Navigate to the Display ZERO and Display SPAN values for AIN 1. Change Display ZERO to 0 and then the Display SPAN to 100.



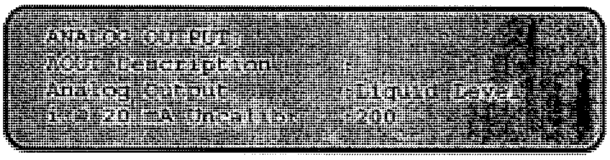
3 Navigate to the Display ZERO and Display SPAN values for AIN 2. Change Display ZERO to 50 and then the Display SPAN to 500.




4 Once these changes have been made, press Exit and save the settings.




5 Navigate to and enter the Analog Output menu. Change the Analog Output setting to 'Liquid Level'




6 Make sure that the 'I @ 20mA uncalibr' setting is set to 200. Exit and save the settings.

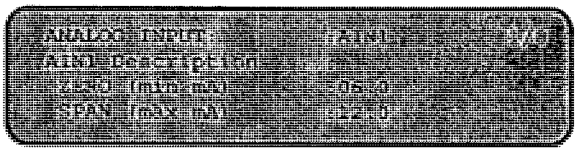
7 Exit from all menus and allow the unit to restart. Once the unit has restarted, enter the menus again and check that the settings are correct.

## 27.5 Customised Zero, Span and Display – Example 3

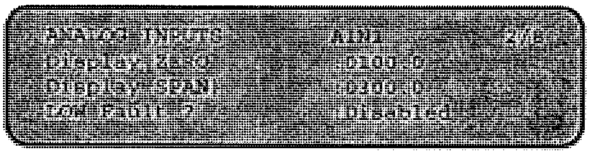
This example shows how to setup an Analog Input that has a range other than 4 – 20mA. In this case AIN 1 has a Zero of 6mA and a Span of 12mA. This will then have a display scale of 100 to 300. These vales can be changed to suit the application. Each of the inputs will be automatically calibrated to nominal values. If extra accuracy is required see Example 4. The AOUT will be set to follow AIN 1 and will be manually calibrated.

- AIN 1 Zero: 6mA, Span: 12mA
- AIN 2 Zero: 4mA, Span: 20mA
- AIN 1 Display Zero: 100, Span: 300
- AIN 2 Display Zero: 4, Span: 20
- Auto Calibrated values used
- AOUT Following AIN1 and Manually Calibrated

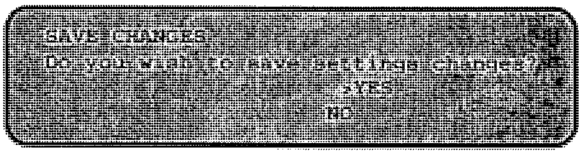
1 Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Inputs menu. Navigate to the Zero and Span values for AIN 1.



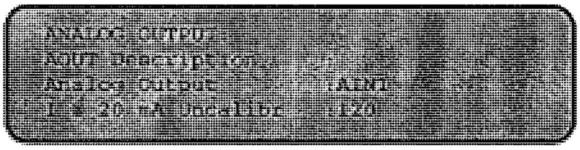

2 Change the Zero to 6mA and the Span to 12mA. Navigate to the Display ZERO and Display SPAN values for AIN 1.



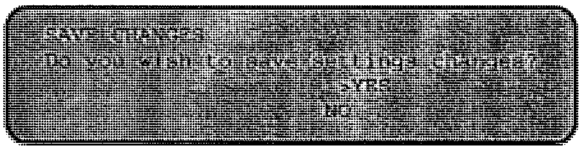

3 Change Display ZERO to 100 and then the Display SPAN to 300. Once these changes have been made, press Exit and save the settings.



4 Navigate to and enter the Analog Output menu. Change the Analog Output setting to 'AIN 1'.



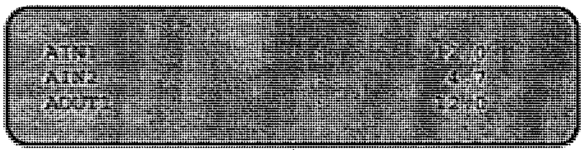

5 Make sure that the 'I @ 20mA uncalibr' setting is set to 120. This is to match the span of AIN 1 which is 12mA. Exit and save the settings.




6 Exit and save the settings. Exit from all menus and allow the unit to restart.

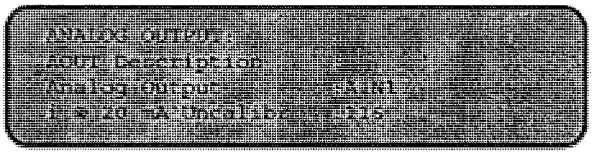
7 Once the unit has restarted, enter the menu again and check that the settings are correct.

8 Input 12mA into AIN 1. This will cause the AOUT to output 12mA.




9 Measure the current coming from the AOUT of the unit. If you require the MonitorPro to supply power for the current loop, short circuit the "SCR" and EXC" terminals, and measure the current between AT+ and AT-.
Multiply this current by 10 to be entered into 'I @ 20mA Uncalibr'. For example if 11.6mA is measured then 116 is the 'I @ 20mA Uncalibr' value.

10 Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Output menu




11 Set 'I @ 20mA uncalibr' to the value calculated in Step 9. Exit and Save these settings. Exit from the menus and allow the unit to restart.

12 Once the unit has restarted, enter the menu again and check that the settings are correct.

## 27.6 Customised Zero and Span with Manual Calibration – Example 4

This example is similar to the previous example except that the Analog Inputs will be manually calibrated. In this example AIN 1 uses a 4 – 20 mA device and scales it over a range of 0 to 100 (e.g. liquid level), while AIN 2 uses a 8 – 18 mA device and displays the milliamp value of this device. AOUT is following AIN 2. All Analog Inputs and Outputs will be manually calibrated for maximum accuracy.

1 AIN 1 Zero: 4mA, Span: 20mA

2 AIN 2 Zero: 8mA, Span: 18mA

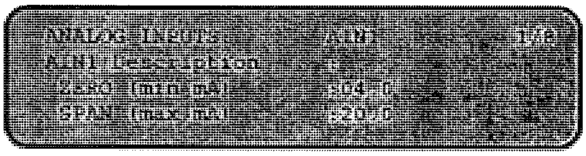
3 AIN 1 Display Zero: 0, Span: 100

4 AIN 2 Display Zero: 8, Span: 18

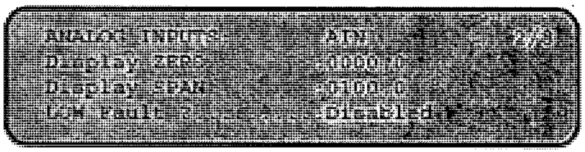
5 Manual Calibration performed

6 AOUT Following AIN2 and Manually Calibrated

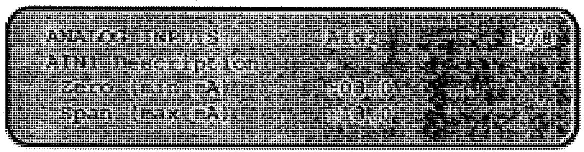
7 Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Inputs menu. Navigate to the Zero and Span values for AIN 1.



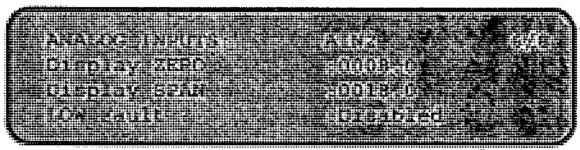
8 Make sure the Zero is set to 4mA and the Span to 20mA. Navigate to the Display ZERO and Display SPAN values for AIN 1.



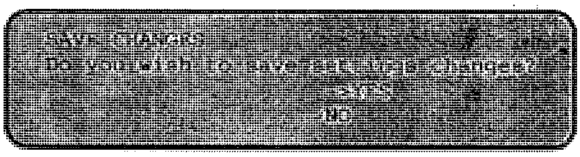
9 Change Display ZERO to 0 and then the Display SPAN to 100. Navigate to the Zero and Span values for AIN 2.



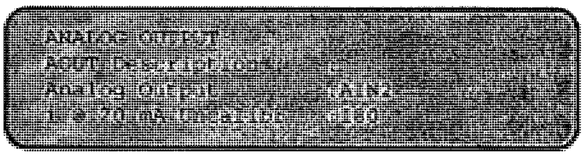
10 Change the Zero to 8mA and the Span to 18mA. Navigate to the Display ZERO and Display SPAN values for AIN 2.



11 Change Display ZERO to 8, and Display SPAN to 18. Press Exit and save the settings.

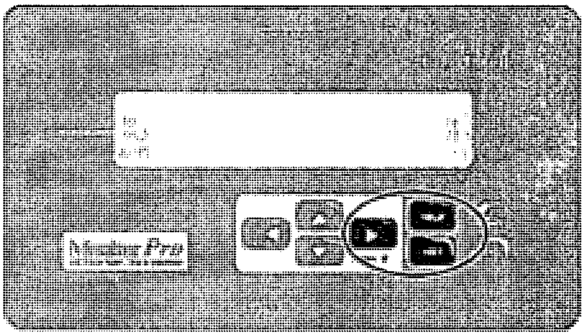


12 Navigate to and enter the Analog Output menu. Change the Analog Output setting to 'AIN 2'

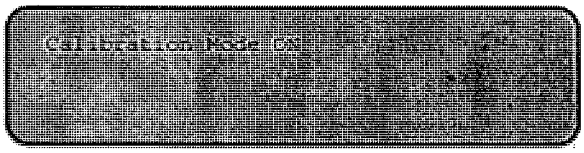


13 Make sure that the 'I @ 20mA uncalibr' setting is set to 180. This is to match the span of AIN 2 which is 18mA. Exit and Save the settings. Exit from the menus and allow the unit to restart.

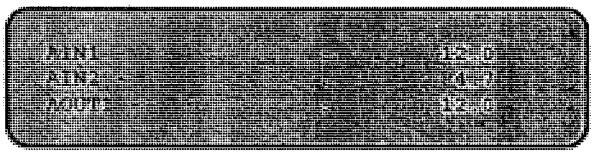
14. Once the unit restarts and is displaying the default overview screen, press the RIGHT, HELP and EXIT buttons at the same time.



15. "Calibration Mode ON" will appear on the screen briefly, then the display will return to normal.




16. Navigate the main display screens until the analog values screen as shown below is displayed (press DOWN four times from the default screen):




17. Connect the current source to the AIN 1 terminals (R1+ and R1-). Remember that these terminals should never be raised above 13VDC from ground; so if you are using a current source with no ground reference, for example a hand-held calibrator, connect the Analog Input 1 negative terminal (R1-) to the MonitorPro ground (at AT-).

18. Apply 4mA to AIN 1 and record the reading shown beside AIN1 as the Zero calibration value.

19. Apply 20mA to AIN 1 and record the reading shown beside AIN1 as the Span calibration value.

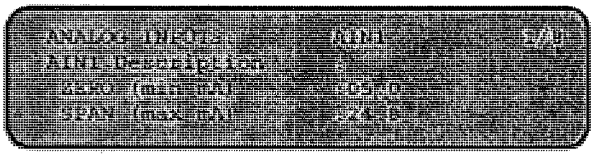
20. Connect the current source to the AIN 2 terminals (R2+ and R2-). Remember that these terminals should never be raised above 13VDC from ground; so if you are using a current source with no ground reference, for example a hand-held calibrator, connect the Analog Input 2 negative terminal (R2-) to the MonitorPro ground (at AT-).

21. Apply 8mA to AIN 2 and record the reading shown beside AIN2 as the Zero calibration value.

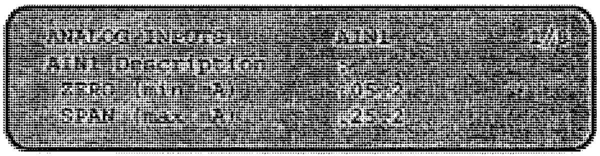
22. Apply 18mA to AIN 2 and record the reading shown beside AIN2 as the Span calibration value.

23. With the unit still in calibration mode, enter the Main Menu> Station Setup> Inputs/Outputs > Analog Inputs Menu

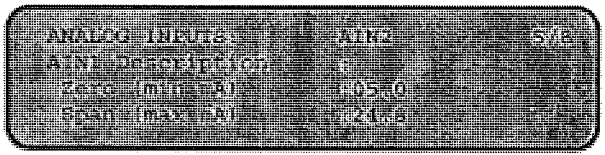
24. The Zero and Span values for AIN 1 and AIN 2 should be displaying calibration values.



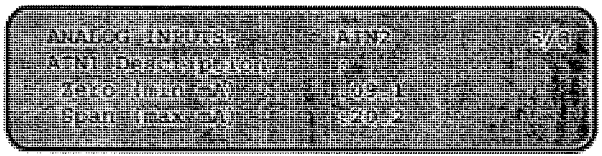

25. Change the Zero and Span calibration values for AIN 1 to the values that were measured earlier.



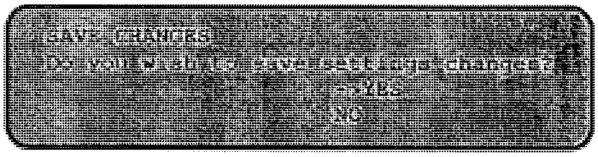
26 Navigate to the AIN 2 Zero and Span settings which also should be showing calibration values.




27 Change the Zero and Span calibration values for AIN 2 to the values that were measured earlier.



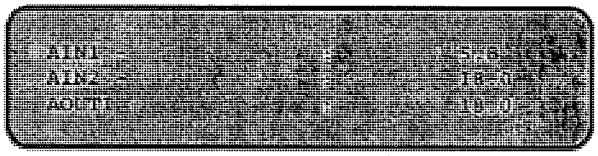

28 Exit this menu and save the changes.




29 Exit from all menus and allow the unit to restart.

30 Once the unit has restarted it will no longer be in 'calibration mode'. Check that AIN 1 and AIN 2 are accurately displaying the correct current measurements (within 0.1mA).

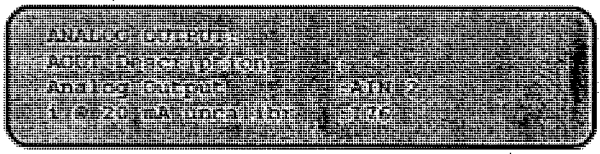
31 Input 18mA into AIN 2. This will cause the AOUT to output 12mA.




32 Measure the current coming from the Analog Output of the unit. If you require the MonitorPro to supply power for the current loop, short circuit the "SCR" and EXC" terminals, and measure the current between AT+ and AT-.

33 Multiply this current by 10 to be entered into 'I @ 20mA Uncalibr'. For example if 17.6mA is measured then 176 is the 'I @ 20mA Uncalibr' value.

34 Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Output menu




35 Set 'I @ 20mA uncalibr' to the value calculated previously.

36 Exit and Save the settings. Exit from all menus and allow the unit to restart.

37 Once the unit has restarted, enter the menu again and check that the settings are correct.

# 28 Analog Inputs Settings – Description

The MonitorPro contains 2 analog inputs. Each of these analog inputs has three main settings that relate the current flowing in the hardware to the displayed value on the MonitorPro. These are ADC Calibration, Zero and Span, and Display Zero and Span. The following diagram displays the series of events that occur to display an analog input.

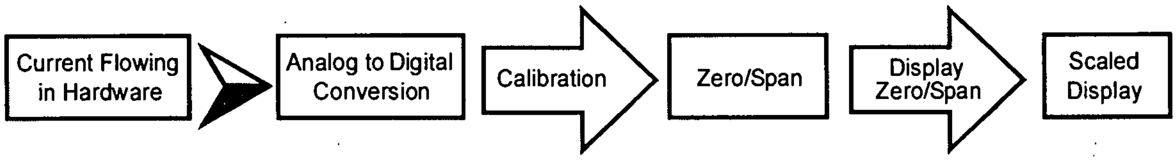



*Figure 162 - Analog Input Display Sequence*

## 28.1 Zero and Span

Zero and span are the first two settings that should be configured. Zero refers to the lowest analog value to be measured and Span is the highest analog value to be measured. For example the default Zero is 4mA and Span is 20mA.

This means that the analog input will measure in the range of 4 to 20 mA. This setting is generally used to reflect the range of the analog device you will be using. For example if you are using a pressure transducer to measure liquid level which shows 6mA as well empty and 14mA when the well is full then you would set a Zero of 6mA and a Span of 14mA.

Note: *Setting the Zero and Span changes the calibration to nominal values. See next section for details.*

## 28.2 ADC Calibration

Calibration is used to relate the physical input (ADC counts) to the Zero and Span settings. Tolerances within components used means that each unit may be slightly different in the way they interpret a physical input current. This calibration matches a physical input current to the measured current. In this way the accuracy of the analog inputs can be improved to within 0.1mA.

If accuracy is not critical, there is added convenience in a set of nominal calibration values that are used in the event of the device not being calibrated. Whenever the Zero and Span are set, the calibration is set to these nominal values which give a reasonable accuracy based on a typical unit. This occurs every time a change is made to the Zero and Span settings.

Calibration must be performed at the Zero and Span values. If the Zero and Span was 6 and 14 mA then calibration must be done with 6mA and 14mA. In this way the ADC counts can be determined when 6mA is input and also when 14mA is input. See Example 4, (Section D3.6), for a description of calibrating the Analog Inputs. There is also a general description of the steps required in Section D.

## 28.3 Display Zero and Span

The MonitorPro has the ability to scale the Zero and Span range over a Display range. For example a range of 4 to 20 mA can be scaled over a range of 10 to 100. That is; 4mA is displayed as 10, 20mA is displayed as 100 and all values in between are scaled linearly. The maximum display Span able to be entered is 6500. However it is recommended to set a display zero and span so that 6500 will never be reached even if the input goes beyond the set Span value.

## 28.4 Overview

The following diagram shows how the three sets of analog input settings relate to each other. It uses the example of a 4-20mA device displaying a liquid level of 0% to 100%.

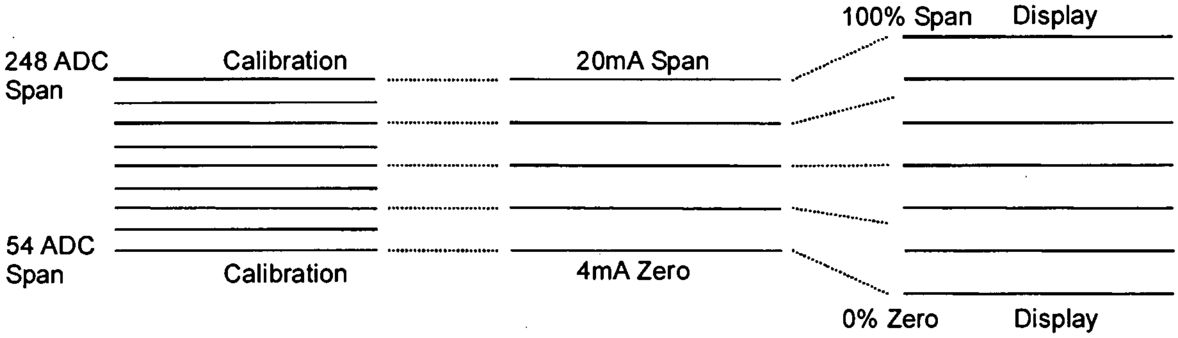



*Figure 163 - Analog Input Settings Relationship*

## 28.5 Out of Range Indication

A feature added into v8.0.4 and later MonitorPro firmware is a visual indication when an analog input has exceeded the set Zero and Span values either above the Span or below the Zero levels.

This is indicated by a star ( * ) being present next to the displayed analog value. In the following example the Display Zero is 4, with the displayed value at 3.8 a star ( * ) is present to indicate that the measurement is outside the range of the set Zero and Span.

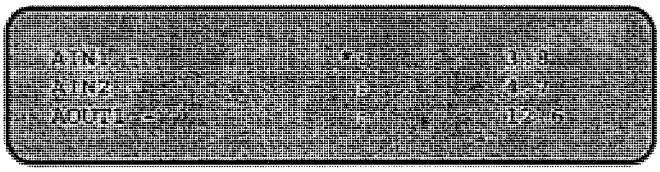


*Figure 164 –Out of Range Indication*

The display will continue to show the value measured even if it is outside the range of the Zero and Span set however a star will be present. The display will only continue to show measurements outside the Zero and Span range until it reaches the limit of the ADC (analog to digital converter). This will be either at 0 or at 255.

The actual display value at which this limit is reached depends on Calibration, Zero/Span and Display Zero/Span. If this display value reaches beyond 6500 then the counter will overflow and the display will not be a correct representation of the input current.

# 29 Analog Output Settings – Description

The MonitorPro features a single Analog Output which can be configured to follow a number of sources. The following section lists each of these sources and gives a description of how the Analog Output responds to a change in these sources.

## 29.1 Sources

The Analog Output of the MonitorPro uses one of 6 sources to determine the current output. These sources are as follows:

## 29.2 SCADA

When configured to follow this source, the Analog Output can be set from a SCADA system. MultiTrode Outpost contains a section in which any current value between 4 and 20 mA can be entered (to the nearest 0.1mA). This value is then transmitted to the MonitorPro, and the Analog Output is set to this value. The Analog Output will then retain this value until another message is received from SCADA with a different Analog Output value.

If this source is not selected then any message from SCADA to change the Analog Output current will be ignored. This is the default setting for the MonitorPro.

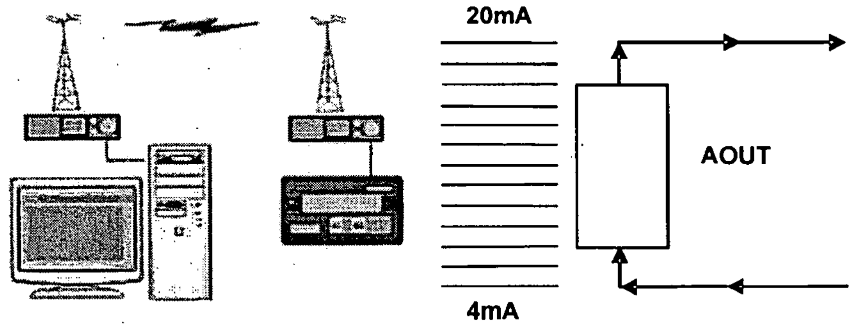



*Figure 165 – Source: SCADA*

## 29.3 Liquid Level

When configured to follow this source, the Analog Output will take on a value representing the level of liquid in the well as seen by the MonitorPro. The level is represented over a scale of 4 to 20 mA where 0% liquid level is represented by 4mA. Every 10% increment results in an increase of 1.6mA until 20mA is reached at 100% liquid level.

This source follows the liquid level as seen by the MonitorPro, not an attached MTxPC. There may be a slight delay between when the level changes on the MTxPC and when the MonitorPro is updated with this change.

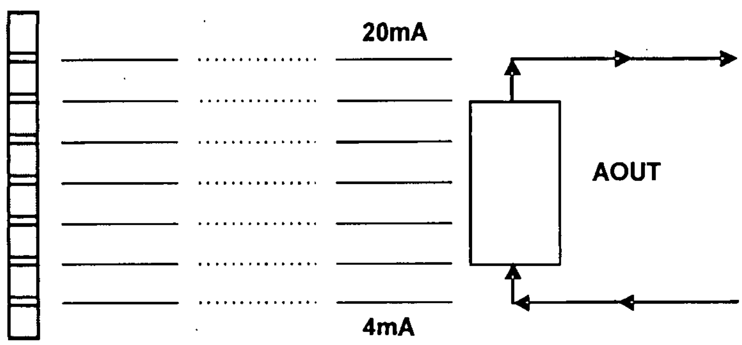



*Figure 166 – Source: Liquid Level*

## 29.4 Analog In 1

When configured to follow this source, the Analog Output will follow the milliamp value of Analog Input 1. This means that the Analog Output will follow the current input into Analog Input 1 and not the display value of AIN 1, however, the AOUT display will show the same display value as AIN 1.

The Analog Output will also be constrained to the Span set for AIN 1. If AIN 1 drops below its Zero then the Analog Output will continue to follow the milliamp value input into AIN 1. If AIN 1 rises above its Span, then the AOUT will stop at the Span set for AIN 1.

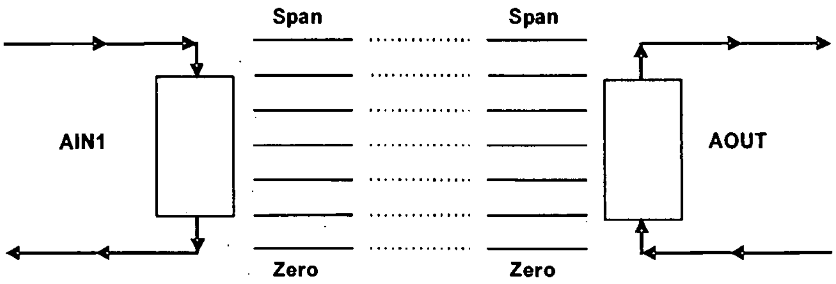



*Figure 167 – Source: Analog In 1*

## 29.5 Analog In 2

This Analog Output source behaves in exactly the same way as the AIN 1 source, except the AIN 2 milliamp value is followed.

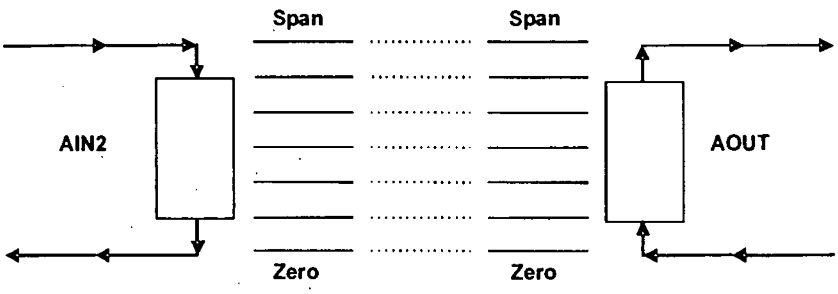



*Figure 168 – Source: Analog In 2*

## 29.6 Analog In 1 Inverse

When configured to follow this source, the Analog Output will follow the milliamp value of Analog Input 1 inversely. This means that when AIN 1 is at its Zero level then AOUT is set to the Span value, as AIN 1 rises AOUT falls until AIN 1 is at the Span level and AOUT is at the Zero level.

Using the example of a 4 to 20mA Zero and Span, 4mA IN = 20mA OUT, 20mA IN = 4mA OUT, 8mA IN = 16mA OUT etc. If AIN 1 drops below the Zero point, then AOUT will be limited to the Span. If AIN 1 rises above its Span then AOUT will drop to 0mA. The AOUT display value will have the same scale as the AIN display it is following.

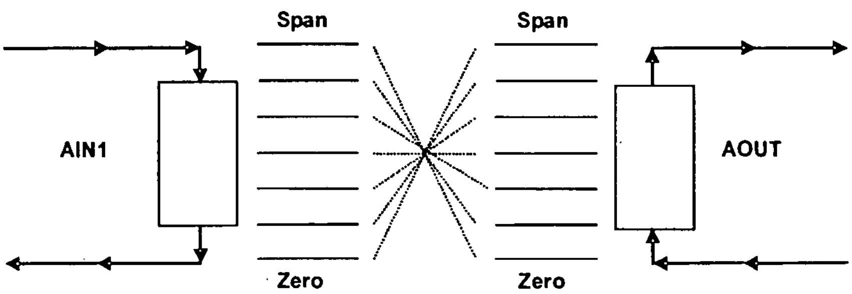



*Figure 169 – Source: Analog In 1 Inverse*

## 29.7 Analog In 2 Inverse

This Analog Output source behaves in exactly the same way as the AIN 1 Inverse source, except the AIN 2 milliamp value is followed inversely.

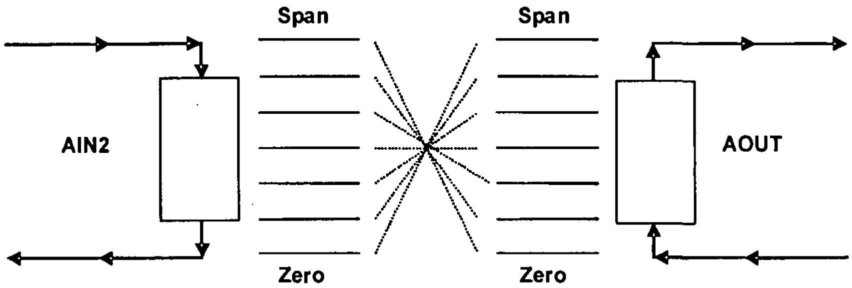



*Figure 170 – Source: Analog In 1 Inverse*

## 29.8 Calibration

Similar to the Analog Inputs, The Analog Output is also able to be calibrated. Within the Analog Output configuration menu there is a constant called I @ 20 mA uncalibr.

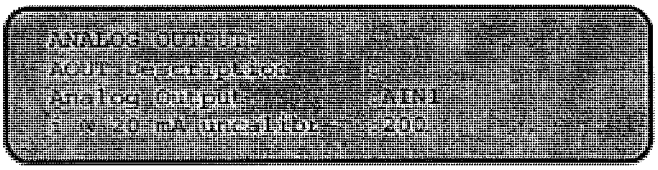


*Figure 171 – Analog Output - Source: Selection Screen*

This is the calibration constant which works in a similar manner to the AIN calibration. The calibration procedure is slightly different depending on which source is used. Depending on the source, calibration must be performed at either 20mA or at the Span value of the source. The following table shows each of these sources and their calibration point:

| AOUT Source | Calibrate at 20 mA | Calibrate at Span |
|---|---|---|
| SCADA | Yes | |
| Liquid Level | Yes | |
| AIN 1 | | Yes |
| AIN 2 | | Yes |
| AIN 1 Inverse | | Yes |
| AIN 2 Inverse | | Yes |

*Note: Changing the AOUT Source will require calibration to be performed again.*

# 30 Methods

## 30.1 Calibrating Analog Inputs (1 or 2)

1 To calibrate the AIN's you will need a current source and a calibrated meter. The current source can be in the form of a PLC or other instrument however the instrument needs the ability to force its output to the Zero and Span current values you will be using.

2 For unused inputs, this procedure should still be followed to prevent the inputs from showing incorrect or misleading values.

3 Navigate to the Main Menu> Station Setup> Inputs/Outputs> Analog Inputs Menu:

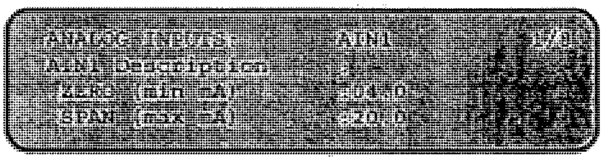



*Figure 172 – Analog Inputs – Screen 1*

4 Enter the Zero and span you wish to use for each of the analog inputs. This will set calibration values to typical values. These will have a reasonable degree of accuracy and no further steps are required if accuracy is not an issue. However, for the most accurate results follow the rest of these calibration steps.

5 Save and exit from the menus, allowing the unit to restart. Once it has restarted and is displaying the default overview screen, press the RIGHT, HELP and EXIT buttons at the same time.

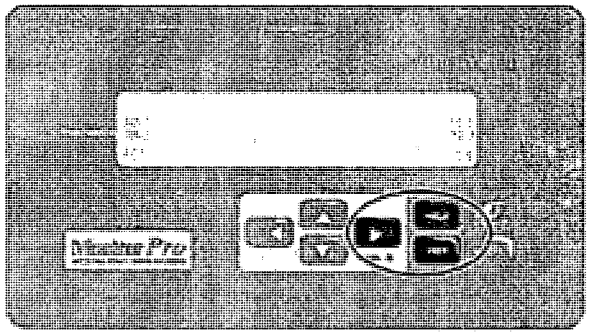


*Figure 173 – Key sequence for enabling calibration*

6 "Calibration Mode ON" will appear on the screen briefly, and then the display will return to normal.

7 Navigate the main display screens until the analog values screen as shown below is displayed (press DOWN four times from the default screen):

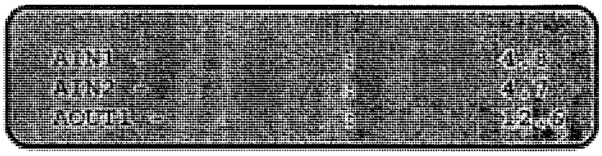



*Figure 174 – Analog I/O Calibration Screen*

8 Connect the current source to the analog input 1 terminals. Remember that these terminals should never be raised above 13VDC from ground; so if you are using a current source with no ground reference, for example a hand-held calibrator, connect the Analog Input 1 negative terminal (R1-) to the MonitorPro ground (at AT-).

9 Apply the current you have set to be the Zero value for this Analog Input.

10 Record the reading shown beside AIN1 as the Zero calibration level. For example at 4mA it should be in the 4.6 - 5.1 range.

11 Apply the current you have set to be the Span value for this Analog Input.

12 Record the reading as the Span calibration level. For example at 20mA it should be in the 24.0 - 25.5 range.

13 Repeat the above steps for Analog Input 2.

14 Enter the Station Setup -> Inputs/Outputs -> Analog Inputs menu.

15 Add the recorded data to the relevant fields for each input (both AIN1 and AIN2)

16 In the "Zero (mA)" field add the previously recorded Zero calibration level (e.g. 4.6 to 5.1).

17 In the "Span (mA)" field add the previously recorded Span calibration level (e.g. 24.0 to 25.5).

18 Exit the menu system and save any changes. The unit should restart.

19 The Analog Inputs are now calibrated. If the Zero or Span values are changed then the typical calibration values will be re-entered and calibration will need to be performed again. This is only required if accuracy is of critical importance.

## 30.2 Calibrating Analog Output with SCADA or Liquid Level as source

1 If Analog Inputs are to be set up on this unit, ensure they are set up and calibrated (if necessary) before calibrating the Analog Output.

2 *This calibration procedure is to be performed when the SCADA or Liquid Level sources are being used.* If you change sources you will need to re-calibrate (even if the two sources undergo the same calibration procedure).

3 Select your Analog Output Source from the Main Menu> Station Setup> Inputs/Outputs> Analog Outputs menu.

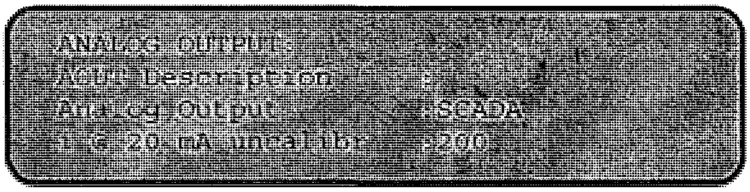



*Figure 175 – Analog Output: Source Screen*

4 Ensure "I @ 20 mA uncalibr" is the default i.e. 200.

5 Save and Exit back to the main menu (unit will restart if changes have been made).

6 Navigate to the following window from the main overview screen

7 Use the AOUT source to cause the AOUT to output 20mA. If SCADA is the source, use Outpost to set the AOUT to 20mA, if Liquid level is the source then set the liquid level on the pump controller to 100%

8 Measure and record the current coming from the AOUT terminals. If you require the MonitorPro to supply power for the current loop, short circuit the "SCR" and EXC" terminals, and measure the current between AT+ and AT-. For 20mA it should be in the 19.0mA - 22.0mA range.

9 Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Output menu.

10 Edit the parameter "I @ 20 mA uncalibr" parameter and program it to ten times the value read from the meter in step 8) above, i.e. if you measured 20.6mA, enter 206.

11 Save and Exit from this menu, the unit should restart.

12 Repeat steps 7) and 8), the output current should now be within 0.1mA of 20mA.

## 30.3 Calibrating Analog Output with AIN1, AIN2, AIN1 Inverse or AIN2 Inverse

1. Ensure the Analog Inputs are calibrated and set up before calibrating the Analog Output. Make note of the Zero and Spans set for the Analog Inputs as well as the Display Zero and Spans.
2. Select your Analog Output Source From the Main Menu> Station Setup> Inputs/Outputs> Analog Outputs menu.
3. Set "I @ 20 mA uncalibr" to 10 times your AIN 1 or 2 Span ie. If you are using AIN1 with a Span of 16 as the source, set this value to 160.
4. Save and Exit back to the main menu (unit will restart if changes have been made).
5. Navigate to the following window from the main overview screen:

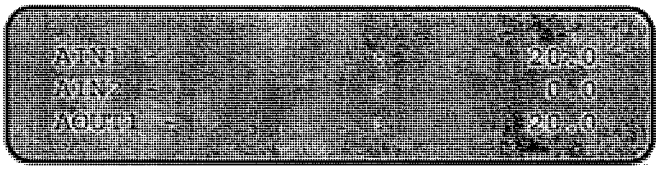



*Figure 176 – Analog I/O Screen*

6. Use the source you selected to cause the AOUT to output the Span current, i.e. if you are using AIN 1 with a span of 16mA as a source, input 16mA into AIN1 so that AOUT outputs 16mA. If an inverse source is used, set the AIN to its Zero value, to force the AOUT to output the Span value.
7. Measure and record the current coming from the AOUT terminals. If you require the MonitorPro to supply power for the current loop, short circuit the "SCR" and EXC" terminals, and measure the current between AT+ and AT-.
8. Enter the Main Menu> Station Setup> Inputs/Outputs> Analog Output menu.
9. Edit the parameter "I @ 20 mA uncalibr" parameter and program it to ten times the value read from the meter in step 7) above, i.e. if you measured 16.6mA, enter 166.
10. Save and Exit from this menu, the unit should restart.
11. Repeat steps 6) and 7), the output current should now be within 0.1mA of the AIN Span.

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# Transformers

## Index

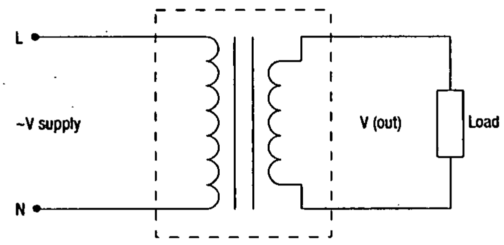
# Principles of operation

A transformer transfers electrical energy from one circuit to another through the medium of a magnetic field. The transformer may step up the voltage, step it down or deliver energy at the same voltage.

## The safety isolating transformer

The safety isolating transformer is one of the most widely used of all transformers. It is designed to achieve an accurate voltage ratio within a specific load range.

There is no direct connection between the windings. They are only connected by the intangible lines of magnetic flux in the core. In some types of circuits the transformers may have 1:1 ratio - that is



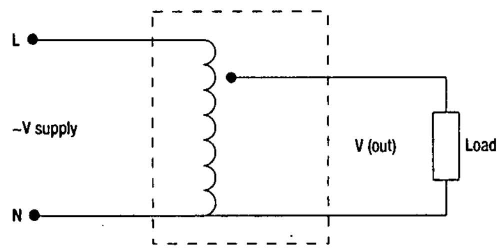

Connection for Safety Isolating transformer

## Autotransformers

Autotransformers use a tapped winding therefore the valuable isolation feature of the isolating transformer is lost.

Auto transformers are generally used to obtain small increments of voltages above or below the input voltage and the closer the output to input voltage ratio comes to 1:1, the better the performance.

Under International Standards AS/NZS 3108 / EN60742 for safety isolating transformers, protection is required to either limit the temperature rise of the transformer windings, limit the current or interrupt the circuit in the event of a short circuit on the output.



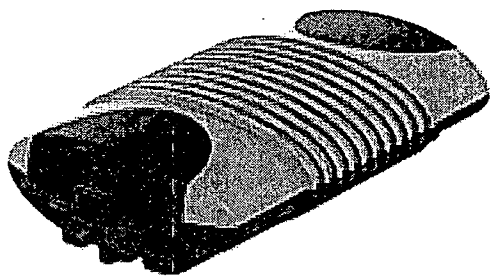

Autotransformer, Tapped winding

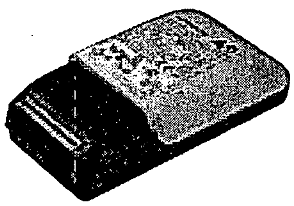
## Short circuit and overload protection

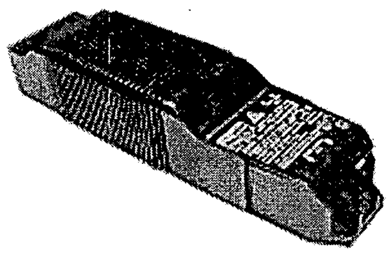
**There are two types of transformer protection namely:**

1. Non inherently short circuit proof transformer where the protection is applied using a high quality self resetting thermal cut-out, eg. ECT type.

2. Non inherently short circuit proof transformers which are designed to be protected against excessive temperature by means of an externally fitted fuse on either the input or output circuit depending on the application, eg: OMT and OGT types.

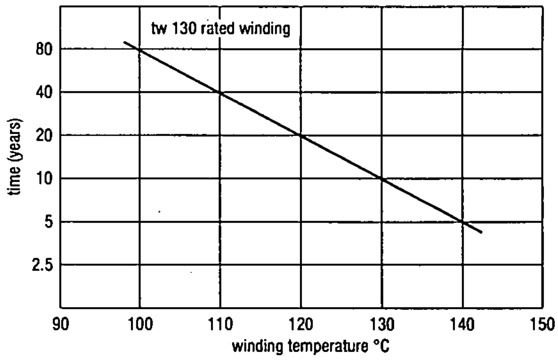






## Long life

Because of the long hours of use, low voltage transformers have to be designed and built to a high specification, which involves the use of quality heat resistant materials. Class H insulation materials ensure long service life, which according to AS/NZS 3108 / EN60742 allows a maximum winding temperature rise of 140°C measurement at 6% over voltage. At an actual winding temperature of 130°C, 10 years life can be expected. The graph shows the theoretical service life of a transformer against winding temperature. Every 10°C over the winding temperature of 130°C halves the transformer life.




Service life versus winding temperature

The manufacturing technique used by TridonicAtco is to vacuum impregnate the transformer with an unsaturated polyester resin. Typical characteristics are thermal class 'H' (180°C IEC600). Vacuum impregnation improves quality and longevity because the resin is drawn into the heart of the core and coil. This maximises heat transfer and also ensures silent operation.

## Voltage regulation

Secondary voltage changes with load. A transformer must always be loaded to its nominal rating to produce the correct secondary voltage. TridonicAtco transformer load ratings and voltage ratings are given at continuous operation on full load.

## Connection on the secondary side

The current on the extra low voltage side can be in excess of 20 times higher than the primary current depending on voltage ratio. Connections must be tight and connectors must be able to withstand the current, naturally the terminals of the transformer have been developed to carry the high currents but connections used elsewhere on the secondary side must be chosen carefully.

Similarly, the wiring on the secondary side must be of the correct length and cross-section, otherwise excessive voltage drop will occur. eg: in extra low voltage halogen lighting applications, when more than one lamp is connected to a transformer the lead lengths should be the same, otherwise lumen output and colour appearance and rendition will be affected.

# Extra low voltage lighting recommendations

ELV (12V) tungsten halogen lighting systems are popular but the lamps are very voltage sensitive and so a slight variation in voltage will have a significant impact on lamp life, eg: a 5% increase in secondary voltage will reduce the rated lamp life by 50% on a 12V system. The transformer must be carefully matched with actual line voltage and strict installation guidelines must be followed to avoid the impact of voltage drop.

## Voltage regulation

The secondary voltage of a transformer changes with the load, therefore, for multi-lamp applications a transformer with good voltage regulation must be used. This is because unloading of the transformer occurs as lamps burn out, eg: there may be 4 x 50W lamps wired to a 200VA transformer and if one or two lamps fail, the transformer regulation may not be able to compensate for the decrease on load. This will subject the remaining lamps to an over supply of secondary voltage. Therefore, it is recommended that failed lamps always be replaced.

On a one lamp / one transformer installation the regulation of the transformer is not important as long as the lamp wattage matches the full load of the transformer. These, small transformers generally have higher impedance and regulation characteristics. It follows that the higher impedance limits the in-rush current on a cold lamp.

The lower in-rush current (or "soft start") helps lamp life. Filament evaporation eventually creates a weak spot on the filament. This weak spot is effected by in-rush current, therefore the one lamp/ one transformer system is beneficial for ferro-magnetic transformers, but does not apply for correctly rated electronic transformers.

## High current on the secondary side

Another important consideration in ELV systems is the impact of high currents. Circuits must be designed and cables sized to carry the higher currents. A 12V lamp can draw 20 times more current than a 240V lamp of the same wattage.

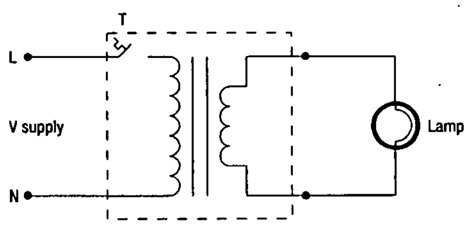
For maximum safety, optimum voltage at the lamp and consequently lamp performance, it is preferable to use one (1) ferro-magnetic transformer per lamp.

On multi-lamp systems, each lamp should be cabled back to the transformer independently - particularly as the relatively smaller cables used would be more practical and easier to terminate at both the light fitting and the transformer. In these installations it is necessary to estimate voltage drop to each lamp and use the appropriate sized cable according to each cable run. If each light fitting in a multi-lamp system is individually wired back to the transformer, then the possibility of using cable lugs to a common stud connection should be considered.

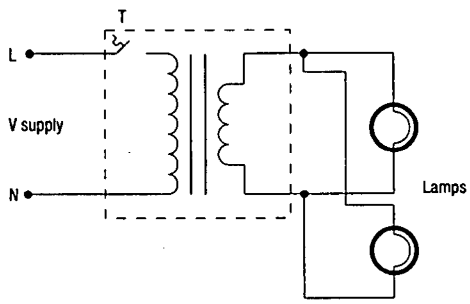
## Protection and approval

It is mandatory under the wiring rules that transformers for remote mounting are housed in a suitable enclosure and as a prescribed item must be approved by the Statutory Authority to AS/NZS 3108/EN 60742. The approval number must be clearly marked on the enclosure. Also under the wiring rules the enclosed transformer must be located in the installation in a position where it is easily accessible for inspection and maintenance.

The transformer enclosure and wiring to the light fitting must have adequate ventilation. If the wiring and the transformer enclosure are covered with building insulation material then substantial derating and overheating may occur.



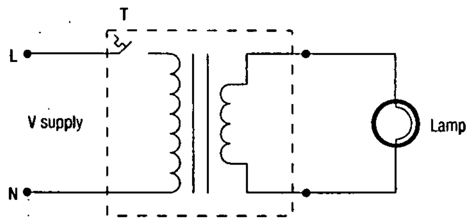

One transformer per lamp




Multi lamps on one transformer

# Technical tips for low voltage lighting transformers

| | | |
|---|---|---|
| Lamp appears to be intact but will not light | Failed lamp | Replace lamp |
| | Supply fault | Check supply volts and circuit fuse or breaker |
| | Wiring fault | Check for loose connections on input and output of transformer and the lampholder connections. |
| | Transformer fault | Check output voltage of transformer, if no voltage measured, substitute transformer |
| Blowing fuses or tripping circuit breakers | Short circuit | Disconnect secondary at the transformer and re-energise the circuit. Should short circuit re-occur immediately (fuse blows), then try substituting the transformer. If short circuit does not immediately re-occur then replace the secondary wiring and/or the light fitting |
| Lamp cycling on/off | Loose connection | Check for loose connection at supply source on primary and secondary connections of the transformer and also at the lamp |
| | Poor contact in lamp holder | Check the lamp contact condition and if necessary replace lampholder |
| | Transformer cycling | Check that transformer is installed in a ventiated area on a flat surface. Remove transformer away from heat source such as the lamp. Remove any insulation which may be around or covering the transformer. |
| | Lamp and transformer incompatible | Check lamp wattage is the same as the transformer rating. |
| Short lamp life | High lamp power | Check voltage at lamp is the same as the transformer nominal secondary voltage rating. **note:** The voltage measurement must be recorded over time to check voltage fluctuations. |
| | Lamp and transformer incompatible | Check lamp wattage is the same as the transformer rating. Also check the secondary voltage at the lamp, that it matches the lamp nominal voltage rating. |
| | Over temperature of lamp | Check the light fitting and ensure the lamp is well ventilated. |
| High or low light output | Incorrect lamp wattage | Check lamp wattage is the same as the transformer rating. |
| | Supply voltage | Check supply voltage is correct and is the same as the transformer nominal voltage rating. **note:** The supply voltage measurement should be taken over time to check voltage fluctuations. |
| | Incorrect wiring | Electrical practice guidelines must be followed in selection of conductor rating to avoid the impact of voltage drop. |
| | Lamp voltage | Check secondary voltage of transformer, it must match the lamp rated voltage. |
| audible noise | Lamp noise | Check if lamp filament is generating noise due to dimmer controller. If necessary introduce an TridonicAtco inductor in the circuit. |
| | Transformer noise | Check with the dimmer supplier or manufacturer to ensure the phase control dimmer is suitable for dimming inductive loads such as transformers. If dimmer switching is asymmetrical it can induce a DC wave form into the transformer winding which can lead to overheating, noise and possible damage or failure of the transformer. |



Low voltage lighting transformer circuit

# Dimming

Dimmers are widely used to control light output of extra low voltage tungsten halogen lamps by varying the input voltage of the transformer. Common dimmers operate by removing a section of the input voltage waveform using a transistor like device called a TRIAC, switching on and off very rapidly – 100 times each second.

There are two main types of dimmers. The more common and also the lower cost is the leading edge type. They remove the beginning of incoming AC mains and are suitable for use with resistive and inductive loads. The other type is trailing edge type which controls the power by removing the trailing section of the incoming supply voltage, suitable for use with resistive and capacitive loads.

Although the extra low voltage tungsten halogen lamp by itself is a resistive load, when a ferro-magnetic transformer is used the circuit becomes inductive. On the other hand, an electronic transformer may be designed to be either inductive or capacitive.

TridonicAtco ferro-magnetic transformers, such as the TM50, can be controlled by the common leading edge dimmers. The size of the dimmer should be selected so that it is capable of carrying the intended load, being the transformer and lamp wattage. The quality and operation of the dimmer is important. Even though a dimmer may be a suitable type, if the switching is asymmetrical it can induce a DC offset waveform into the transformer winding which can lead to overheating and possible damage or failure of the transformer.

TridonicAtco TED range electronic transformers are primarily designed for common leading edge dimmers. These dimmers require an inductive load for correct operation. A capacitive load would cause very large current spikes at the switching instants, thereby, generating unacceptable EMI emission from the installation. Most electronic transformers available in the market are capacitive loads. Although they may seem to be working correctly with leading edge dimmers, the problems they generate are usually not visible to the eye.

To achieve correct operation with leading edge dimmers, the TED is designed with an inductive front end. Therefore, at the dimmer switching instants, the current spike is minimal. However, when the TED is controlled by a trailing edge dimmer, because of the stored energy in the input inductor, there will be a voltage spike at the switching points. This voltage spike is usually eliminated by the snubber components in the trailing edge dimmers.

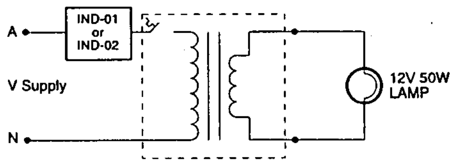
Note that because of different dimmer designs, an approved dimmer must be used to guarantee correct operation of the TED range electronic transformers. Approval must be sought for any new dimmer.

## Dimming and lamp filament noise

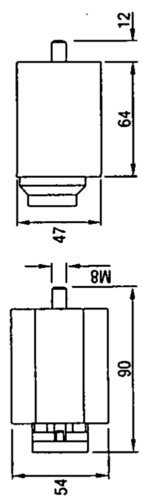
At times, when dimming extra low voltage lighting, the lamp filament may generate noise due to the dimming controller. By introducing an TridonicAtco IND-01 or IND-02 inductor in the circuit, this noise will be reduced to an inaudible level. The inductor is to be connected in series with the input winding of a 50VA extra low voltage lighting transformer. Note that it may be possible to use only one inductor per dimmer circuit provided that only one transformer is connected in series with the inductor (see diagram below).

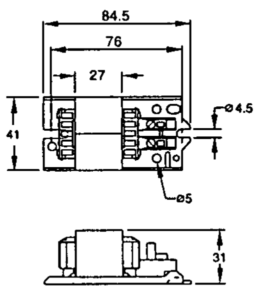
Apart from being simple to wire, it also has low losses and low temperature rise. This inductor has been developed for the more popular, transverse type 50W filament lamps. This inductor is available either as IND-01, an EC ballast type for use in assemblies, or as IND-02, being fully encapsulated in its own enclosure.

The number of inductors required to reduce the noise on a circuit is dependant on the dimmer design. As a general rule one inductor can be used in a circuit with four transformers reducing the noise to an inaudible level when wired as per the recommended wiring diagram.




IND lamp noise inductor

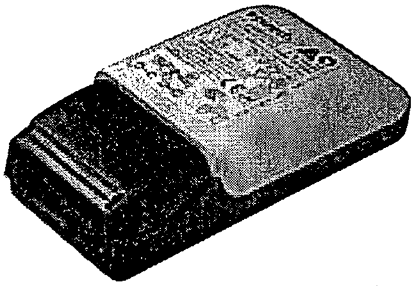



Inductor IND-02

Inductor IND-01

# Electronic safety isolating transformers for low voltage lamps



speedy®

## Universal performance for halogen lighting

TE transformers are TridonicAtco's universal solution for all installations. A combination of optimum perfomance in electronics and intelligent processor technology provides high levels of safety, convenience and reliability in the operation of modern halogen lamps.

## Proven safety

TridonicAtco electronic isolating transformers have been tested in accordance with the relevant European standards. Safety is paramount. TE transformers are isolating transformers that conform to EN 61046, IEC 61046 and VDE 0712.24.

## Optimum lamp operation

Electronic transformers operate the lamp in the high frequency range (30-40kHz). The use of modern electronic technology guarantees optimum lamp operation. The life of the lamps can be extended considerably by limiting the starting current, soft starting and a constant secondary voltage, independent of the load throughout the entire output range. A unique circuit design in the higher output ranges 150VA and 210VA provides additional secondary voltage stabilisation throughout the entire primary voltage range from 207V-264V.

## Dimming

TE Transformers can be controlled by virtually any dimming signal. The transformer is selected to suit the appropriate dimming option. Whether digital, general phase control, phase cutting, switchDIM or analogue 1-10V. A flexibility that offers considerable savings in both operation and installation costs.

## Protection

TE transformers are protected against overload, overheating and short circuit. If a short circuit occurs on the secondary side, the transformer will switch off within a few milliseconds. It will be ready for operation again automatically after the short circuit has been rectified. The precise structure of the circuit guarantees protection against short circuits on the secondary side for all specified lengths of wiring.

The electronic overload protection system automatically reduces the output in the event of an overload condition, thus protecting the electronic transformer. If the overload is removed from the output, the electronic transformer automatically re-adjusts to the rated output.

An automatic reduction in output power and thus protection of the electronic transformer also takes place if the casing or ambient temperatures are exceeded. Re-adjustment to the rated output also takes place automatically.

## Immunity

A transient mains voltage surge may occur when inductive loads (e.g. motors or conventional chokes) are switched off. TE electronic transformers are protected against voltage surges and spurious pulses of any polarity with random phase position superimposed on the supply voltage, in accordance with EN 61547.

## Emission

The limits for emission as per EN 61000-3-2 are maintained by high-quality filter circuits.

## RFI-Protection

The sophisticated filtering system of electronic transformers TE ensures compliance with EN 55015 and VDE 0875-151.

## Harmonics

Harmonics from non-linear loads cause distortions in the mains supply. The special circuit design fulfils the requirements of EN 61000-3-2.

## Electromagnetic compatibility

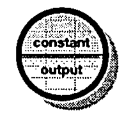
The requirements of the EMS Directive 89/336/EEC are fulfilled by observance of the standards for emission and immunity.

# Electronic transformers: technical information

### Quality assurance
Our EN 29001/ISO 9001 quality assurance system guarantees a constant product quality standard. Constant process controls, modern test facilities, 100% final testing, burn-in, accelerated lifetime tests such as HASS (High Accelerated Stress Screening) and HTL (High Temperature Life), life tests and thermal shock tests also ensure consistently high quality.

### Service life
The use of high quality electronic components, some of which are manufactured exclusively for TridonicAtco, and excellent circuit design, enables service life of over 50,000 operating hours to be achieved.


### ASIC technology
The ASIC (Application Specific Integrated Circuit) is the core of the patented circuit which ensures optimised, low-loss control of the power output. At the same time it regulates all protection and monitoring functions as well as voltage stabilisation.

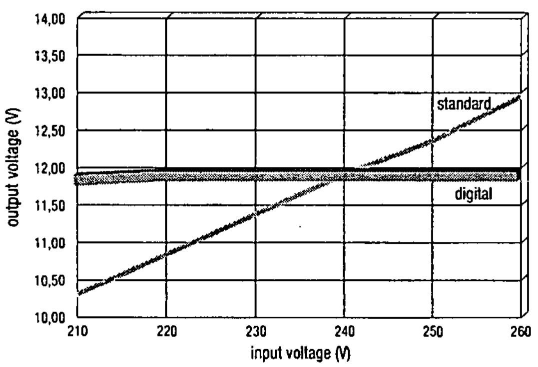


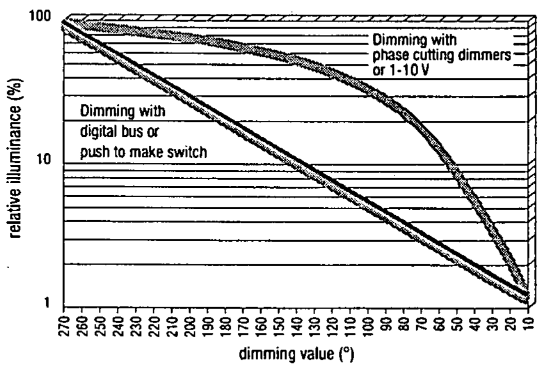

### Maximum light and service life
The service life of low-voltage halogen lamps is very much dependent on the voltage. If there is 6% over-voltage, then the lamp life is reduced by 50%. If the voltage is low the luminous flux is considerably reduced. TridonicAtco provides the solution for TE-L/T/U/SA models by stabilising the output voltage.

### Technical features and advantages:
- safety isolating transformer with maximum output of 20-300 VA, available in 5 versions
- safety conforming to EN 61046, IEC 61046 and VDE 0712.24
- electro magnetic compatibility 89/336/EWG
- RFI protection conforming to EN 55015 and VDE 0875-151
- immunity conforming to EN 61547
- emission and harmonics conforming to EN 61000-3-2
- performance requirements according to EN 61047, IEC 61047 and VDE 0712.25
- increased lamp life with softstart
- minimum inrush current
- secondary voltage independent of load
- output voltage is independent of input voltage with all digital transformers
- protection against short circuit with automatic restart
- protection against high temperature with automatic restart
- suitable for DC with all digital transformers

### Optimal lighting comfort – matched to the human eye

The eye is most sensitive in the range up to 10% light output, irregular changes in the illuminance level are perceived as unpleasant. The control characteristics of an electronic transformer controlled by a micro-processor are compared with a conventional phase-cutting dimmer and 1-10 V systems in the adjacent graph. The dimming curve is linear over the whole control range, controlling the lighting level in a way matched to the requirements of the human eye.



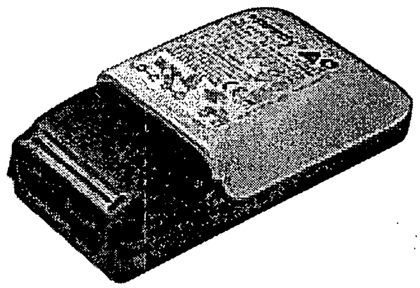



## Recommended lamp loads

| Type | Max VA | Min VA | 20W | 35W | 50W |
|---|---|---|---|---|---|
| **ECT transformer** | | | | | |
| ECT35 | 20 | 14 | 1 | - | - |
| ECT50 | 35 | 25 | - | 1 | - |
| ECT75 | 50 | 35 | 2 | 1 | 1 |
| ECT105 | 70 | 49 | 3 | 2 | 1 |
| ECT120 | 80 | 56 | 4 | 2 | - |
| ECT160 | 100 | 70 | 5 | 3 | 2 |
| **OMT transformer** | | | | | |
| OMT30 | 25 | 10 | 1 | - | - |
| OMTM40 | 50 | 20 | 2 | 1 | 1 |
| OMT55 | 65 | 26 | 3 | 2 | 1 |
| OMT65 | 80 | 32 | 4 | 2 | 1 |
| OMT75 | 100 | 40 | 5 | 3 | 2 |
| OMT105 | 160 | 64 | 8 | 4 | 3 |
| OMT120 | 200 | 80 | 10 | 6 | 4 |
| **OGT transformer** | | | | | |
| OGT30 | 180 | 36 | 9 | 5 | 3 |
| OGT40 | 250 | 50 | 13 | 7 | 5 |
| OGT50 | 320 | 64 | 16 | 9 | 6 |
| OGT60 | 400 | 80 | 20 | 11 | 8 |
| OGT70 | 500 | 100 | 25 | 14 | 10 |
| OGT80 | 550 | 110 | 28 | 16 | 11 |
| OGT90 | 650 | 130 | 33 | 19 | 13 |
| OGT100 | 750 | 150 | 38 | 21 | 15 |
| OGT110 | 800 | 160 | 40 | 23 | 16 |
| OGT120 | 900 | 180 | 45 | 26 | 18 |
| OGT140 | 1000 | 200 | 50 | 29 | 20 |
| OGT160 | 1200 | 240 | 60 | 34 | 24 |
| **Enclosed and electronic transformer** | | | | | |
| ACT35-2 | 20 | 14 | 1 | - | - |
| TM50-2 | 50 | 35 | 2 | 1 | 1 |
| LVL48A-2-01 | 50 | 35 | 2 | 1 | 1 |
| LVL10-2-22 | 50 | 20 | 2 | 1 | 1 |
| LVL10-2-23 | 75 | 30 | 3 | 2 | 1 |
| LVL48A-2-02 | 100 | 20 | 5 | 3 | 2 |
| LVL10-2-24 | 100 | 40 | 5 | 3 | 2 |
| LVL14-2 | 100 | 40 | 5 | 3 | 2 |
| TE 70 & 105 speedy® | 70/105 | 20/35 | | | |
| TE-DC | 300 | 100 | | | |
| TE-L 0070 & TE-T 0070 | 70 | 20 | 3 | 2 | 1 |
| TE-L 0105 & TE-T 0105 | 105 | 35 | 5 | 3 | 2 |
| TE-L 0150 & TE-T 0150 | 150 | 20 | 7 | 4 | 3 |
| TE-L 0210 & TE-T 0210 | 210 | 20 | 10 | 6 | 4 |
| LVL10-2 | 160 | 64 | 8 | 4 | 3 |
| LVL6-2 | 200 | 40 | 10 | 6 | 4 |
| LVL8-2 | 200 | 80 | 10 | 6 | 4 |
| MT120-2-D427-SP1 | 200 | 80 | 10 | 6 | 4 |
| LVL48A-2-03 | 200 | 40 | 10 | 6 | 4 |
| BGT40-2-D490-SP4 | 250 | 50 | 13 | 7 | 5 |
| LVL4-2 | 250 | 50 | 13 | 7 | 5 |
| LVL21-2 | 320 | 64 | 16 | 9 | 6 |
| LVL23-2 | 320 | 64 | 16 | 9 | 6 |
| LVL19-2 | 500 | 100 | 25 | 14 | 10 |
| LVL17-2 | 650 | 130 | 33a | 19 | 13 |

## TE 20–105 VA 230–240/11,5 V 50/60 Hz speedy®

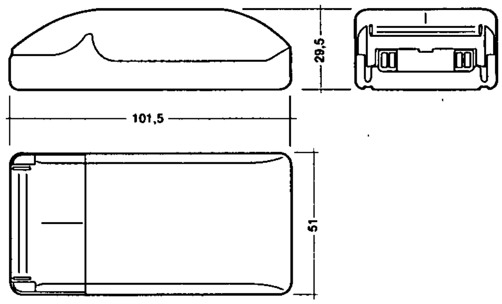
There has never been an Australian made transformer with such small dimensions and so much power. One single speedy® can be connected to up to five low voltage halogen lamps. Each transformer offers smooth stepless dimming. speedy® has a large wiring space, multiple terminals and tool free cable grip. All this at a price as small as the external dimensions of the new speedy®.



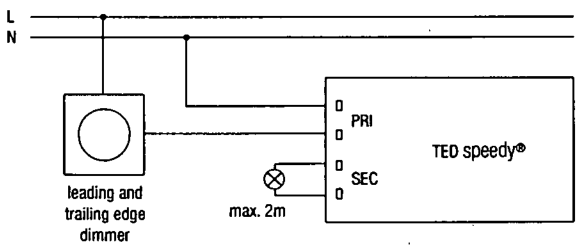
**More powerful**
TridonicAtco speedy® transformers are designed and made in Australia to meet the demands of Australian electrical contractors. Available in 2 different power ratings: 20-70VA and 35-105VA with multiple secondary terminals.

**Small is beautiful**
Its extremely compact external dimensions mean that speedy can be manoeuvred into the tightest of corners. More often than not there is no need for speedy® to be installed into its own opening as it will fit comfortably through the luminaire fixing hole within the ceiling.

**Leading edge technology**
Quite simply, the highest principle of modern industrial design has been applied to speedy®, the small transformer. In fact, its external form is both attractive and practical. It really is a shame that speedy®'s elegant exterior is usually hidden in the background during operation.




**All the advantages at a glance**
- suitable for use with approved leading and trailing edge dimmers.
- ability to run multiple lamps.
- speedy comes in two different power ratings (20-70VA, 35-105VA).
- tool free installation of cable grip for quick and simple wiring.
- its compact external dimensions mean that speedy can be installed in even the most restricted of locations.
- a lot of power for a small price.
- overload protection fades down so you will not be left in the dark.
- utilising warm start technology to increase the life of the lamp



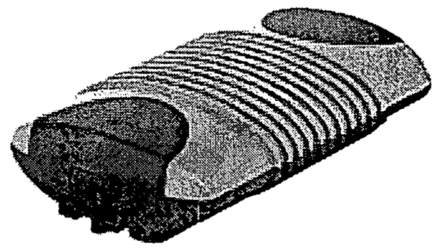

Wiring with dimmer

| Type | Unit | TE-0070 230-240/11.7 V 70 VA | TE-0105 230-240/11.7 V 105 VA |
|---|---|---|---|
| Primary voltage | V | 230 – 240 | 230 – 240 |
| Primary voltage range | VAC | 211– 254 | 211 – 254 |
| Input current 240 V / 50Hz | A | 0.30 | 0.49 |
| Frequency | Hz | 50/60 | 50/60 |
| Secondary voltage / Nominal | V | 11.5 | 11.5 |
| Lamp wattage | VA | 20 – 70 | 35 – 105 |
| Circuit power at 240 V | W | 72.0 | 108 |
| Losses at 240 V | W | 4 | 6 |
| Power factor I | | > 0.95 | > 0.95 |
| Frequency of output | kHz | 50 | 35 |
| Ambient temperature ta | °C | -20 to +50 | -20 to +45 |
| Max. case temperature tc | °C | 85 | 95 |
| Softstart (time) | s | < 1 | < 1 |
| Dimming | | leading & trailing edge | leading & trailing edge |
| Dimensions L x W x H | mm | 102 x 51 x 30 | 102 x 51 x 30 |
| Weight | g | 105 | 120 |
| Secondary terminal | | 2-pole | 4-pole |

| speedy® range | Article numbers |
|---|---|
| TE - 0070 C101 230-240/11.5V 50/60Hz | 89400019 |
| TE - 0070 C171 230-240/11.5V 50/60Hz with flex and plug | 89400020 |
| TE - 0105 C101 230-240/11.5V 50/60Hz | 89400021 |
| TE - 0105 C171 230-240/11.5V 50/60Hz with flex and plug | 89400022 |

**Conformity with**
- IEC61046 • EN50082-1 • IEC61047 • EN55015
- IEC61547, AS/NZS3250 • IEC61000-3-2, AS/NZS4051 • IEC61000-4-4

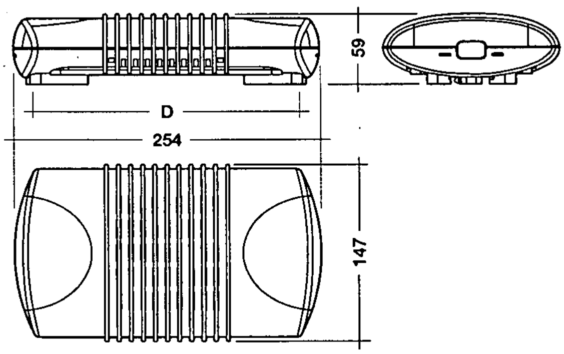
## TE-DC 100–300 VA 230–240 V 0/50/60 Hz



This lightweight, dimmable, DC transformer is suitable for long cables, wire and rails up to 20m. It has a constant voltage output even with variable loads which means a longer lamp life.

The new electronic DC transformers from the trackCONTROL series have a distinct advantage: the length from the transfomer to the lamp can be up to 20m.

- they are ideal for 12 V low-voltage wire and track systems
- short-circuit switch-off with automatic restart
- protection against overheating and overload, through regulation of output power with automatic reset
- protection class 2
- for remote mounting
- double assignments of terminals possible
- individually packed with installation instructions
- integrated strain-relief and terminal cover
- tool free assembly of the strain-relief
- constant output voltage
- DC operation possible, for use in emergency installations according to VDE 108
- suitable for cable lengths of max. 20 m




**Packaging:**
box of 10
12 boxes/pallet
120 pieces/pallet

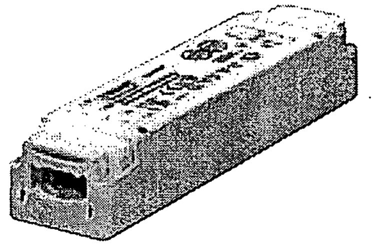
**Certified:**
• EN 55015 • EN 61000-3-2 • EN 61046 • EN 61047 • EN 61547

| Type | Unit | TE-DC 0300 F101 300 VA | TE-DC 0300 D101 300 VA |
|---|---|---|---|
| article number | | 86454757 | 22086163 |
| primary voltage | V | 207–254 | 207–254 |
| primary voltage range | VAC | 207–254 | 207–254 |
| primary voltage range | VDC | 230–240 | 230–240 |
| input current | A | 1,49 | 0,28–1,49 |
| frequency | Hz | 0/50/60 | 0/50/60 |
| secondary voltage | V | 11,9 ① | 11,9 ① |
| lamp wattage | VA | 100–300 | 100–300 |
| power reduction at DC | % | 70 | 70 |
| efficiency | % | > 90 | > 90 |
| power factor | l | > 0,99 | > 0,99 |
| power circuit | | digital | digital |
| ambient temperature ta | °C | -20 to +35 | -20 to +35 |
| max. case temperature tc | °C | 100 | 100 |
| current guard | | yes | yes |
| softstart | | yes | yes |
| dimming | | no dimming (fixed output) | DSI, DALI, single push to make switches |
| dimensions L x B x H | mm | 254 x 147 x 59 | 254 x 147 x 59 |
| fixing centres (D) | mm | 218–226 | 218–226 |
| weight | kg | 0,8 | 0,8 |
| secondary terminal | | 2-pole, screw terminal | 2-pole, screw terminal |

**notes**
① constant output voltage

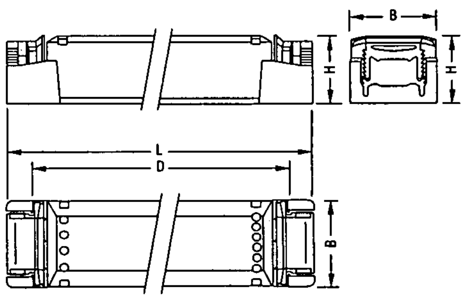
## TE-L 001 20–105 VA 220/240/12 V 50/60 Hz

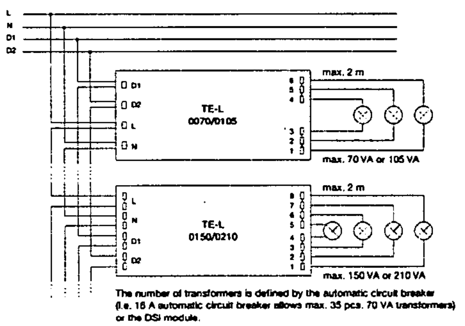
- short-circuit switch-off with automatic restart
- protection against overheating and overload,through regulation of output power with auto-matic reset
- protection class 2
- for remote mounting
- looping on primary side possible with double assignments of terminals possible
- 6 pole terminal block on secondary side
- captive screw terminals
- individually packed with installation instructions
- tool free assembly of the strain-relief and terminal cover
- constant output voltage
- DC operation possible, for use in emergency installations according to VDE 108



**Packaging:**
- box of 20
- 40 boxes/pallet
- 800 pieces/pallet

**Certified:**
- EN 55015
- EN 61000-3-2
- EN 61046
- EN 61047
- EN 61547




TE 0070 L001, TE 0105 L001, TE-L 0150 and TE-L 0210

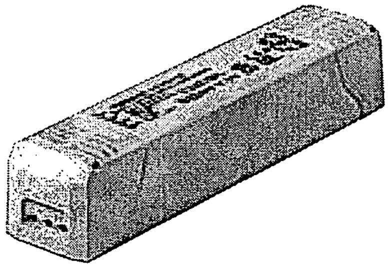
| Type | Unit | TE 0070 L001 230–240/12V 70 VA | TE 0105 L001 230–240/12V 105 VA |
|---|---|---|---|
| article number | | 22082678 | 22082662 |
| primary voltage | V | 230–240 | 230–240 |
| primary voltage range | VAC | 198–254 | 198–254 |
| primary voltage range | VDC | 220–240 | 220–240 |
| input current | A | 0,09–0,33 | 0,15–0,46 |
| frequency | Hz | 0/50/60 | 0/50/60 |
| secondary voltage | V | 11,9 ① | 11,9 ① |
| lamp wattage | VA | 20–70 | 35–105 |
| power reduction at DC | % | 70 | 70 |
| efficiency | % | > 94 | > 94 |
| power factor | I | > 0,95 | > 0,95 |
| frequency of output | kHz | 33 | 33 |
| digital power circuit | | yes | yes |
| ambient temperature ta | °C | -20 to +60 | -20 to +50 |
| max. case temperature tc | °C | 95 | 95 |
| softstart | | yes | yes |
| dimming | | DSI signal | DSI signal |
| dimensions L x B x H | mm | 167 x 42 x 31 | 167 x 42 x 31 |
| fixing centres (D) | mm | 143–148 | 143–148 |
| weight | kg | 0,17 | 0,17 |
| secondary terminal | | 6-pole | 6-pole |

**notes**

① output voltage independent of input voltage in the range 210–254 V

## TE-L 20–210 VA 230–245 V 50/60 Hz

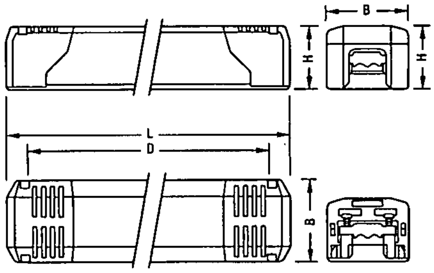
- short-circuit switch-off with automatic restart
- protection against overheating and overload, through regulation of output power with automatic reset
- protection class 2
- for remote mounting
- looping on primary side possible
- 8 pole terminal block on secondary side
- individually packed with installation instructions
- integrated strain-relief and terminal cover
- constant output voltage
- DC operation possible, for use in emergency installations according to VDE 108

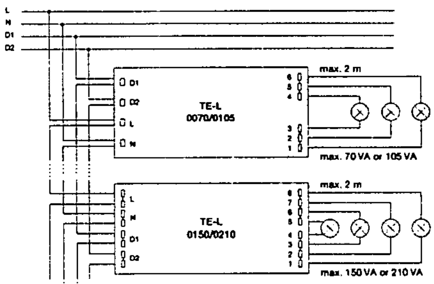


**Packaging:**
- box of 10
- 60 boxes/pallet
- 600 pieces/pallet

**Wiring:**
- page 288 figure 2C

**Certified:**
- EN 55015
- EN 61000-3-2
- EN 61046
- EN 61047
- EN 61547



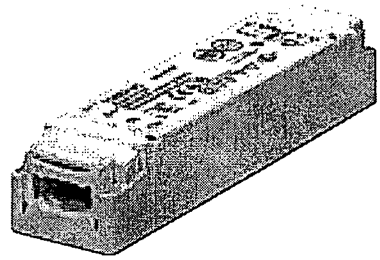

The number of transformers is defined by the automatic circuit breaker (i.e. 16 A automatic circuit breaker allows max. 35 pcs. 70 VA transformers) or the DSI module.

| Type | Unit | TE-L 0150 230–245/12 V 150 VA | TE-L 0210 230–245/12 V 210 VA |
|---|---|---|---|
| article number | | 20826312 | 20826328 |
| primary voltage | V | 230–245 | 230–245 |
| primary voltage range | VAC | 198–264 | 198–264 |
| primary voltage range | VDC | 220–240 | 220–240 |
| input current | A | 0,68 | 0,90 |
| frequency | Hz | 50/60 | 50/60 |
| secondary voltage | V | 11,9 ① | 11,9 ① |
| lamp wattage | VA | 20–150 | 20–210 |
| power reduction at DC | % | 70 | 70 |
| efficiency | % | > 95 | > 95 |
| power factor | I | > 0,99 | > 0,99 |
| frequency of output | kHz | 35 | 35 |
| digital power circuit | | yes | yes |
| ambient temperature ta | °C | 0 to +50 | 0 to +50 |
| max. case temperature tc | °C | 95 | 95 |
| softstart | | yes | yes |
| dimming | | DSI signal | DSI signal |
| dimensions L x B x H | mm | 207 x 46 x 40 | 207 x 46 x 40 |
| fixing centres (D) | mm | 170–174 | 170–174 |
| weight | kg | 0,29 | 0,38 |
| secondary terminal | | 8-pole, spring terminal | 8-pole, spring terminal |

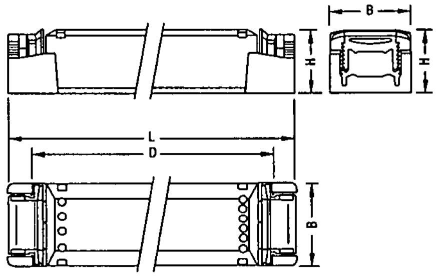
**notes**

① output voltage independent of input voltage in the range 207–264 VAC

## switch**DIM TE-T 001 20–105 VA 230/240/12 V 50/60 Hz**

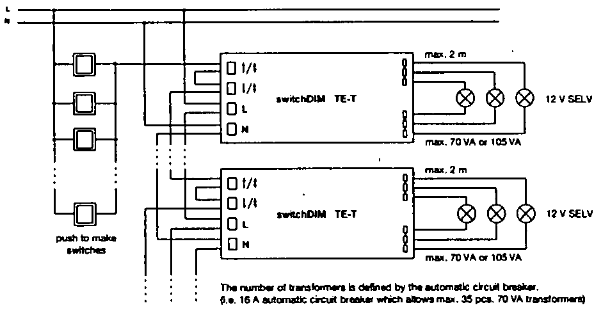


- short-circuit switch-off with automatic restart
- protection against overheating and overload, through regulation of output power with automatic reset
- protection class 2
- for remote mounting
- looping on primary side possible with double assignments of terminals possible
- 6 pole terminal block on secondary side
- captive screw terminals
- individually packed with installation instructions
- tool free assembly of the strain-relief and terminal cover
- constant output voltage
- 6 pole terminal block on secondary side
- captive screw terminals
- individually packed with installation instructions
- tool free assembly of the strain-relief and terminal cover
- constant output voltage

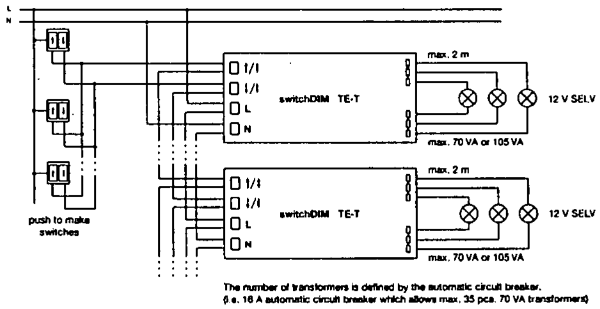



**Packaging:**
- box of 20
- 40 boxes/pallet
- 800 pieces/pallet

**Certified:**
- EN 55015, EN 61000-3-2, EN 61046, EN 61047, EN 61547




switchDIM TE-T – control with a single switch




switchDIM TE-T – control with double switches

| Type | Unit | TE 0070 T001 230–240/12 V 70 VA | TE 0105 T001 230–240/12 V 105 VA |
|---|---|---|---|
| article number | | 22082690 | 22082684 |
| primary voltage | V | 230–240 | 230–240 |
| primary voltage range | VAC | 198–254 | 198–254 |
| input current | A | 0,09–0,33 | 0,15–0,46 |
| frequency | Hz | 50/60 | 50/60 |
| secondary voltage | V | 11,9 ① | 11,9 ① |
| lamp wattage | VA | 20–70 | 35–105 |
| efficiency | % | > 94 | > 94 |
| power factor | l | > 0,95 | > 0,95 |
| frequency of output | kHz | 33 | 33 |
| digital power circuit | | yes | yes |
| ambient temperature ta | °C | -20 to +60 | -20 to +50 |
| max. case temperature tc | °C | 95 | 95 |
| softstart | | yes | yes |
| dimming | | single or double push to make switches | single or double push to make switches |
| dimensions L x B x H | mm | 167 x 42 x 31 | 167 x 42 x 31 |
| fixing centres (D) | mm | 143–148 | 143–148 |
| weight | kg | 0,17 | 0,17 |
| secondary terminal | | 6-pole | 6-pole |

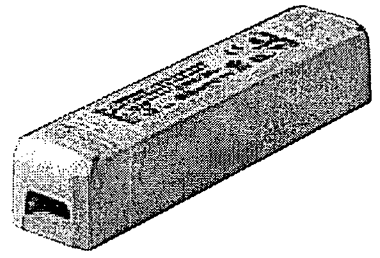
**notes**

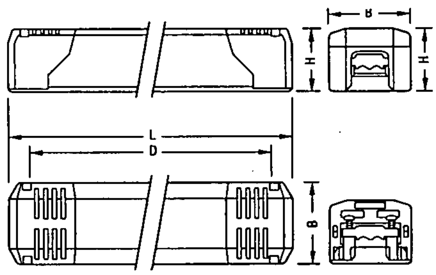
① output voltage independent of input voltage in the range 210–254 V

**Transformers**

## switchDIM TE-T 20–210 VA 230–245/12 V 50/60 Hz

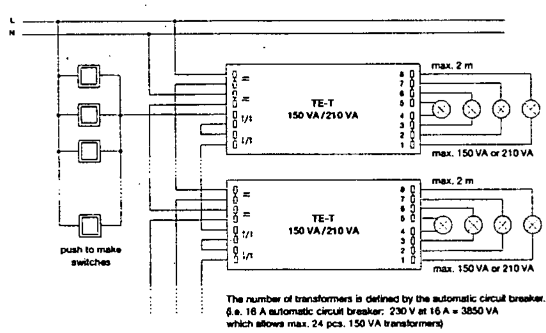
- short-circuit switch-off with automatic restart
- protection against overheating and overload, through regulation of output power with automatic reset
- protection class 2
- for remote mounting
- looping on primary side possible with double assignments of terminals possible
- 8 pole terminal block on secondary side
- spring terminal
- individually packed with installation instructions
- integrated strain-relief and terminal cover
- constant output voltage
- DC operation possible, for use in emergency installations according to VDE 108



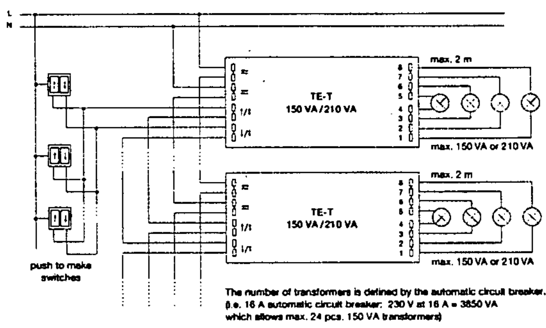



**Packaging:**
- box of 10
- 60 boxes/pallet
- 600 pieces/pallet

**Certified:**
- EN 55015, EN 61000-3-2, EN 61046, EN 61047, EN 61547




TE-T – control with a single switch



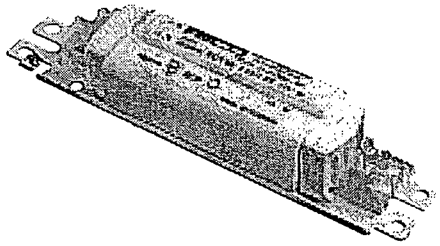

TE-T – control with double switches

| Type | Unit | TE-T 0150 230–245/12 V 150 VA | TE-T 0210 230–245/12 V 210 VA |
|---|---|---|---|
| article number | | 20826334 | 20826340 |
| primary voltage | V | 230–245 | 230–245 |
| primary voltage range | VAC | 198–264 | 198–264 |
| input current | A | 0,68 | 0,90 |
| frequency | Hz | 50/60 | 50/60 |
| secondary voltage | V | 11,9 ① | 11,9 ① |
| lamp wattage | VA | 20–150 | 20–210 |
| power reduction at DC | % | 70 | 70 |
| efficiency | % | > 95 | > 95 |
| power factor | l | > 0,99 | > 0,99 |
| frequency of output | kHz | 35 | 35 |
| digital power circuit | | yes | yes |
| ambient temperature ta | °C | 0 to +50 | 0 to +50 |
| max. case temperature tc | °C | 95 | 95 |
| softstart | | yes ② | yes ② |
| dimming | | single or double push to make switches | single or double push to make switches |
| dimensions L x B x H | mm | 207 x 46 x 40 | 207 x 46 x 40 |
| fixing centres (D) | mm | 170–174 | 170–174 |
| weight | kg | 0,29 | 0,38 |
| secondary terminal | | 8-pole | 8-pole |

**notes**
① output voltage independent of input voltage in the range 207–264 VAC
② controlled softstart due to reduction of inrush current to twice running current

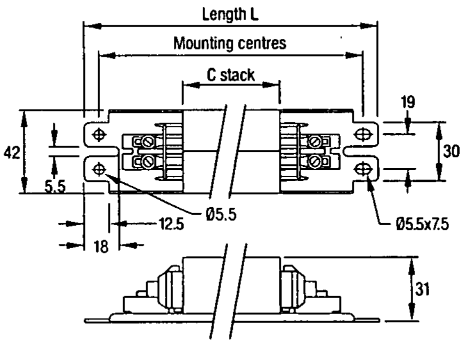
## 20-100VA ECT transformers

- slim cross-section and compact
- low magnetic stray field
- excellent load weight ratio
- vacuum impregnation
- insulation class 'H'
- long service life
- mains voltage: 240v 50/60Hz
  (other voltages and frequencies on request eg: 110v 50/60Hz etc)
- standard secondary voltage 12v VA quoted at full resistive load 100% duty cycle (other voltages and VA ratings on request)
- screw terminals
- high current on secondary may require alternative connector or flying leads at the discretion of TridonicAtco
- recommended total load is 70 to 100% of the VA rating
- short circuit protected transformer
- built-in self re-setting thermal cut-out



**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage

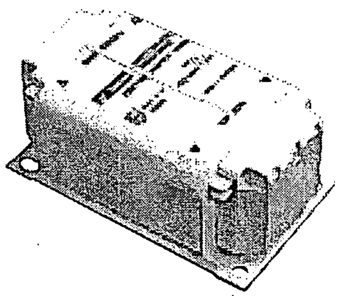



| Article number | Type | VA | typical voltages (V) | core stack (mm) | length l (mm) | mtg centres (mm) | weight (kg) |
|---|---|---|---|---|---|---|---|
| **ECT transformer** | | | | | | | |
| | ECT 35 | 20 | 240/12 | 35 | 140 | 125 | 0.46 |
| 89000753 | ECT 50 | 35* | 240/11.4 | 50 | 155 | 140 | 0.55 |
| | ECT 60 | 35 | 240/12 | 60 | 165 | 152 | 0.65 |
| 89002945 | ECT 75 | 50* | 240/11.4 | 75 | 180 | 167 | 0.85 |
| 89000787 | ECT 90 | 50 | 240/12 | 90 | 195 | 182 | 1.00 |
| 89000717 | ECT 105 | 70* | 240/11.4 | 105 | 210 | 197 | 1.10 |
| | ECT 120 | 80* | 240/11.4 | 120 | 225 | 212 | 1.20 |
| 89000728 | ECT 140 | 80 | 240/12 | 140 | 245 | 230 | 1.40 |
| 89000739 | ECT 160 | 100 | 240/12 | 160 | 265 | 250 | 1.50 |
| **ECTA auto transformer** | | | | | | | |
| | ECTA 35 | 35 | 120/240 | 35 | 110 | 97 | 0.46 |
| 89000807 | ECTA 50 | 60 | 120/240 | 50 | 150 | 137 | 0.55 |
| | ECTA 60 | 70 | 120/240 | 60 | 150 | 137 | 0.65 |
| | ECTA 75 | 85 | 120/240 | 75 | 165 | 152 | 0.85 |
| 89000816 | ECTA 90 | 100 | 120/240 | 90 | 195 | 182 | 1.00 |
| | ECTA 105 | 120 | 120/240 | 105 | 195 | 182 | 1.10 |
| | ECTA 120 | 140 | 120/240 | 120 | 205 | 192 | 1.20 |
| | ECTA 140 | 160 | 120/240 | 140 | 225 | 210 | 1.40 |
| | ECTA 160 | 200 | 120/240 | 160 | 245 | 230 | 1.50 |

**notes**

* only for 12V halogen lamps

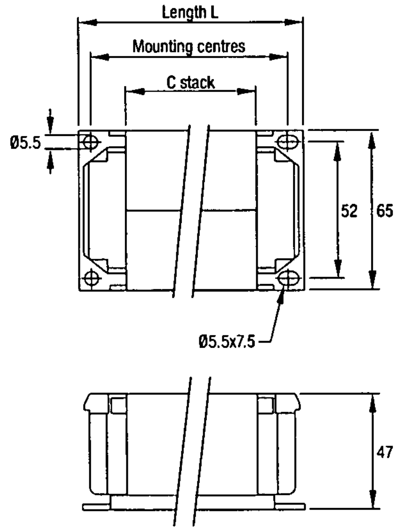
## 25-200VA OMT transformers



- high power density relative to low weight
- low magnetic stray field
- excellent load weight ratio
- vacuum impregnation
- insulation class 'H'
- long service life
- mains voltage: 240V 50/60Hz
  (other voltages and frequencies on request eg: 220V 50/60Hz etc)
- standard secondary voltage 12V VA quoted at full resistive load 100% duty cycle (other voltages and VA ratings on request)
- integrated screw terminals
- high current on secondary may require flying leads at the discretion of TridonicAtco
- recommended total load is 40 to 100% of the VA rating
- short circuit protection requires external fuse

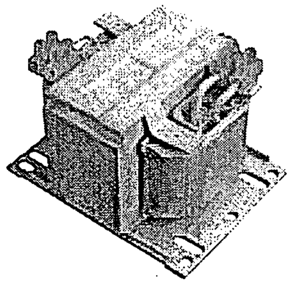
**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage




| article number | type | VA | typical voltages (V) | core stack (mm) | length l (mm) | mtg centres (mm) | weight (kg) |
|---|---|---|---|---|---|---|---|
| **OMT transformer** | | | | | | | |
| 89001501 | OMT 30 | 25 | 240/12 | 30 | 65 | 50 | 0.75 |
| 89001520 | OMTM 40 | 50 | 240/12 | 40 | 75 | 60 | 0.98 |
| 89001538 | OMT 55 | 65 | 240/12 | 55 | 90 | 75 | 1.28 |
| 89001562 | OMT 65 | 80 | 240/12 | 65 | 100 | 85 | 1.55 |
| 89001582 | OMT 75 | 100 | 240/12 | 75 | 110 | 95 | 1.80 |
| 89001415 | OMT 105 | 160 | 240/12 | 105 | 140 | 125 | 2.40 |
| 89001461 | OMT 120 | 200 | 240/12 | 120 | 155 | 140 | 2.65 |
| **OMTA auto transformer** | | | | | | | |
| | OMTA 30 | 50 | 120/240 | 30 | 65 | 50 | 0.75 |
| | OMTA 40 | 75 | 120/240 | 40 | 75 | 60 | 0.98 |
| | OMTA 55 | 130 | 120/240 | 55 | 90 | 75 | 1.25 |
| | OMTA 65 | 160 | 120/240 | 65 | 100 | 80 | 1.55 |
| | OMTA 75 | 200 | 120/240 | 75 | 110 | 95 | 1.80 |
| | OMTA 105 | 300 | 120/240 | 105 | 140 | 125 | 2.40 |
| | OMTA 105 | 2000 | 220/240 | 105 | 140 | 125 | 2.40 |
| | OMTA 120 | 400 | 120/240 | 120 | 155 | 140 | 2.65 |
| | OMTA 120 | 2500 | 220/240 | 120 | 155 | 140 | 2.65 |

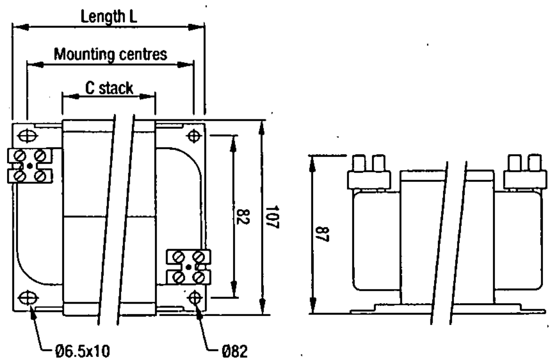
## 180-1200VA OGT transformers



- excellent regulation 5%
- high power density
- low magnetic stray field
- excellent load weight ratio
- vacuum impregnation
- insulation class 'H'
- long service life
- mains voltage: 240v 50/60Hz
  (other voltages and frequencies on request eg: 110v 50/60Hz etc)
- standard secondary voltage 12v VA quoted at full resistive load 100% duty cycle (other voltages and VA ratings on request)
- screw terminals
- high current on secondary may require alternative connector or flying leads at the discretion of TridonicAtco
- recommended total load is 20 to 100% of the VA rating
- short circuit protection requires external fuse

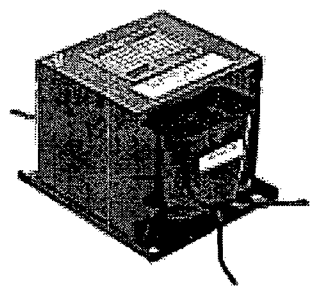
**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing:**
- high voltage
- winding short circuit
- secondary voltage



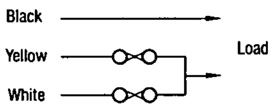

| article number | type | VA | typical voltages (v) | core stack (mm) | length l (mm) | mtg centres (mm) | weight (kg) |
|---|---|---|---|---|---|---|---|
| **OGT auto transformer** | | | | | | | |
| 89121198 | OGT 30 | 180 | 240/12 | 30 | 110 | 95 | 2.5 |
| 89121226 | OGT 40 | 250 | 240/12 | 40 | 120 | 105 | 3.0 |
| 89121275 | OGT 50 | 320 | 240/12 | 50 | 130 | 115 | 3.5 |
| 89121312 | OGT 60 | 400 | 240/12 | 60 | 140 | 125 | 4.0 |
| 89121336 | OGT 70 | 500 | 240/12 | 70 | 150 | 135 | 5.0 |
| 89121353 | OGT 80 | 550 | 240/12 | 80 | 160 | 145 | 5.5 |
| 89121360 | OGT 90 | 650 | 240/12 | 90 | 170 | 155 | 6.0 |
| 89121149 | OGT 100 | 750 | 240/12 | 100 | 180 | 165 | 6.5 |
| 89121159 | OGT 110 | 800 | 240/12 | 110 | 190 | 175 | 7.0 |
| 89121158 | OGT 120 | 900 | 240/12 | 120 | 200 | 185 | 7.5 |
| 89121165 | OGT 140 | 1000 | 240/12 | 140 | 220 | 205 | 8.5 |
| 89121175 | OGT 160 | 1200 | 240/12 | 160 | 240 | 225 | 9.5 |
| **OGTA auto transformer** | | | | | | | |
| | OGTA 40 | 500 | 120/240 | 40 | 120 | 105 | 3.0 |
| | OGTA 50 | 650 | 120/240 | 50 | 130 | 115 | 3.5 |
| | OGTA 70 | 1000 | 120/240 | 70 | 150 | 135 | 5.0 |
| | OGTA 90 | 1300 | 120/240 | 90 | 170 | 155 | 6.0 |
| | OGTA 110 | 1600 | 120/240 | 110 | 190 | 175 | 7.0 |
| 89121372 | OGTA 140 | 2000 | 120/240 | 140 | 220 | 205 | 8.5 |
| | OGTA 140 | 12000 | 220/240 | 140 | 220 | 205 | 8.5 |
| | OGTA 160 | 2500 | 120/240 | 160 | 240 | 225 | 9.5 |
| | OGTA 160 | 15000 | 220/240 | 160 | 240 | 225 | 9.5 |

## 1500/2000VA "TX" PW series



- long service life
- insulation class 'H'
- 300mm long flying leads
- self-resetting thermal protection
- other voltages and VA ratings on request

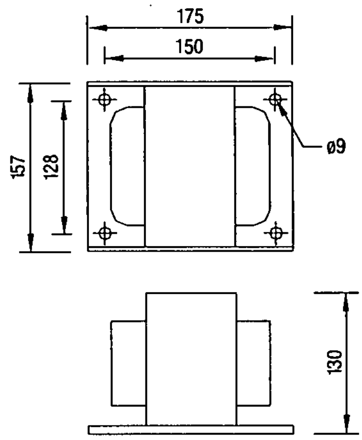
**Installation**
- transformers must be protected by either a primary or secondary fuse
- the fuses specified for primary side are semi-delay miniature fuses
- for 400(415)/110(115) transformers, the yellow and white leads must be fused separately. (see diagram below)




**Manufactured to:**
- AS/NZS 3108

**100% final testing**
- high voltage
- voltage ratio

**1500VA core stack:** 100mm
**2000VA core stack:** 125mm



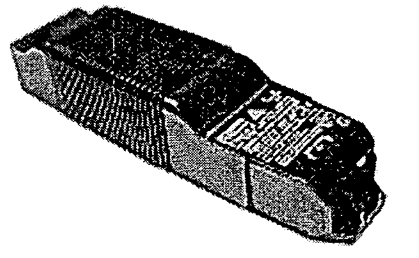

| type | VA | typical voltages (V) | recommended protection (fuse) | | weight (kg) |
|---|---|---|---|---|---|
| | | | primary | secondary | |
| ATX1500PW-01 | 1500 | 230(240)/230(240) | 1 x 8A T | 10A | 16.0 |
| ATX1500PW-02 | 1500 | 400(415)/230(240) | 2 x 5A T | 10A | 16.0 |
| ATX1500PW-03 | 1500 | 230(240)/110(115) | 1 x 8A T | 16A | 16.0 |
| ATX1500PW-04 | 1500 | 400(415)/110(115) | ---- | black<br>yellow=10A<br>white | 16.0 |
| ATX2000PW-01 | 2000 | 230(240)/230(240) | 1 x 10A T | 10A | 19.0 |
| ATX2000PW-02 | 2000 | 400(415)/230(240) | 2 x 5A T | 10A | 19.0 |
| ATX2000PW-03 | 2000 | 230(240)/110(115) | 1 x 10A T | 20A | 19.0 |
| ATX2000PW-04 | 2000 | 400(415)/110(115) | ---- | black=common<br>yellow<br>white=10A | 19.0 |

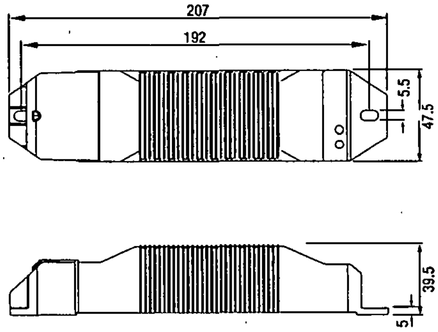
## TM50-2 enclosed transformer – self resetting thermal cutout

The TridonicAtco commitment to Australian manufacturing has evolved best practice transformers designed specifically in Australia to meet the requirements of extra low voltage lighting application and practices.

- self resetting current sensitive thermal cutout provides greater protection against overload
- the TridonicAtco TM50-2 has innovative wiring features with a Patent Pending as well as a Design Application Registration
- the new case design of the TM50-2 improves the heat dissipation
- absolute safe separation of 240V primary supply with 12V secondary being at the opposite end of the transformer
- spacious accommodation junction box designed to take 2xTPS (twin core and earth) for looping supply
- easy application cable clamping on the primary accommodates a range of cable sizes and types. The use of screws to clamp the cables is not required and meets the requirements of fixed or portable applications
- slimline construction enables installation through a 60mm diameter ceiling hole
- soft start performance extends lamp life
- dimmable on a dimmer designed for inductive (magnetic transformer) loads
- approval certification to EN60742/AS3108
- quality endorsed ISO9002/AS3902
- safety, health and environment - CE mark

Many transformers are unfit for extra low-voltage lighting applications and practices as having confined connecting space causes serious wiring difficulties.






TM50-2

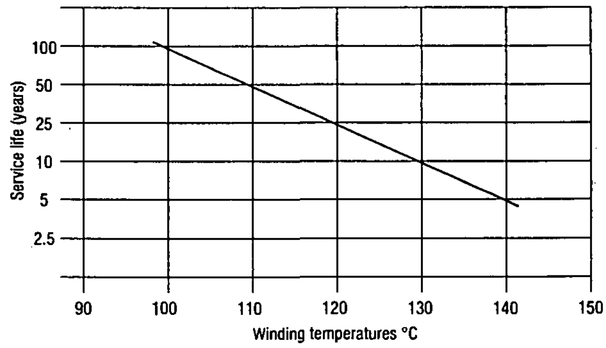
### Unique wiring features for easy wiring installation

2 core light or ordinary duty
or
(0.75mm² - 1mm²)

2 core ordinary or heavy duty
(0.75mm² - 1.5mm²)

2 core (plus earth) TPS power
or
(1mm² - 2.5mm²)

2 core (plus earth) looping TPS power
or
(1mm² - 1.5mm²)




**Maintenance - free long service life.**
TridonicAtco transformers are designed and constructed around Class H (180°C) insulation materials and tw130 rated winding. In normal operation in a 40°C ambient temperature, probable service life is more than 50 years.

The graph shows theoretical service life of the TridonicAtco TM50-2 transformer. Even when arduously operated at the maximum recommended ambient temperature of 60°C, more than 10 years service life can be expected.

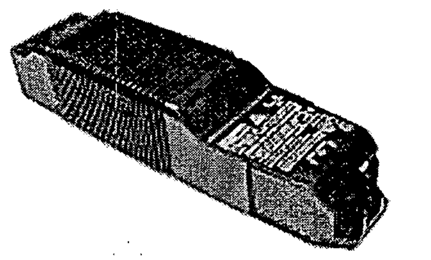
| type | article number | VA | typical voltages (V) | length (mm) | output current (A) | mtg centres | weight (kg) |
|---|---|---|---|---|---|---|---|
| TM50-2 | 89001778 | 50 | 240/11.4 | 207 | 4.0 | 192 | 0.80 |

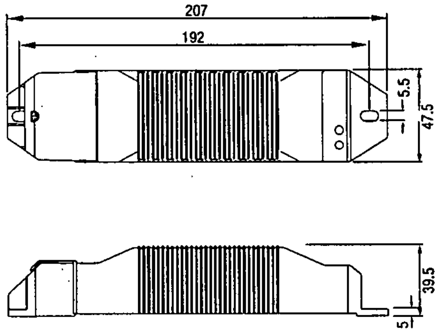
## TM50-2-07 enclosed transformer – non self resetting thermal cutout

The TridonicAtco commitment to Australian manufacturing has evolved best practice transformers designed specifically in Australia to meet the requirements of extra low voltage lighting application and practices.

- a non-self resetting thermal cutout is provided to protect against overload and short circuit. It can be reset by interupting the power supply to the transformer
- the TridonicAtco TM50-2-07 has innovative wiring features with a Patent Pending as well as a Design Application Registration.
- the new case design of the TM50-2-07 improves the heat dissipation
- absolute safe separation of 230V primary supply with 12V secondary being at the opposite end of the transformer
- spacious accommodation junction box designed to take 2xTPS (twin core and earth) for looping supply
- easy application cable clamping on the primary accommodates a range of cable sizes and types. The use of screws to clamp the cables is not required and meets the requirements of fixed or portable applications
- slimline construction enables installation through a 60mm diameter ceiling hole
- soft start performance extends lamp life
- dimmable on a dimmer designed for inductive (magnetic transformer) loads
- approval certification to EN60742/AS3108
- quality endorsed ISO9002/AS3902
- safety, health and environment - CE mark

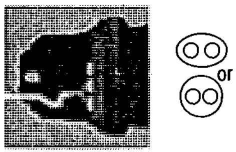
Many transformers are unfit for extra low-voltage lighting applications and practices as having confined connecting space causes serious wiring difficulties.



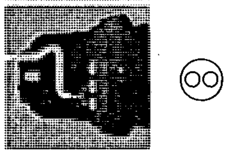



TM50-2-07

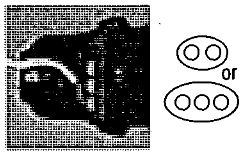
### Unique wiring features for easy wiring installation



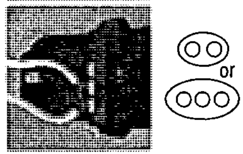
2 core light or ordinary duty (0.75mm² - 1mm²)



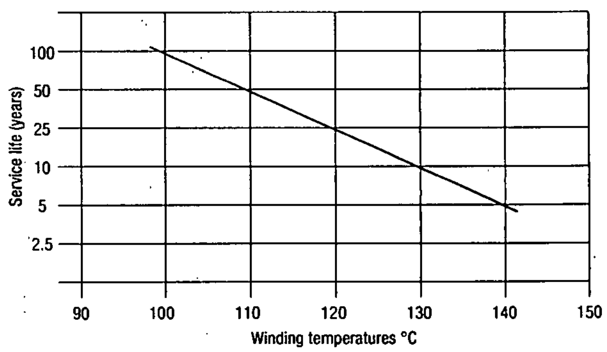
2 core ordinary or heavy duty (0.75mm² - 1.5mm²)



2 core (plus earth) TPS power (1mm² - 2.5mm²)



2 core (plus earth) looping TPS power (1mm² - 1.5mm²)



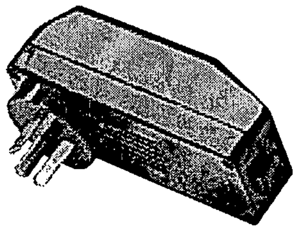

**Maintenance - free long service life.**
TridonicAtco transformers are designed and constructed around Class H (180°C) insulation materials and tw130 rated winding. In normal operation in a 40°C ambient temperature, probable service life is more than 50 years.

The graph shows theoretical service life of the TridonicAtco TM50-2-07 transformer. Even when arduously operated at the maximum recommended ambient temperature of 60°C, more than 10 years service life can be expected.

| type | article number | VA | typical voltages (V) | length (mm) | output current (A) | mtg centres | weight (kg) |
|---|---|---|---|---|---|---|---|
| TM50-2-07 | 89001781 | 50 | 230/11.4 | 207 | 4.0 | 192 | 0.80 |

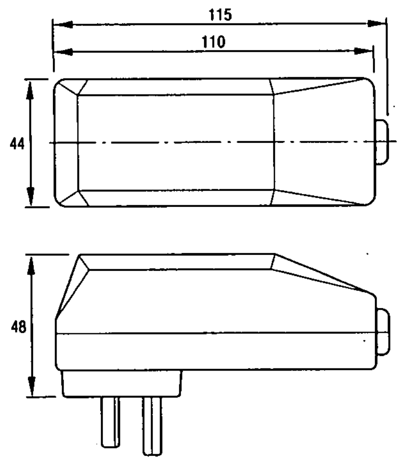
## 20VA plug pack transformer

- compact, self contained design
- soft start of extra low voltage lamps
- integrated screw terminals
- long service life
- mains voltage: 240V 50/60Hz
  (other voltages and frequencies on request eg: 220V 50/60Hz etc)
- standard secondary voltage 12v VA quoted at full resistive load 100% duty cycle (other voltages and VA ratings on request)
- recommended total load is 70 to 100% of the VA rating
- short circuit protected transformer
- built-in self re-setting thermal cut-out



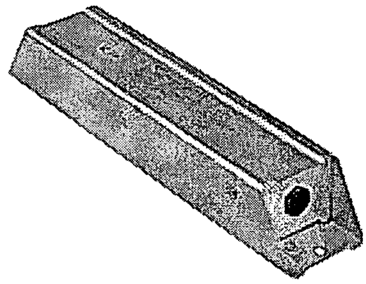
**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage




| type | article number | VA | typical voltages (V) | 12v lamp load (W) | output current (A) | weight (kg) |
|---|---|---|---|---|---|---|
| ACT35-2 | 89000844 | 20 | 240/12 | 20 | 1.6 | 0.5 |

## 65-200VA LVL enclosed transformers

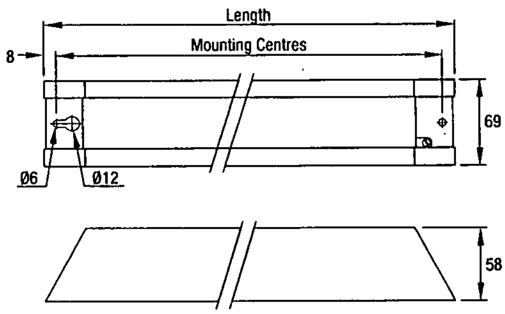


- compact yet high power density
- enclosed section of 58mm x 69 mm
- robust extruded aluminium enclosure
- protection rating IP 31
- 160VA and above have stud termination
- long service life
- mains voltage: 240V 50/60Hz (other voltages and frequencies on request eg: 220V 50/60Hz etc)
- standard secondary voltage 12v VA quoted at full resistive load 100% duty (other voltages and VA ratings on request)
- recommended total load is 40 to 100% of the VA rating
- short circuit protected fused on secondary

**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage

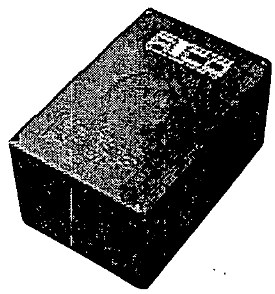
**Flex and plug version available:**
- LVL13A-2
- LVL14A-2
- LVL11A-2
- LVL8A-2.




Enclosure type D427

| type | article number | VA | typical voltages (V) | length l (mm) | output current(A) | mtg centres (mm) | weight (kg) |
|---|---|---|---|---|---|---|---|
| LVL 13-2 | 89000915 | 65 | 240/12 | 330 | 5.4 | 310 | 1.9 |
| LVL 14-2 | 89000918 | 100 | 240/12 | 340 | 8.3 | 320 | 2.3 |
| LVL 11-2 | 89000904 | 160 | 240/12 | 360 | 13.3 | 340 | 3.0 |
| LVL 8-2 | 89000938 | 200 | 240/12 | 360 | 16.7 | 340 | 3.3 |

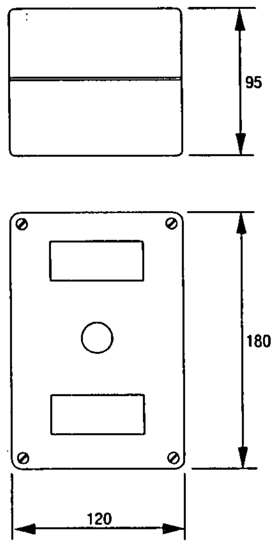
## 50-200VA LVL weatherproof enclosed transformers



- compact yet high power density
- enclosure section of 95mm x 120mm
- high impact polycarbonate
- protection rating IP 65
- four (4) 16mm conduit entries (knock outs)
- long service life
- mains voltage: 240V 50/60Hz
  (other voltages and frequencies on request eg: 220V 50/60Hz etc)
- standard secondary voltage 12v VA quoted at full resistive load 100% duty
  (other voltages and VA ratings on request)
- recommended total load is 40 to 100% of the VA rating
- short circuit protected fused on secondary
- colours available; green

**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage




Enclosure type D490

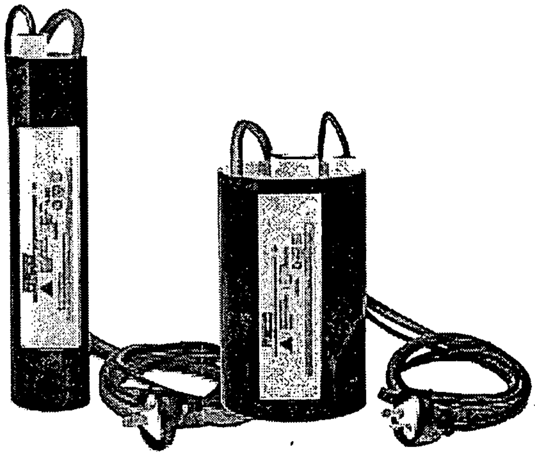
| type | article number | VA | typical voltages (v) | length l (mm) | output conduit (mm) | output current (A) | weight (kg) |
|---|---|---|---|---|---|---|---|
| LVL 10-2-22 | 89000891 | 50 | 240/12 | 180 | 4.1 | 164 | 2.2 |
| LVL 10-2-23 | 89000892 | 75 | 240/12 | 180 | 6.3 | 164 | 2.4 |
| LVL 10-2-24 | 89000893 | 100 | 240/12 | 180 | 8.3 | 164 | 2.6 |
| LVL 10-2-20 | 89000890 | 160 | 240/12 | 180 | 13.3 | 164 | 3.0 |
| LVL 6-2-SP01 | 89121684 | 200 | 240/12 | 180 | 16.7 | 164 | 3.8 |

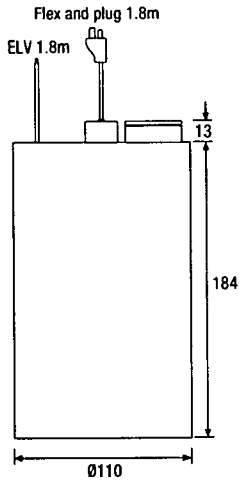
## 50-200VA LVL below ground transformers

- designed for buried applications when installed by a licensed electrical contractor in accordance with AS3000
- encapsulated construction
- protection rating IP67
- mains voltage: 250V 50/60Hz
- standard secondary voltages at full resistive load
- short circuit protected transformers
- type LVL48A-01: Built-in self resetting thermal cut-out
- type LVL48A-02 and LVL48A-03 : Fused on secondary

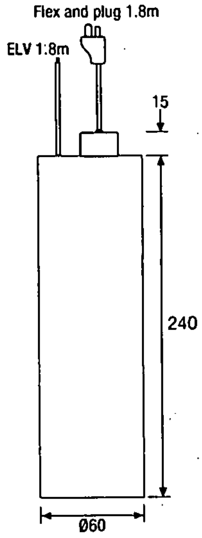
**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage





LVL48-01



LVL48-02 and LVL48-03

| type | article number | VA | typical voltages (V) | diamter (mm) | length l (mm) | output cconduit (mm) | output current(A) | weight (kg) |
|---|---|---|---|---|---|---|---|---|
| LVL48A-2-01 | 89000930 | 50 | 250/12 | 60 | 255 | 4.6 | 4.2 | 3.0 |
| LVL48A-2-02 | 89120661 | 100 | 250/12 | 110 | 197 | 6.0 | 8.4 | 5.5 |
| LVL48A-2-03 | 89120622 | 200 | 250/12 | 110 | 197 | 6.0 | 16.7 | 6.5 |

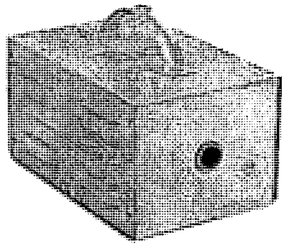
## 250-650VA LVL enclosed transformers

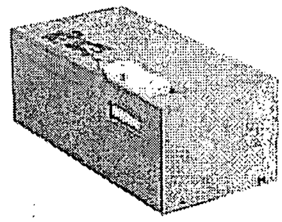
- high VA ratings
- excellent regulation 5%
- fabricated enclosures
- protection rating IP 31
- long service life
- mains voltage: 240V 50/60Hz
  (other voltages and frequencies on request eg: 220V 50/60Hz etc)
- standard secondary voltage 12v VA quoted at full resistive load 100% duty cycle (other voltages and VA ratings on request)
- recommended total load is 20 to 100% of the VA rating
- short circuit protected fused on secondary

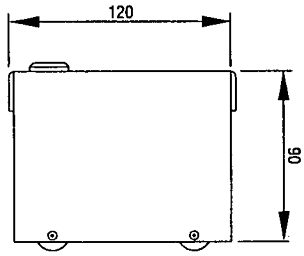
**Approved to:**
- AS/NZS 3108
- EN60742

**100% final testing**
- high voltage
- winding short circuit
- secondary voltage

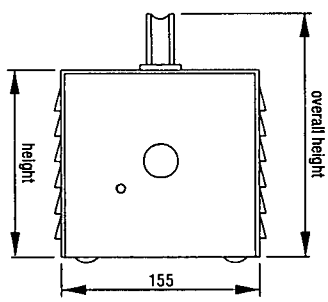
**Flex and plug version available:**
LVL4A-2, LVL21A-2, LVL19A-2, LVL17A-2.








LVL21-2




LVL4-2, LVL17-2, LVL19-2

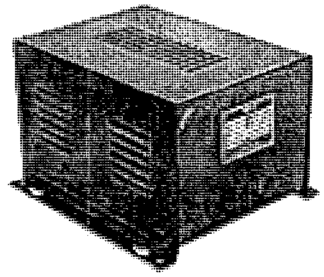
| type | article number | VA | typical voltages (V) | output current (A) | height (mm) | width (mm) | length (mm) | overall height (mm) | weight (kg) |
|---|---|---|---|---|---|---|---|---|---|
| LVL 4-2 | 89120659 | 250 | 240/12 | 20.8 | 125 | 155 | 230 | 170 | 4.6 |
| LVL 21-2 | 89120641 | 320 | 240/12 | 26.6 | 90 | 120 | 240 | 90 | 4.8 |
| LVL 19-2 | 89120632 | 500 | 240/12 | 41.6 | 145 | 155 | 320 | 190 | 7.9 |
| LVL 17-2 | 89120626 | 650 | 240/12 | 54.0 | 145 | 155 | 320 | 190 | 8.9 |

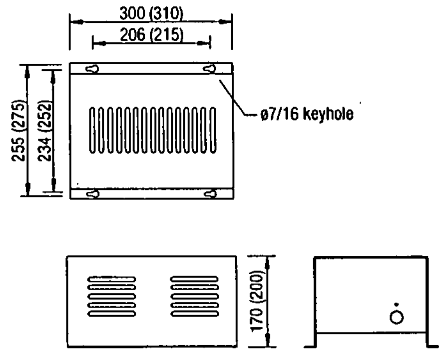
## 1500/2000/3000VA "TX" PWE series

- long service life.
- class "H" insulation system.
- cable entry 2 x Ø25mm.
- self-resetting thermal protection.
- spare fuses supplied.
- other voltages and VA ratings on request.

**Manufactured to:**
- AS/NZS 3108

**100% final testing**
- high voltage
- voltage ratio






1500/2000VA (3000VA)

| type | article number | VA | typical voltages (V) | weight (kg) |
|---|---|---|---|---|
| ATX1500PWE-01 | 89002375 | 1500 | 230(240)/230(240) | 19.0 |
| ATX1500PWE-02 | | 1500 | 400(415)/230(240) | 19.0 |
| ATX1500PWE-03 | | 1500 | 230(240)/110(115) | 19.0 |
| ATX1500PWE-04 | | 1500 | 400(415)/110(115) | 19.0 |
| ATX2000PWE-01 | | 2000 | 230(240)/230(240) | 22.0 |
| ATX2000PWE-02 | | 2000 | 400(415)/230(240) | 22.0 |
| ATX2000PWE-03 | | 2000 | 230(240)/110(115) | 22.0 |
| ATX2000PWE-04 | | 2000 | 400(415)/110(115) | 22.0 |
| ATX3000PWE-01 | | 3000 | 230(240)/230(240) | 31.0 |
| ATX3000PWE-02 | | 3000 | 400(415)/230(240) | 31.0 |
| ATX3000PWE-03 | | 3000 | 230(240)/110(115) | 31.0 |
| ATX3000PWE-04 | | 3000 | 400(415)/110(115) | 31.0 |

## 2000/3000VA "TX" FPE series

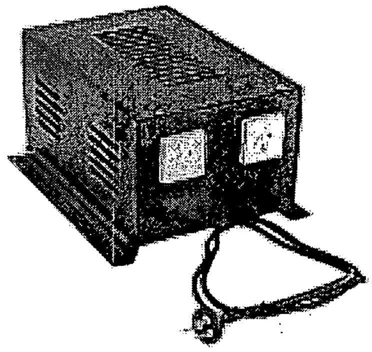
- long service life.
- class "H" insulation system.
- self-resetting thermal protection.
- spare fuses supplied.
- dual output sockets.
- 110V (115V) secondary versions have USA style sockets
- socket-earths are connected together.
- other voltages and VA ratings on request.

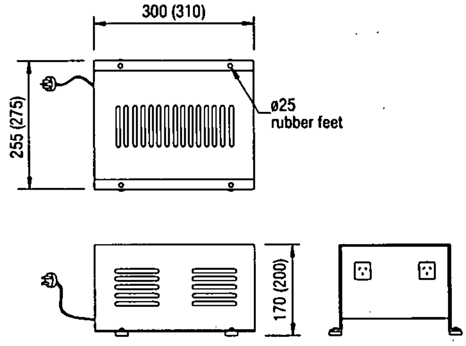
**2000VA**
- flex & plug: 3-core 2.1m x 1.0mm2 (230/240V Primary).
- flex no plug: 3-core 2.1m x 1.0mm2 (400/415V Primary).

**3000VA**
- flex no plug: 3-core 2.1m x 1.5mm2.

**manufactured to:**
- AS/NZS 3108

**100% final testing**
- high voltage
- voltage ratio



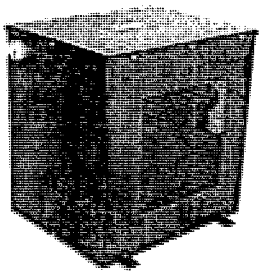


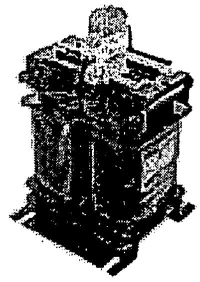

2000VA (3000VA)

| type | article number | VA | typical voltages (V) | weight (kg) |
|---|---|---|---|---|
| ATX2000FPE-01 | | 2000 | 230(240)/230(240) | 22.0 |
| ATX2000FPE-02 | | 2000 | 400(415)/230(240) | 22.0 |
| ATX2000FPE-03 | | 2000 | 230(240)/110(115) | 22.0 |
| ATX2000FPE-04 | | 2000 | 400(415)/110(115) | 22.0 |
| ATX3000FPE-01 | | 3000 | 230(240)/230(240) | 31.0 |
| ATX3000FPE-02 | | 3000 | 400(415)/230(240) | 31.0 |
| ATX3000FPE-03 | | 3000 | 230(240)/110(115) | 31.0 |
| ATX3000FPE-04 | | 3000 | 400(415)/110(115) | 31.0 |

## 4-200kVA single phase open and enclosed

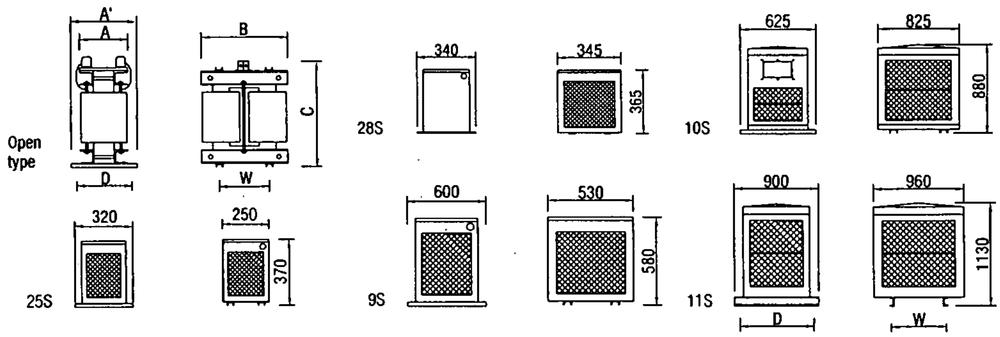
- class "H" insulation system.
- terminal type depends on current rating of the transformer:
  - DIN rail mounting terminal block.
  - DIN rail mounting stud terminals.
  - crimp terminal lugs.
- case 28S and 25S Ø25mm, 2 x bushes for cable entry (opposite ends).
- case 9S Ø44mm, 2 x bushes for cable entry (opposite ends).
- case 10S, 2 x aluminium gland plates for cable entry (opposite ends).
- case 11S, 2 x aluminium gland plates for cable entry (bottom).
- weight, core loss, copper loss are approximate values only.





**Manufactured to:**
- AS/NZS 3108 or AS2735

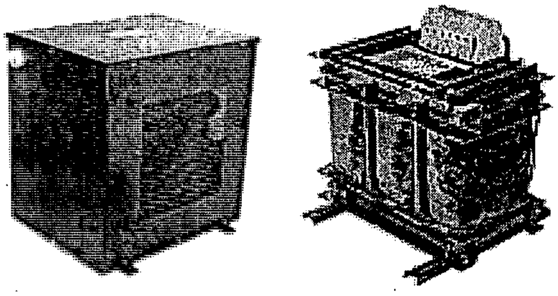
**100% final testing**
- high voltage
- voltage ratio




| | Open Type | | | | | | Enclosed Type | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KVA | A | A' | B | C | mounting centres (DxWxØ) | weight | diagram no | mtg centres (DxWxØ) | weight | typical core loss (W) | typical copper loss @115°C (W) |
| 4.0 | 200 | 310 | 220 | 340 | 245 x 130 x Ø9 | 40 | 25S | 295 x 170 x Ø10 | 50 | 110 | 120 |
| 6.0 | 255 | 340 | 220 | 340 | 300 x 130 x Ø9 | 50 | 25S | 295 x 170 x Ø10 | 60 | 150 | 130 |
| 9.0 | 310 | 425 | 220 | 340 | 355 x 130 x Ø9 | 80 | 28S | 315 x 245 x Ø10 | 90 | 220 | 140 |
| 10 | 185 | 310 | 270 | 500 | 260 x 160 x Ø9 | 80 | 9S | 565 x 300 x Ø13 | 100 | 150 | 270 |
| 13 | 215 | 310 | 270 | 500 | 260 x 160 x Ø9 | 90 | 9S | 565 x 300 x Ø13 | 110 | 190 | 320 |
| 17 | 250 | 340 | 270 | 500 | 325 x 160 x Ø9 | 110 | 9S | 565 x 300 x Ø13 | 130 | 240 | 350 |
| 20 | 280 | 425 | 270 | 500 | 325 x 160 x Ø9 | 120 | 9S | 565 x 300 x Ø13 | 140 | 290 | 380 |
| 27 | 340 | 425 | 270 | 500 | 385 x 160 x Ø9 | 160 | 9S | 565 x 300 x Ø13 | 180 | 380 | 440 |
| 33 | 405 | 490 | 270 | 500 | 450 x 160 x Ø9 | 190 | 9S | 565 x 300 x Ø13 | 210 | 480 | 490 |
| 40 | 235 | 290 | 390 | 690 | 240 x 205 x Ø13 | 160 | 10S | 575 x 500 x Ø13 | 190 | 150 | 1520 |
| 50 | 265 | 315 | 390 | 690 | 265 x 205 x Ø13 | 190 | 10S | 575 x 500 x Ø13 | 220 | 180 | 1650 |
| 67 | 310 | 360 | 390 | 690 | 310 x 205 x Ø13 | 230 | 10S | 575 x 500 x Ø13 | 260 | 240 | 1820 |
| 83 | 360 | 405 | 390 | 690 | 355 x 205 x Ø13 | 280 | 10S | 575 x 500 x Ø13 | 310 | 300 | 1970 |
| 93 | 390 | 430 | 390 | 690 | 380 x 205 x Ø13 | 300 | 10S | 575 x 500 x Ø13 | 330 | 330 | 2230 |
| 100 | 310 | 445 | 540 | 920 | 395 x 280 x Ø13 | 340 | 11S | 840 x 560 x Ø13 | 380 | 360 | 2240 |
| 133 | 330 | 445 | 540 | 920 | 395 x 280 x Ø13 | 390 | 11S | 840 x 560 x Ø13 | 430 | 400 | 2960 |
| 167 | 360 | 445 | 540 | 920 | 395 x 280 x Ø13 | 460 | 11S | 840 x 560 x Ø13 | 500 | 490 | 3210 |
| 200 | 400 | 445 | 540 | 920 | 395 x 280 x Ø13 | 540 | 11S | 840 x 560 x Ø13 | 580 | 560 | 3330 |

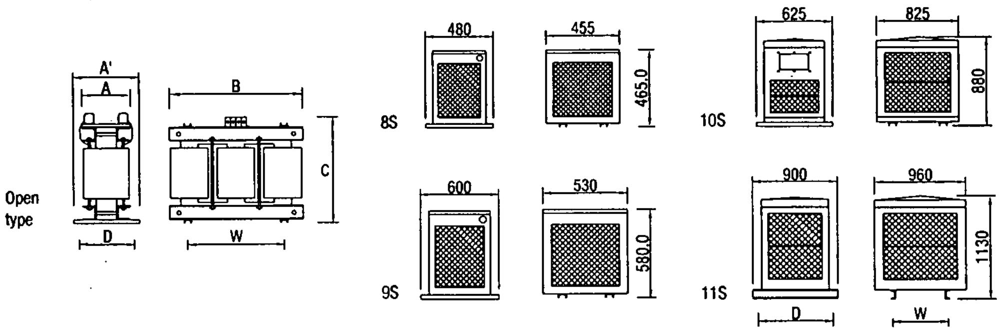
## 4-300kVA three phase open and enclosed

- class "H" insulation system
- terminal type depends on current rating of the transformer:
  - DIN rail mounting terminal block
  - DIN rail mounting stud terminals
  - crimp terminal lugs
- case 8S and 9S Ø44mm, 2 x bushes for cable entry (opposite ends)
- case 10S, 2 x aluminium gland plates for cable entry (opposite ends)
- case 11S, 2 x aluminium gland plates for cable entry (bottom)
- standard winding connection Dyn11 (unless otherwise specified)
- weight, core loss, copper loss are approximate values only



**Manufactured to:**
- AS/NZS 3108 or AS2735

**100% final testing**
- high voltage
- voltage ratio




| | Open type | | | | | | Enclosed type | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KVA | A | A' | B | C | mounting centres (DxWxØ) | weight | diagram no | mtg centres (DxWxØ) | weight | typical core loss (W) | typical copper loss @115°C (W) |
| 4.0 | 165 | 310 | 360 | 340 | 245 x 250 x Ø9 | 50 | 8S | 445 x 250 x Ø13 | 60 | 120 | 120 |
| 6.0 | 200 | 310 | 360 | 340 | 245 x 250 x Ø9 | 60 | 8S | 445 x 250 x Ø13 | 70 | 180 | 150 |
| 9.0 | 255 | 340 | 360 | 340 | 300 x 250 x Ø9 | 90 | 8S | 445 x 250 x Ø13 | 100 | 260 | 160 |
| 12.5 | 310 | 425 | 360 | 340 | 355 x 250 x Ø9 | 110 | 8S | 445 x 250 x Ø13 | 120 | 350 | 190 |
| 15 | 185 | 310 | 420 | 500 | 260 x 300 x Ø9 | 110 | 9S | 565 x 300 x Ø13 | 130 | 230 | 460 |
| 20 | 215 | 310 | 420 | 500 | 260 x 300 x Ø9 | 140 | 9S | 565 x 300 x Ø13 | 160 | 300 | 480 |
| 25 | 250 | 340 | 420 | 500 | 325 x 300 x Ø9 | 170 | 9S | 565 x 300 x Ø13 | 190 | 380 | 500 |
| 30 | 280 | 425 | 420 | 500 | 325 x 300 x Ø9 | 190 | 9S | 565 x 300 x Ø13 | 210 | 440 | 560 |
| 40 | 340 | 425 | 420 | 500 | 385 x 300 x Ø9 | 240 | 9S | 565 x 300 x Ø13 | 260 | 600 | 650 |
| 50 | 405 | 490 | 420 | 500 | 450 x 300 x Ø9 | 280 | 9S | 565 x 300 x Ø13 | 300 | 730 | 750 |
| 60 | 235 | 290 | 595 | 690 | 240 x 410 x Ø13 | 240 | 10S | 575 x 500 x Ø13 | 270 | 230 | 2310 |
| 75 | 265 | 315 | 595 | 690 | 265 x 410 x Ø13 | 300 | 10S | 575 x 500 x Ø13 | 330 | 280 | 2450 |
| 100 | 310 | 360 | 595 | 690 | 310 x 410 x Ø13 | 360 | 10S | 575 x 500 x Ø13 | 390 | 370 | 2730 |
| 125 | 360 | 405 | 595 | 690 | 355 x 410 x Ø13 | 440 | 10S | 575 x 500 x Ø13 | 470 | 460 | 3100 |
| 140 | 390 | 430 | 595 | 690 | 380 x 410 x Ø13 | 480 | 10S | 575 x 500 x Ø13 | 510 | 510 | 3110 |
| 150 | 310 | 445 | 820 | 920 | 395 x 560 x Ø13 | 520 | 11S | 840 x 560 x Ø13 | 560 | 540 | 3470 |
| 200 | 330 | 445 | 820 | 920 | 395 x 560 x Ø13 | 630 | 11S | 840 x 560 x Ø13 | 670 | 600 | 4490 |
| 250 | 360 | 445 | 820 | 920 | 395 x 560 x Ø13 | 710 | 11S | 840 x 560 x Ø13 | 750 | 760 | 4800 |
| 300 | 400 | 445 | 820 | 920 | 395 x 560 x f13 | 850 | 11S | 840 x 560 x F13 | 890 | 860 | 5200 |

# Transformer enquiry sheet

| | |
|---|---|
| Company: | |
| Address: | |
| | |
| | |
| Contact and Title: | |
| | |
| | |
| Phone: | |
| Fax: | |
| Email: | |
| Web Site: | |

| Questions | Information to be completed by the customer or sales dept. | Technical department use only |
|---|---|---|
| 1) Type of transformer | Auto / isolating transformer | |
| 2) Input voltage | ______V | |
| 3) Input frequency | ______Hz | |
| 4) Output voltage | ______V AC/DC | |
| 5) Output current | ______A | |
| 6) If output is DC: | Tick one of the following: | |
| a) Regulated | ❑ | |
| b) Smoothed DC only | ❑ ____Vpp ripple | |
| c) Rectified DC only | ❑ Half wave / full wave | |
| 7) Enclosed | IP | |
| 8) Maximum dimensions | | |
| 9) Input terminations | Tick one of the following: | |
| a) Flex and plug | ❑ ____mm | |
| b) Screw terminals | ❑ ____mm² | |
| c) Flying leads | ❑ ____mm | |
| 10) Output terminations | Tick one of the following: | |
| a) Socket | ❑ type: | |
| b) Stud terminals | ❑ open / covered | |
| c) Screw terminals | ❑ ____mm² | |
| d) Flying leads | ❑ ____mm | |
| 11) Description of application | | |
| | | |
| | | |
| | | |
| | | |
| 12) Approvals required | | |
| 13) Additional requirements | | |
| | | |
| | | |
| 14) No. of samples required | | |
| 15) Quantity | | |

TERASAKI

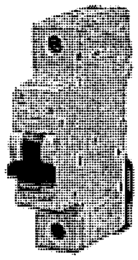
## Miniature circuit breakers

### Din-T6 series 2-63 A

1

### *6 kA 'C' curve*

- Standard AS/NZS 4898
- Approval No. N17481
- Current range 2-63 amps 1, 2 and 3 pole
- Sealable and lockable handle
- DIN rail mounting
- Padlockable in OFF position
- Suits CD type chassis
- General purpose light and power distribution



**Curve type: C (5 – 10 In)**

**Single pole**

| In (A) | Cat. No. | Price $ | In (A) | Cat. No. | Price $ |
|---|---|---|---|---|---|
| 2 | DTCB6102C | 35.00 | 20 | DTCB6120C | 35.00 |
| 4 | DTCB6104C | 35.00 | 25 | DTCB6125C | 35.00 |
| 6 | DTCB6106C | 35.00 | 32 | DTCB6132C | 35.00 |
| 10 | DTCB6110C | 35.00 | 40 | DTCB6140C | 35.00 |
| 13 | DTCB6113C | 35.00 | 50 | DTCB6150C | 35.00 |
| 16 | DTCB6116C | 35.00 | 63 | DTCB6163C | 35.00 |

**Double pole**

| In (A) | Cat. No. | Price $ | In (A) | Cat. No. | Price $ |
|---|---|---|---|---|---|
| 2 | DTCB6202C | 110.00 | 20 | DTCB6220C | 110.00 |
| 4 | DTCB6204C | 110.00 | 25 | DTCB6225C | 110.00 |
| 6 | DTCB6206C | 110.00 | 32 | DTCB6232C | 110.00 |
| 10 | DTCB6210C | 110.00 | 40 | DTCB6240C | 110.00 |
| 13 | [i] DTCB6213C | 110.00 | 50 | DTCB6250C | 110.00 |
| 16 | DTCB6216C | 110.00 | 63 | DTCB6263C | 110.00 |

**Triple pole**

| In (A) | Cat. No. | Price $ | In (A) | Cat. No. | Price $ |
|---|---|---|---|---|---|
| 2 | DTCB6302C | 140.00 | 20 | DTCB6320C | 140.00 |
| 4 | DTCB6304C | 140.00 | 25 | DTCB6325C | 140.00 |
| 6 | DTCB6306C | 140.00 | 32 | DTCB6332C | 140.00 |
| 10 | DTCB6310C | 140.00 | 40 | DTCB6340C | 140.00 |
| 13 | [i] DTCB6313C | 140.00 | 50 | DTCB6350C | 140.00 |
| 16 | DTCB6316C | 140.00 | 63 | DTCB6363C | 140.00 |

**Notes: The LINE-side is the OFF or bottom of the MCB, and connects to CD chassis tee-offs.**

Suitable for the following side mounted accessories:–

- AUX/ALM switches – refer page 1 - 31
- Shunt trip – refer page 1 - 30
- UVT Trip - refer page 1 - 30
- Clip-on RCD module - refer page 1 - 23
- Din-Safe-M module – refer page 1 - 23
- Din-T terminals and accessories – refer page 1 - 35

[i] Available on indent only

 GST not included Price schedule T1

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## *Residual current device*

### Din-Safe single pole width residual current circuit breaker (RCBO)

**10 kA**

- Standard AS/NZS 61009
- Approval No. N17482
- One module wide (18 mm)
- Short circuit, overcurrent and earth leakage protection
- Short circuit capacity 10 kA
- Sensitivity 10 and 30 mA
- Suits CD chassis
- Type 'A' RCD

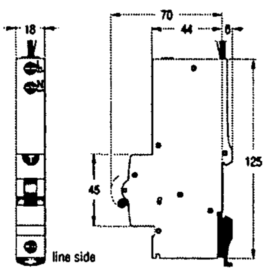

**Curve type: C (5 – 10 In)**

| In (A) | Modules (18mm) | Voltage (AC) | Short circuit cap. (kA) | Trip sens. (mA) | Cat. No. [1] [2] | Price $ |
|---|---|---|---|---|---|---|
| 6 | 1 | 240 | 10 | 30 | DSRCBH-06-30A | 275.00 |
| 10 | 1 | 240 | 10 | 30 | DSRCBH-10-30A | 275.00 |
| 16 | 1 | 240 | 10 | 30 | DSRCBH-16-30A | 275.00 |
| 20 | 1 | 240 | 10 | 30 | DSRCBH-20-30A | 275.00 |
| 25 | 1 | 240 | 10 | 30 | DSRCBH-25-30A | 275.00 |
| 32 | 1 | 240 | 10 | 30 | DSRCBH-32-30A | 275.00 |
| 40 | 1 | 240 | 10 | 30 | DSRCBH-40-30A | 275.00 |
| 6 | 1 | 240 | 10 | 10 | [i] DSRCBH-06-10A | 320.00 |
| 10 | 1 | 240 | 10 | 10 | DSRCBH-10-10A | 320.00 |
| 16 | 1 | 240 | 10 | 10 | DSRCBH-16-10A | 320.00 |
| 20 | 1 | 240 | 10 | 10 | DSRCBH-20-10A | 320.00 |
| 25 | 1 | 240 | 10 | 10 | [i] DSRCBH-25-10A | 320.00 |
| 32 | 1 | 240 | 10 | 10 | [i] DSRCBH-32-10A | 320.00 |
| 40 | 1 | 240 | 10 | 10 | [i] DSRCBH-40-10A | 320.00 |

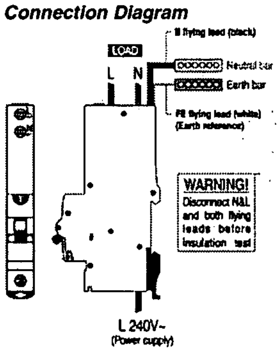
**Notes: The LINE-side is the OFF or bottom of the MCB, and connects to CD chassis tee-offs.**

[1]) Neutral not switched.
[2]) Will not accept Din-T side mounting accessories.
[i] Available on indent only.

*Dimensions (mm)*




*Connection Diagram*




**Note: Nuisance tripping may be experienced in VFD and motor starting applications refer NHP.**

MULTITRODE®

*Leaders in Pump Station Management Technology*

# Installation and Operation Manual

# *MT2PC and MT2SPC*

## MultiTrode Duplex Pump Controller and Duplex SCADA Pump Controller

MULTITRODE

MultiTrode MT2PC and MT2SPC Pump Controllers
Installation and Operation Manual

# MULTITRODE®

## *Leaders in Pump Station Management Technology*

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This Manual is the support documentation for the installation, commissioning and operation of the MultiTrode MT2PC and MT2SPC.

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Z1226 (US letter size version)

Software Version 7.7.x
Hardware Version 7.00 – 7.99

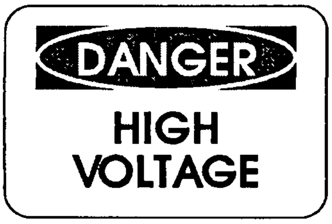
**Comprehensive Release MT2PC**

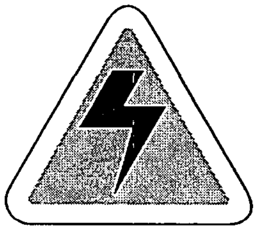
24 October 2003

# Warning and Cautions

*WARNING: THE MT2PC'S INSTALLATION AND WIRING MUST BE PERFORMED BY QUALIFIED PERSONNEL.*

*THE MT2PC HAS NO USER SERVICEABLE PARTS. TO REDUCE THE RISK OF ELECTRIC SHOCK, LEAVE ALL SERVICING TO QUALIFIED MULTITRODE TECHNICAL STAFF.*



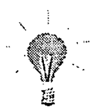
## Documentation Standards

*WARNING: THIS IS A WARNING NOTICE AND IS USED WHERE NON-COMPLIANCE COULD RESULT IN INJURY OR DEATH.*

*AS AN EXAMPLE, NOTE THE WARNINGS AT THE HEAD OF THIS PAGE.*

**CAUTION: THIS IS A CAUTION NOTICE AND IS USED WHERE NON-COMPLIANCE COULD RESULT IN INCORRECT OPERATION, DAMAGE TO OR FAILURE OF THE EQUIPMENT.**

**Note**: This is a general information notice. This is used to highlight an issue or special case within the body of the manual.



This symbol marks a useful tip or particularly interesting feature of the product.

# Glossary of Terms and Abbreviations

| | |
|---|---|
| **%r** | The symbol *%r* denotes a measurement as a percentage of range. For example 25%r, if a pump has a range 1000–1400 rpm, 25%r equates to1100rpm. |
| **AIN** | Analog Input |
| **AOUT** | Analog Output |
| **CDS** | MultiTrode's Control and Diagnostic Software |
| **CMF** | Central Monitoring Facility for SCADA systems. |
| **DIN** | Digital Input<br>DIN also refers to an industry standard switchboard component mounting system, as in DIN Rail, DIN mounting clips and so on. |
| **DNP3** | Industry standard industrial communications protocol |
| **DOT** | Digital Output |
| **EDS** | Electronic Dip Switch. Software switches, or configurable parameters, used to configure items such as delays and levels. See Chapter 7. There are three types of EDS: On/Off, Numerical Value and Settings types. Refer to section 7.1 for details. |
| **LAN** | Local Area Network. |
| **MiniCAS** | Relay to drive the combined thermal sensor and conductivity sensor, © Flygt Pumps. |
| **Modbus** | Industry standard industrial communications protocol |
| **MTxPC** | Any of the controllers in the MT2PC and MT3PC family, including the MT2PC, MT2SPC, MT2PCVFD, MT2SPCVFD, MT3PC, MT3SPC, MT3PCVFD and MT3SPCVFD. |
| **N/C** | Normally Closed. |
| **N/O** | Normally Open. |
| **Outpost** | MultiTrode's SCADA software package |
| **PC** | Personal Computer |
| **PLC** | Programmable Logic Controller |
| **Probe** | A Conductive Liquid Level Detection Device with multiple sensing points. MultiTrode manufactures a range of such conductive level sensors. They have many advantages over traditional devices such as ball floats. Advantages include: Resistance to fatty deposit build-up, Tangle free, and Adjustable sensitivity to liquid to prevent false readings. |
| **RTU** | Remote Telemetry Unit |
| **SCADA** | Supervisory Control And Data Acquisition – A software package and communications system to monitor and control remote systems, such as MultiTrode Outpost. |
| **VFD** | Variable Frequency Drive. |
| **Zero and Span** | Zero refers to the pressure measurement in an analog sensor where the water level is said to be at zero. The span is the measurement at which it is said to be full. See section 9.2 for a complete explanation. |

# Table of Contents

# Part 1

# Operator's Manual

# Chapter 1 Introduction

The MultiTrode Pump Controller is an advanced microprocessor based pump controller designed to control two pumps (MT2PC) or three pumps (MT3PC). The pump controller is specifically designed for use in water and sewer pumping stations. It combines automatic level control, level indication, pump alternation, pump protection logic, and level alarms with an intuitive operator interface.

More than 50 preset essential and useful pump management functions are incorporated to safeguard and protect equipment, as well as reducing or eliminating common problems such as water hammer, excessive starts, station odors and fat build-up problems.

At a glance, an operator can determine the pump station status, with easy resetting of faults and alarms. The interface also allows changing setpoints and configuring the pump management functions simply and easily through the faceplate.

The panel wiring is greatly simplified, as components such as timers, and relays for thermistor fault, seal fault and alternation are no longer needed. This increases reliability and reduces cost. For example, with Flygt pumps, the thermal and seal fault can be directly wired into the MTxPC, saving over $500 on the miniCAS relay.

Level inputs can come from pressure transducers, ultrasonic, the patented MultiTrode probe or from ball floats. Redundancy options are built in ready for use after being properly configured.

The pump controller has 240v/110v options, both with backup 10-30v dc for battery backup in the event of mains failure.

### 1.1.1. Increasing functionality with variations on the basic MTxPC

Up to 9 pumps can be controlled in a variety of modes – grouping of pumps, multi-well mode, mimic mode – by networking pump controllers together.

The pump controller also has a couple of optional versions

- VFD control – for simplifying control of duty/standby pumps (MTxPC-VFD)
- SCADA – the pump controller with a built-in RTU (MTxSPC)

The pump controller also interfaces directly to the MultiTrode MonitorPro - an innovative station supervisor that protects motors, automatically carries out insulation resistance testing, measures flow without a flow meter, and has an in-built datalogger and RTU.

### 1.1.2. Rapid installation, commissioning and fault finding

The pump controller is DIN rail mounted with plug in terminal blocks. The unit ships with default settings that cater for 90% of sewer (discharge mode) applications. Switching to water (charge mode) is a 30 second task.

Fault finding is much simpler than either relay/timer based panels or PLC panels. Relay based panels tend to have out of date wiring diagrams and non-standard components, with each panel in a network being different from the last. PLC panels have frequent software issues, and a significant overhead of software maintenance.

A panel based on the MultiTrode pump controller is simple, and with more than 5,000 units in the field, software issues are rare, allowing MultiTrode personnel or distributors to rapidly identify any actual problem.

### 1.1.3. Easy interfacing

The product comes with a number of configurable outputs which can be "connected" to over 60 internally derived sources. For example, outputs can be set to close (or open) when specific faults occur on specific pumps, when level alarms occur, when any pump faults, when 2 pump run together, and so on. This makes interfacing the pump controller to other telemetry systems very straightforward. In addition, the SCADA version of the MTxPC has an optional Modbus/DNP3 translator to allow serial connection from other PLCs or SCADA systems.

## 1.2. Terminology and conventions

When this manual refers to a button on the controller, the button's name appears in a font resembling the printing on the controller. For example, "Press the SELECT ONE button", or "Press SELECT ONE".

In certain regions, different terminology is used to describe the same functions. For these functions, the manual will refer to the terminology used on the international version of the controllers, followed by the regional alternate in brackets. Where the regional terminology is shown on the faceplate, diagrams of both faceplates will be shown.

For example, the international version uses the terminology "Manual Mode" to describe when a pump is under control of the operator rather than the control system, where the regional version of the controller referes to this state as being in "Hand Mode". This manual will therefore use terminology such as:

> "To place the controller into Manual (Hand) mode, press the SELECT ONE or SELECT TWO button once."

# Chapter 2 Pump Controller Operation

## 2.1. Overview

The pump controller is primarily programmed and operated through the front panel.

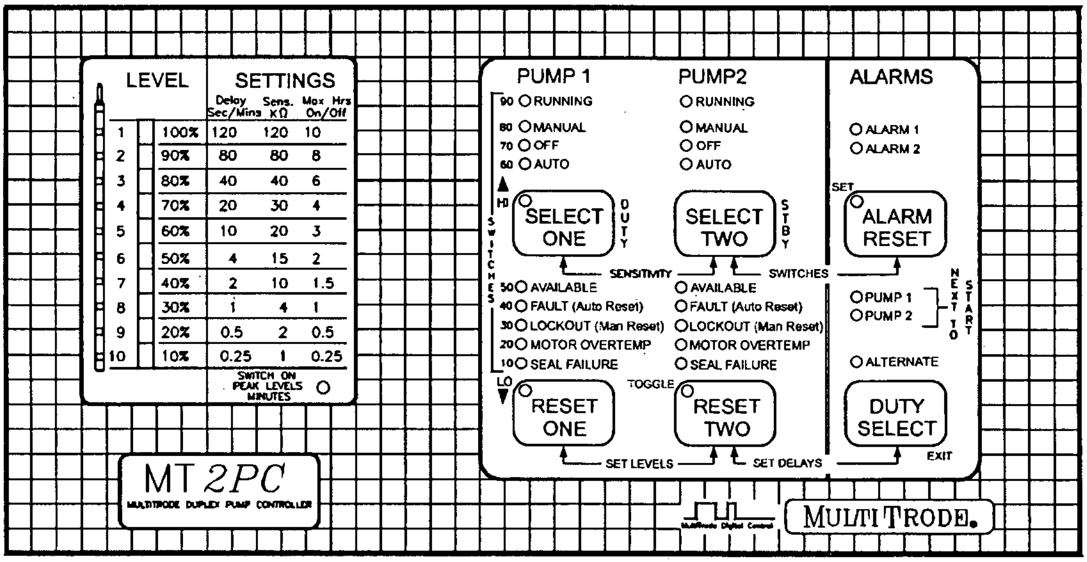



*Figure 1: The International MT2PC Front Panel*

The following sections describe the front panel and the terminology used.

### 2.1.1. Indicators

LED indicators are used to display liquid level, current status' of each pump, and other information when programming the device. MultiTrode documentation refers to these indicators as

- On
- Off
- Flashing slowly (1Hz, i.e. on for ½ second then off for ½ second)
- Flashing quickly (2Hz, i.e. on for ¼ second then off for ¼ second)
- Strobing (On for ¾ second then off for ¼ second)

### 2.1.2. Buttons

Buttons are used to turn pumps on and off, reset faults and alarms, program functions and adjust settings. Note that some of these functions may be disabled if the Keypad Lockout input has been asserted. Refer to Section 4.1—Keypad Lockout Feature on page 15 for more information.

### 2.1.3. Default display

When the controller is showing its default display, the keys have their default functionality and the lights show the current status for the level, pumps, alternation and alarms.

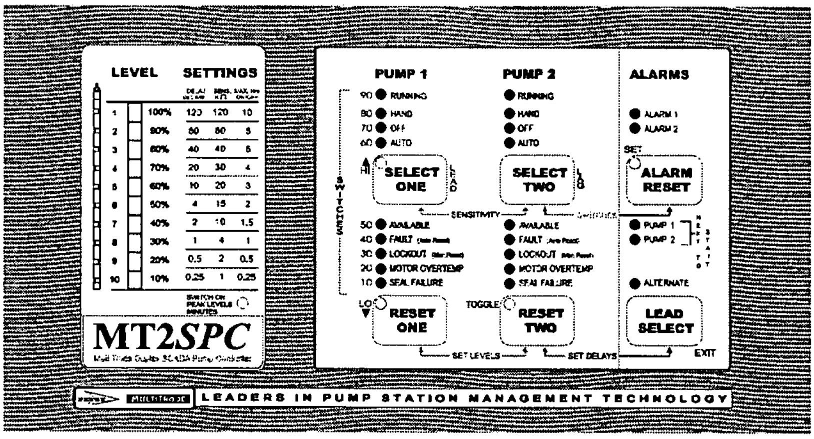



*Figure 2: The International MT2SPC Front Panel*

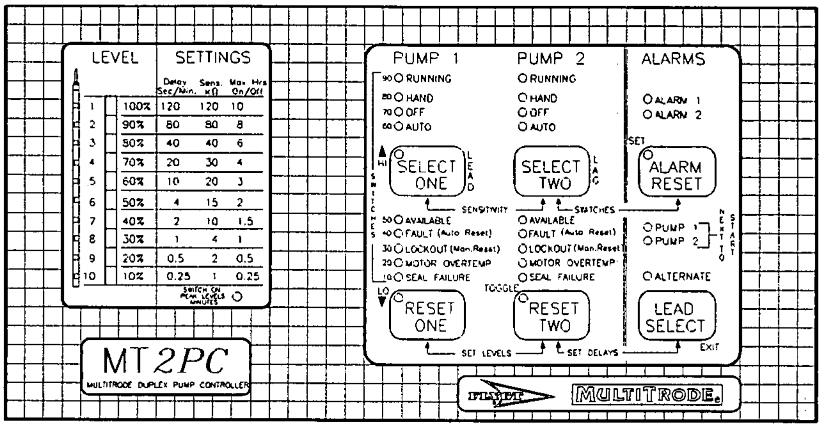



*Figure 3: The Regional MT2PC Front Panel*

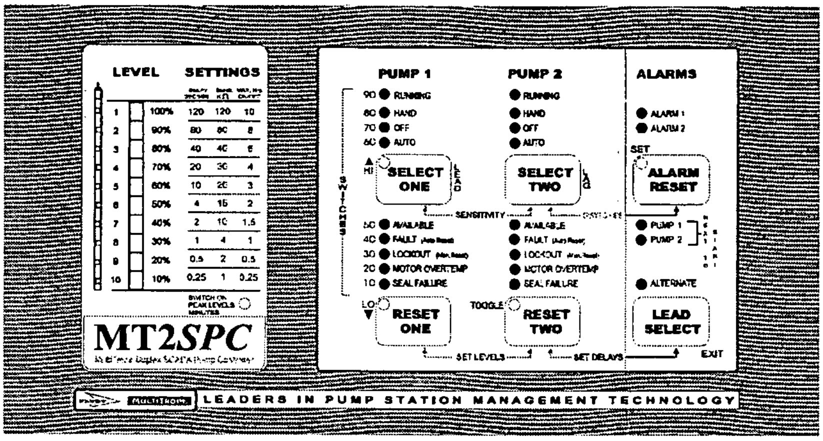



*Figure 4: The Regional MT2SPC Front Panel*

### 2.1.4. Bar graph

The Bar Graph on the left of the front panel has two basic functions. The primary function is to indicate the present level of the liquid. The secondary function is for parameter value indication during programming of the controller.

#### *2.1.4.1. Level Indication*

The percentages to the right of the bar graph indicate the level of the pit or reservoir in 10% steps. If a particular indicator is flashing slowly (1 Hz) this indicates that the controller has detected a fault with that sensor. Although the controller will continue to function it is recommended that the fault be cleared.

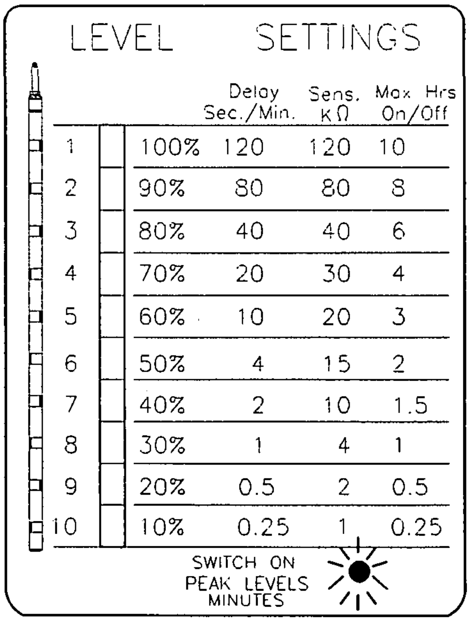



*Figure 5: The Bar Graph*

During normal operation the peak levels indicator, at the bottom right corner of the Settings block, indicates that the controller is using Peak Levels. For more information on peak levels see section 8.1.1.

### 2.1.5. Select One, Select Two, and Select Three Buttons

A select mode button is provided for each pump and is used to cycle a pump through the selections of Auto, Off and Manual (Hand). Only the MT3PC has a 'Select Three' button.

### 2.1.6. RESET ONE, TWO and THREE Buttons

Use these buttons to reset unacknowledged pump faults. Only the MT3PC has a RESET THREE button. Note that a fault cannot be reset if the fault condition is still present.

### 2.1.7. ALARM 1 and ALARM 2 Indicators

These indicate that an abnormal level condition has been detected.

### 2.1.8. DUTY SELECT (LEAD SELECT)

The pump controller has pump alternation capability built in to allow you to share the workload between all pumps more evenly, and is easily configured. This pump controller can be put into alternation mode, or you may specify which of the pumps will always be first to start.

The NEXT TO START lights, on the right hand side of the controller, indicate which pump will be the first to run when the next pump cycle is started. If you press the DUTY SELECT (LEAD SELECT ) button momentarily, the next pump to start will be cycled through the available pumps. If you hold down the DUTY SELECT (LEAD SELECT ) button, the controller will change between alternation modes of alternating the duty (lead) pump, or using a fixed duty (lead) sequence.

If no pump lights are on then all pumps must be either running, decommissioned or unavailable. When the ALTERNATE light is on, the controller is automatically alternating the pump sequence, so that a different pump is first to start each time.

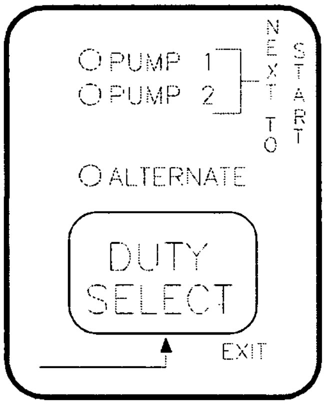



*Figure 6: International Next To Start Selector*

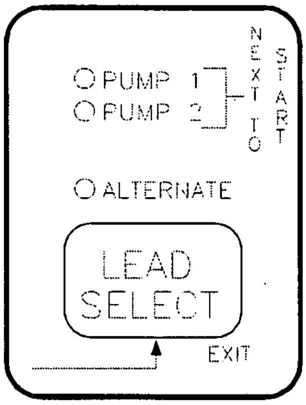



*Figure 7: Regional Next To Start Selector*

## 2.2. Pump Operation

The buttons on the front panel allow you to control pumps manually, reset alarms, monitor the pump status and program the controller.

### 2.2.1. MANUAL (HAND)–Off–Auto

Each pump at an installation can be set to run in Auto, Off, Manual (Hand) and Semi-Automatic mode. Cycle through Auto, Off, and Manual (Hand) by using the select key for that pump.

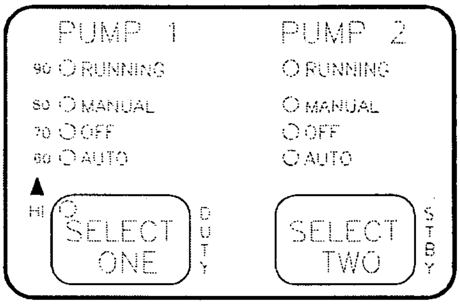
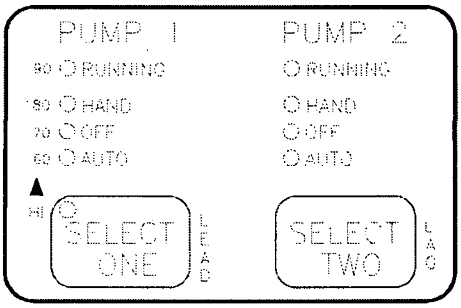



*Figure 8: International Pump Selectors*




*F igure 9: Regional Pump Selectors*

### 2.2.1.1. MANUAL (HAND) Operation

To place a pump into MANUAL (HAND) mode, select MANUAL (HAND) using its SELECT button. In MANUAL (HAND) mode it is necessary to hold the SELECT button continuously once MANUAL (HAND) has been selected. This allows the pump to run outside of its operating range. When you release the SELECT button the pump will either:

- change to Semi-Automatic mode (if the level is within its operating range), or
- change to Automatic mode (if the level is outside its operating range)

**EXAMPLE:** In Discharge mode the level is above the pump deactivation level but has not yet reached the activation level. Select MANUAL (HAND) using the pump's SELECT button, ensuring that when MANUAL (HAND) is selected you hold the button depressed. The pump will continue to run regardless of level, provided the SELECT button remains depressed. When you release the SELECT button the pump will either:

- continue to run in Semi-Automatic Mode (if the level is above its deactivation level) or
- revert to Automatic Mode and switch the pump OFF (if the level is below its deactivation level)

**CAUTION: THE PUMPS WILL RUN AS LONG AS THE MANUAL (HAND) BUTTON IS HELD DOWN. THEREFORE, IT IS POSSIBLE TO RUN THE PUMPS WITH NO LIQUID IN THE WELL, THEREBY RUNNING THE PUMPS DRY AND DAMAGING THEM.**

### 2.2.1.2. Semi Automatic Operation

To put pumps into Semi-Automatic mode, press the respective SELECT button for each pump until the respective status lights show MANUAL (HAND). In Semi-Automatic mode it is not necessary to hold the SELECT button continuously. Semi automatic operation allows you to start a pump prior to its activation level, provided the liquid level is above the normal deactivation level. The controller will automatically deactivate the pump at the appropriate deactivation level and return to the automatic mode.

**Example:** In Discharge mode the level is above the pump deactivation level but has not yet reached the Activation level. **Press and release** the pump's SELECT button twice. The pump's lights will change from AUTO to OFF on the first press, then from OFF to MANUAL (HAND) on the second press, and the pump will run. The pump will continue to run until the level reaches the Deactivation level. At this point the pump will stop and the pump will revert to automatic mode.

### 2.2.2. Analysing a pump's status

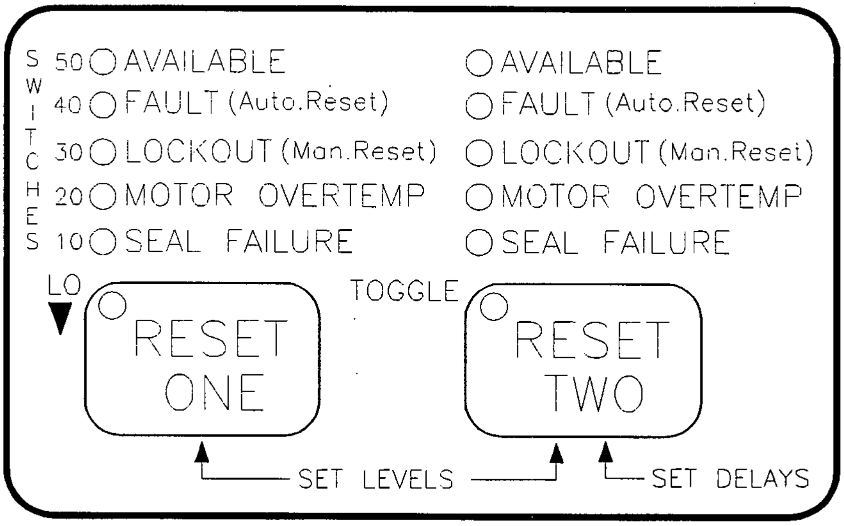



*Figure 10: MT2PC Pump Fault indication on the front panel*

#### *2.2.2.1. Fault states*

A fault may be in one of three states: present, unacknowledged or cleared.

**Fault Present:** A fault condition exists on one of the inputs.

**Fault Unacknowledged:** A fault has occurred but no longer exists. There will be an indication on the controller to show this. If the fault was a **critical** fault the pump will remain unavailable until reset by the operator. If the fault was **non-critical** the pump will become available once the fault condition clears.

**Fault Cleared:** A fault which has occurred is no longer present and has been reset by the operator, or no fault has occurred since the last fault was cleared or the unit was reset.

#### *2.2.2.2. Fault types*

The primary types of fault input are critical, non-critical, delay fail, conductive seal, thermistor, Flygt thermal, Flygt seal and delay lockout.

Faults are cleared from their unacknowledged state by pressing the appropriate pump's reset button.

#### *2.2.2.3. Fault indication*

All fault lights flash at different rates to indicate their current status, as such:

| | |
|---|---|
| Flash quickly | = fault is present |
| flash slowly | = fault is unacknowledged |
| OFF | = fault is cleared |

**Note**: Delay fail faults produce different indication to other faults. Refer to Table 1—Fault indication Quick Reference.

#### 2.2.2.4. Fault indication quick reference

The table below is a quick reference to determine which fault is being indicated.

| Light | Visual Effect | Description |
|---|---|---|
| All Fault Lights | Flash Quick | A fault detected by the MonitorPro or fault with SCADA system is present |
| | Flash Slow | A fault detected by the MonitorPro or SCADA is unacknowledged |
| | Off | No faults detected by the MonitorPro or SCADA, or any other other fault conditions, exist. |
| FAULT (Auto Reset) | Flash Quick | Non Critical Fault Present |
| | Flash Slow | Non Critical Fault Unacknowledged |
| | On | Delay Fail Fault Present |
| | Off | No critical or delay fault conditions exist. |
| LOCKOUT (Man Reset) | Flash Quick | Critical Fault Present |
| | Flash Slow | Critical Fault Unacknowledged |
| | On | Max number of delay fails exceeded |
| | Off | No critical or delay fault lockout conditions exist. |
| MOTOR OVERTEMP | Flash Quick | Thermal Fault Present (Thermistor or Flygt) |
| | Flash Slow | Thermal Fault Unacknowledged (Thermistor or Flygt) |
| | On | The thermistor is indicating an elevated temperature condition after a fault has been present which may be manually reset by the operator. |
| | Off | No thermistor or Flygt Thermal fault conditions exist. |
| SEAL FAILURE | Flash Quick | Conductive Seal or Flygt Seal Fault Present |
| | Flash Slow | Conductive Seal or Flygt Seal Fault Unacknowledged |
| | Off | No conductive seal or Flygt seal conditions exist. |
| AUTO | Flash Quick | Individual Pump is being held out on its start to try to suit the desired starts per hour. (See Section 8.3.8) |
| | Flash Slow | Maximum Station Starts Per Hour has been exceeded. (See Section 8.3.7) |
| AVAILABLE | Flash Quick | LAN Fault is present |
| | Flash Slow | Power fail / hold out present |
| | On | Pump available |
| | Off | Pump unavailable or decommissioned. |
| RUNNING | Flash Quick | Pump about to start |
| | Flash Slow | Pump about to stop |
| | On | Pump running |
| | Off | Pump Stopped |
| All Level Lights | Flash Slow | Analog Sensor Fail or Comms level Fail |
| Individual Level Light | Flash Slow | Probe input determined to have failed (as another sensor higher in the well is wet and the failed sensor is dry). See section 8.2. |

| Light | Visual Effect | Description |
|---|---|---|
| Alarm Light (see section 6.4) | On | Alarm has been muted |
| | Off | No alarm condition are present |
| | Flash Slow | Unacknoweldged Alarm |
| | Flash Quick | Alarm condition is present |
| | Strobing | Alarm has been temporarily disabled |

*Table 1—Fault indication Quick Reference*

#### *2.2.2.5. Pump availability*

Any of the following items can make a pump unavailable:

- A fault is present on the critical, non-critical ordelay fail inputs
- Maximum consecutive number of delay fails has been exceeded (EDS 16).
- An unacknowledged Critical fault is present
- A seal fault is present and seal is set to critical or non critical
- A seal fault is unacknowledged and seal is set to critical
- A thermistor fault is present and thermal is set to critical or non critical
- A thermistor fault is unacknowledged and thermal is set to critical
- A Flygt thermal fault is present and thermal is set to critical or non critical
- A Flygt thermal fault is unacknowledged and thermal is set to critical
- A hold out condition is present (See section 8.1.2)
- A level input fault is present (a valid level can not be determined)
- The pump is not in a Duty (Lead) group
- There is a MonitorPro or SCADA Fault on a pump
- The consecutive Standby starts before Duty (Lead) lockout have been exceeded
- The pump is decommissioned (See EDSs 35, 36, 37)
- A communications fault is present and the LAN network communications have been set to fail-safe operation in EDS 44
- The LAN has timed out

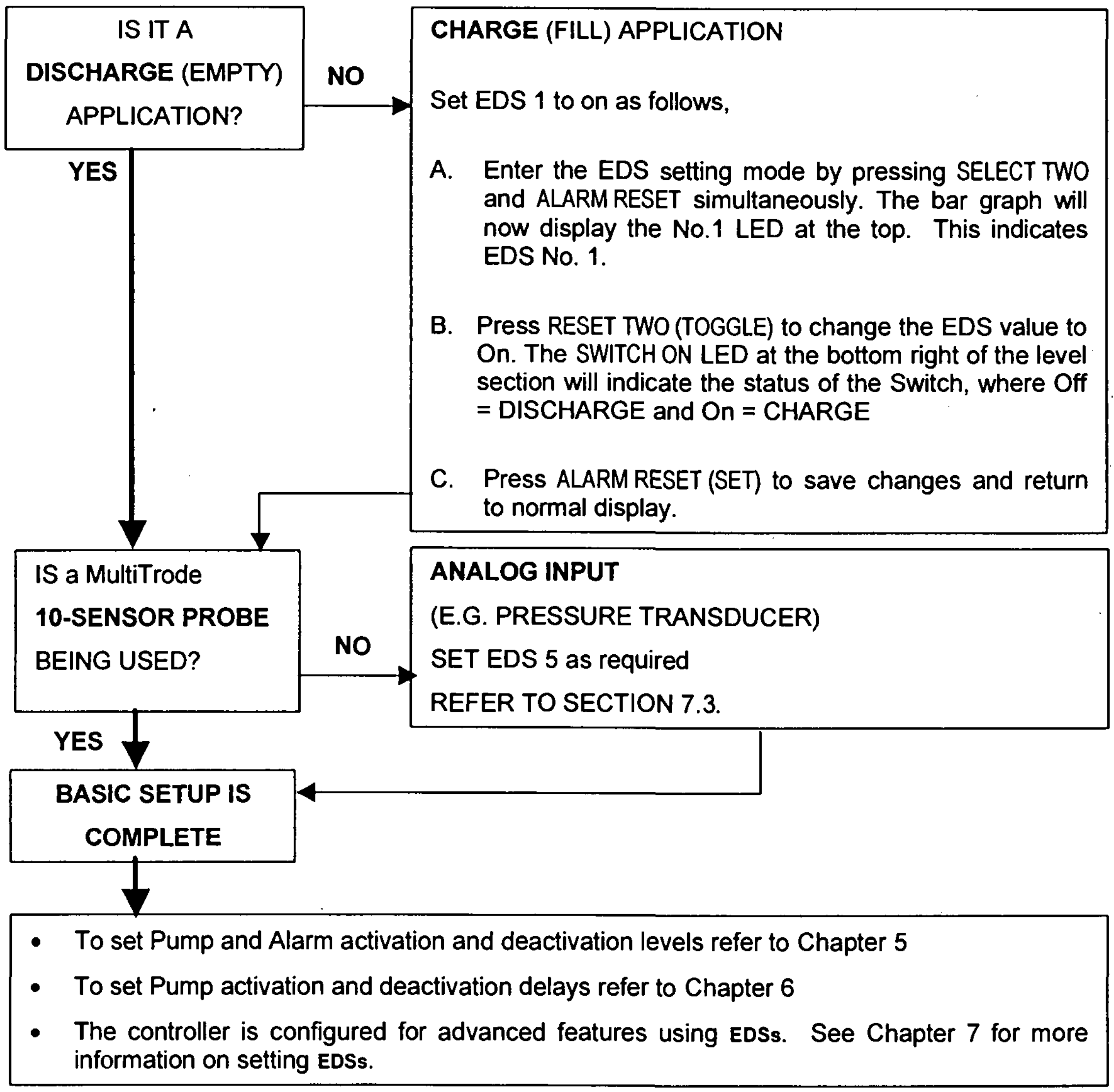
# Part 2

# Installation and Commissioning Manual

# Chapter 3 Quick Commissioning Guide

The pump controller is configured by setting parameters via configurable parameters. For historical reasons these were known to the customer base as Electronic DIP Switches or EDSs, and therefore we have continued to use this term in the current manual. Refer to Chapter 7 for information on EDSs. All settings on the Pump Controller are easily programmed using the buttons on the front panel. In addition to the EDSs, there are also a number of activation and deactivation levels and delays programmed from the front panel.

MultiTrode has pre-programmed the controller with **factory default** settings to suit typical sewerage applications. Little or no adjustment should be necessary in the majority of cases. Prior to installation check the procedure shown in the chart below.



# Chapter 4 Key Combinations

The pump controller is programmed by pressing key combinations on the faceplate or from a laptop PC via the CDS software.

To move away from the default display and access the configuration areas of the controller you must use key combinations, often abbreviated to "key combos". A key combo is a combination of two or three keys to be pressed simultaneously.

The two illustrations below show the combinations, and Table 2 sumarises these. Notice that the combinations are marked on the front panel (SENSITIVITY, SWITCHES, SET LEVELS, SET DELAYS).

> **Note**: These combos only function correctly while the unit is in the normal operating mode.

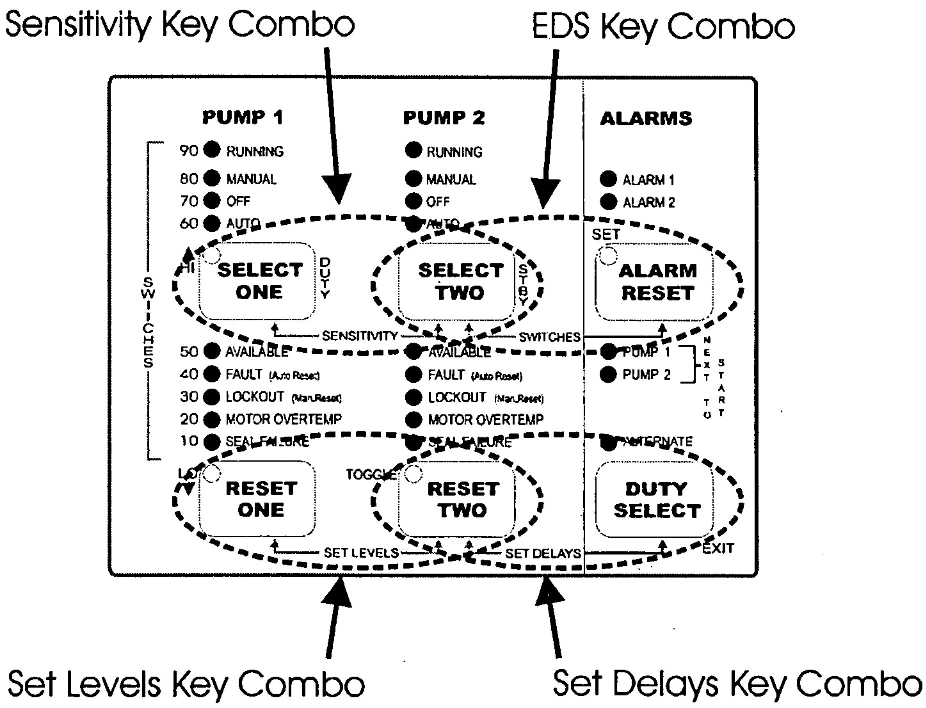



*Figure 11: Key Combos to Set Levels, Set Delays, Sensitivity and EDSs*

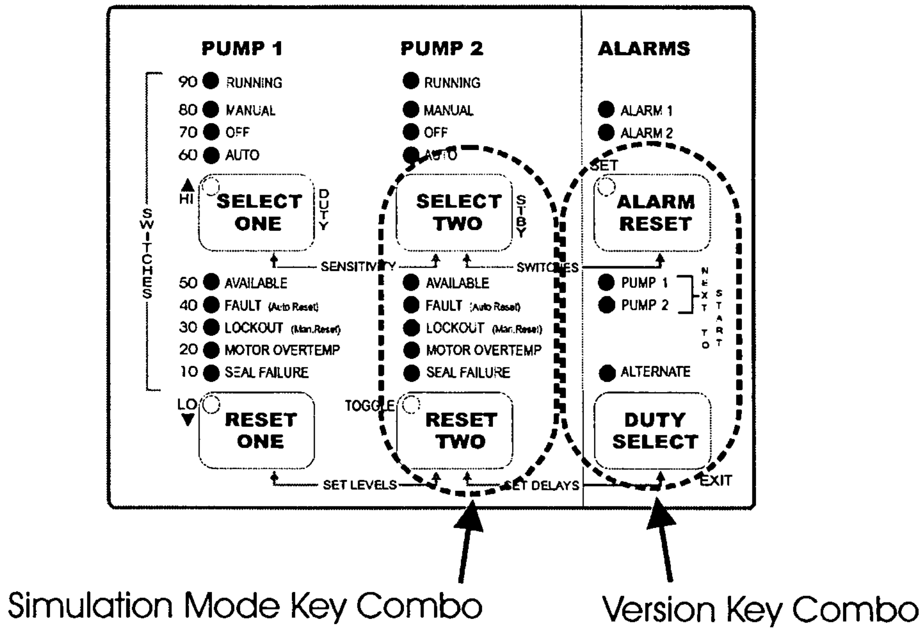



*Figure 12: Key Combos to enter commissioning mode (level simulation) and to display version information*

The table below shows where you can find more information on the functions you can perform with these key combos:

| **Key Combo** | **Keys to press simultaneously** | **Function** | **Refer to** |
|---|---|---|---|
| EDS Key Combo | SELECT TWO + ALARM RESET | Modifies EDS values | Chapter 7 |
| Set Delays Key Combo | RESET TWO + DUTY SELECT (LEAD SELECT) | Set Pump and Alarm Activation and Deactivation Delays | Chapter 6 |
| Set Levels Key Combos | RESET ONE + RESET TWO | Set Pump and Alarm Activation and Deactivation Levels | Chapter 5 |
| Sensitivity Key Combo | SELECT ONE + SELECT TWO | Changes probe sensitivity or analog calibration | Section 9.1 |
| Simulation Mode Key Combo | SELECT TWO + RESET TWO | Commissioning Mode (Level Simulation) | Section 5.4 |
| Version Key Combo | ALARM RESET + DUTY SELECT (LEAD SELECT) | Displays software version. | Section 11.3 |

*Table 2 – Summary table of key combinations*

## 4.1. Keypad Lockout Feature

Access to certain features can be restricted if a key lock switch has been wired into the controller. Access may be restricted in one of three ways:

1. None—All keys will function as normal.
2. Partial—Only the 'Select' and 'Reset' keys will work.
3. Full Keylock—No keys will work on the panel.

Section 12.2.4.11 describes how to wire a key lock into the controller.

# Chapter 5 Pump Alarm Activation and Deactivation Levels

Use the procedure below to set activation and deactivation levels for each pump connected to the controller.

## 5.1. Default Level Settings

For most applications the default level settings should be appropriate for correct operation of the installation. These levels are shown in the illustrations below. Note that the controller stores two sets of all parameters: a "Normal" set and a "Peak"set. Refer to section 8.1.1 for a description of Peak Levels.

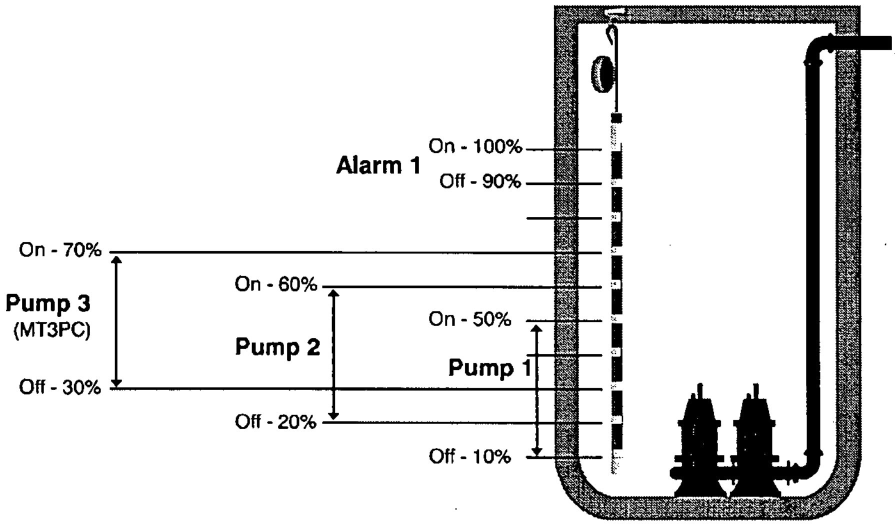



*Figure 13: Discharge Mode—Default Normal Levels*

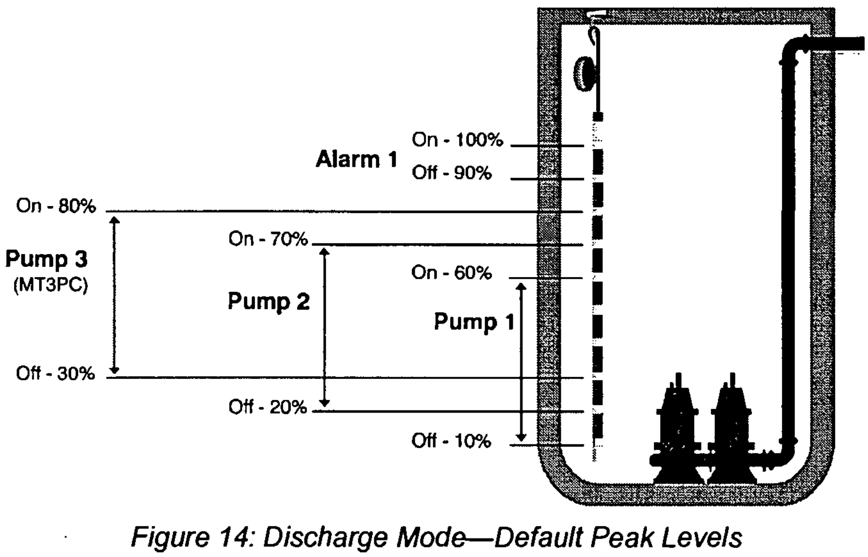



*Figure 14: Discharge Mode—Default Peak Levels*

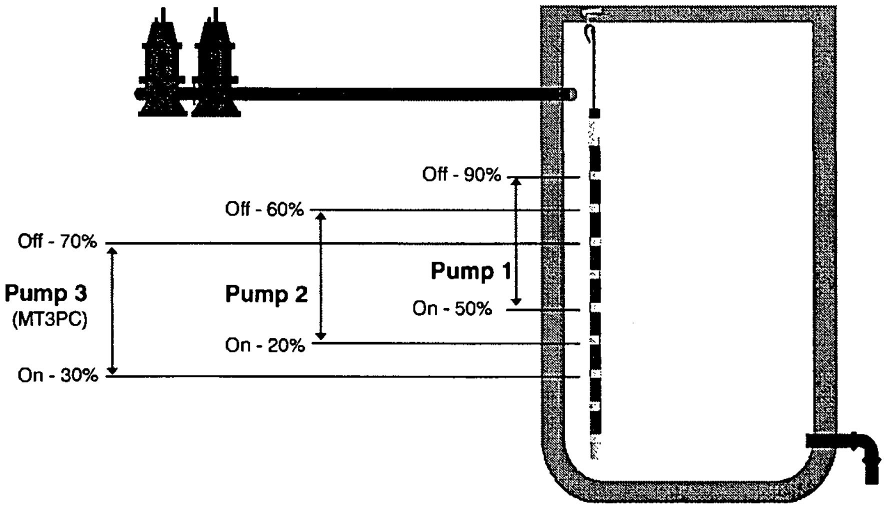



*Figure 15: Charge Mode – Default Normal Levels*

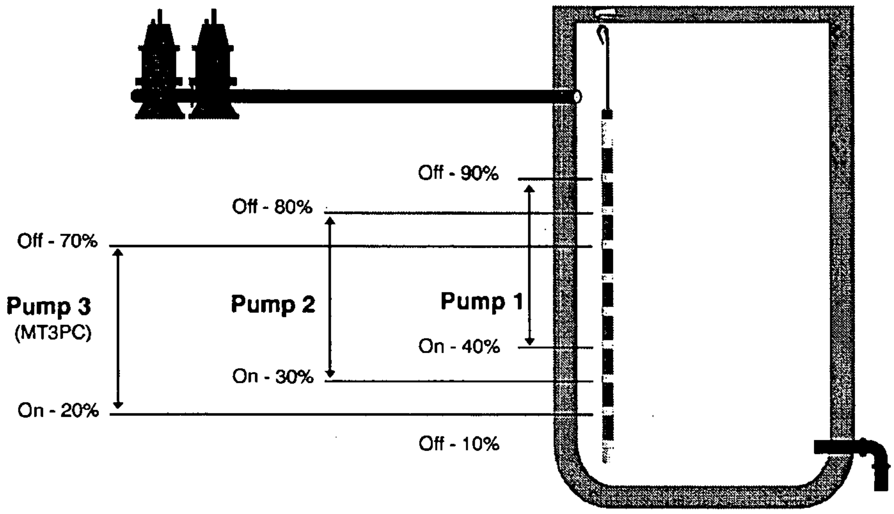



*Figure 16: Charge Mode—Default Peak Levels*

## 5.2. Setting Pump and Alarm Levels (Activaton/Deactivation)

### 5.2.1. Limitations

Note that when setting Activaton and Deactivation levels for pumps, you must observe certain restrictions on the levels. In the case of a system in **discharge mode**, these restrictions are:

- The activation level for the Standby (Lag) pump cannot be less than the activation level for the Duty (Lead) pump.
- The deactivation level for the Standby (Lag) pump cannot be less than the deactivation level for the Duty (Lead) pump.

In the case of a system in **charge mode**, these conditions are inverted:

- The activation level for any particular pump cannot be more than the activation level for the pevious pump in the duty (lead) order.
- The deactivation level for any particular pump cannot be more than the deactivation level for the pevious pump in the duty (lead) order.

### 5.2.2. Use of the Two Alarm Levels

The pump controller provides two independent level alarms. These are usually set up to operate as a high level and a low level alarm but they may be set as two High Level Alarms or two Low Level Alarms. The Level Alarms will operate as High Level Alarms if their activation levels are set higher than the Duty (Lead) Pump Activation level. The Level Alarms will operate as Low level Alarms if their activation levels are set lower than the Duty (Lead) Pump Activation level.

The usage of the alarams is the same for both charge mode and discharge mode.

### 5.2.3. Setting Levels when Using Probe Input only

Use this procedure to set levels when using probe input only (that is, EDS 5 is set to OFF).

1. Press the 'Set Levels Key Combo'.

   The pump and alarm lights are now flashing.

2. Press one of the following keys to select which levels to adjust:

   SELECT ONE to adjust Duty (Lead) levels.
   SELECT TWO to adjust Standby (Lag) levels.
   ALARM RESET to set alarm levels.
   DUTY SELECT (LEAD SELECT) to exit and return to normal operation.

   If you pressed ALARM RESET to set alarm levels, press

   SELECT ONE to set Alarm 1 levels or
   RESET ONE to set Alarm 2 levels.

   The running light for the selected pump or alarm will now be lit.

   The bar graph indicators alternate between the current activation and deactivation levels for the pump (or alarm).

3. Press one of the following keys to select which level to adjust:

| | |
|---|---|
| SELECT ONE (HI) | This is the Activation level in Discharge mode or the Deactivation level in Charge mode. |
| RESET ONE (LO) | This is the Activation level in Charge mode. or the Deactivation level in Discharge mode. |
| DUTY SELECT (LEAD SELECT) (EXIT) | exits and returns to normal operation. |

4. Raise or lower the level using one of these keys:

| | | |
|---|---|---|
| SELECT ONE | (▲) | to raise the level. |
| RESET ONE | (▼) | to lower the level. |

5. To return to normal operation , press either :

| | |
|---|---|
| ALARM RESET (SET) | To return and **save** the new settings, or |
| DUTY SELECT (LEAD SELECT) (EXIT) | To return and **discard** the changes. |

### 5.2.4. Setting Levels when Using Analog Input only

Use this procedure to set levels when using analog input only (EDS 5 set to 1 or 4), or if you are using both probe and analog inputs.

Steps 1 to 3 are the same as the method for the pevious section, 5.2.3.

The level will now be displayed for the selected point. Unlike probe levels, when you use an analog (4–20 mA) input you may set the level from 0 to 100% in 0.5% increments. The Bar Graph displays 10% increments while indicators in the pump two column display the 0.5% and 1% increments. The 0.5% levels are indicated by a flashing light and 1% levels are shown with a steady light.

For example, if

- o the bottom two lights in the Bar Graph are on, and
- o RESET TWO (TOGGLE), SEAL FAILURE and PUMP 2 MOTOR OVERTEMP are on, and
- o the PUMP 2 LOCKOUT light flashes,

this indicates 23.5%.

4. Raise or lower the level using one of these keys:

| | | |
|---|---|---|
| SELECT ONE | (▲) | to raise the level in 0.5% steps |
| RESET ONE | (▼) | to lower the level in 0.5% steps |
| SELECT TWO | (▲) | to raise the level in 10% steps |
| RESET TWO | (▼) | to lower the level in 10% steps |

5. To return to normal operation , press either :

| | |
|---|---|
| ALARM RESET (SET) | To return and **save** the new settings, or |
| DUTY SELECT (LEAD SELECT) (EXIT) | To return and **discard** the changes. |

### 5.2.5. Probe and Analog Combinations

If you are using both probe and analog inputs for level detection, set pump levels using the procedure for Analog Input only.

## 5.3. Setting Peak Levels

This procedure for setting peak levels is similar to the one for setting normal levels except that you must place the controller into Peak Level mode prior to setting levels. Refer to section 8.1.1 for information on how to place the controller into Peak Levels mode.

## 5.4. Simulating Levels for Safety or Commissioning Purposes

The pump controller can simulate levels for safety or commissioning purposes. This function allows you to increase or decrease the level in 10% steps from the keypad. Using this facility you can test the control switchboard before it is installed at the pump station.

Enter Level Commissioning Mode by pressing the 'Simulation Key Combo'. In this mode the SELECT ONE (HI) and RESET ONE (LO) lights flash alternately. When these lights are flashing, the following buttons have the following functions:

SELECT ONE (▲) raise the current level by 10%
RESET ONE (▼) lower the current level by 10%
DUTY SELECT
(LEAD SELECT) (EXIT) exit this mode and return to the default display, using the currently configured level input device.

**Note**: In level commissioning mode the normal Manual (Hand)-Off-Auto functions and fault/alarm reset functions are not available. To make use of these functions, exit the commissioning mode by using the DUTY SELECT (LEAD SELECT) (EXIT) key.

**CAUTION: THE PUMPS WILL RESPOND TO THE SIMULATED LEVEL EXACTLY AS THEY WOULD TO A REAL LEVEL. THEREFORE, IT IS POSSIBLE TO RUN THE PUMPS WITH A "SIMULATED LIQUID" IN THE WELL AND NO ACTUAL LIQUID, THEREBY RUNNING THE PUMPS DRY AND DAMAGING THEM.**

**As a safeguard against the possible dangers associated with simulating levels, as described in the caution above, if the operator presses no keys for 30 seconds, the controller will return to using the normal level sensor to determine the level and cancel the simulation.**

**Health and Safety Feature**: This feature allows operators to test pump and alarm levels without having to open the pit cover to move level sensing devices.

# Chapter 6 Pump and Alarm Activation and Deactivation Delays

Activation and deactivation delays are used to prevent a pump or alarm from turning on when it reaches its activation level until the activation delay has timed out. The procedures for setting delays are similar to those for setting levels, except with a different key combo.

Activation delays can be used to stagger equipment starts from a common level point. Deactivation delays allow you to pump beyond the normal deactivation level for a set period of time.

The Pump Controller can be set up so that it periodically runs past the normal deactivation level for a configured time, to enable a full sump clean-out. Refer to EDSs 86 and 87 in section 0 for details.

Activation delays can be used to prevent false alarm trips due to splashing or foam build-up, so that the alarm will only be raised if the level is above the alarm level for a certain time period. Deactivation delays allow you to be sure the alarm condition has passed before clearing the alarm.

## 6.1. Default Delay Settings

All Pump and Alarm activation and deactivation delays have a factory Default setting of one second. These may be adjusted as required as shown below.

## 6.2. Setting Pump and Alarm Delays

1. Press the SET DELAYS key combination as defined in Chapter 4. The pump and alarm lights are now flashing.
2. Press one of the following keys to select which delays to adjust:

| | |
|---|---|
| SELECT ONE | to adjust Duty (Lead) delays |
| SELECT TWO | to adjust Standby (Lag) delays |
| ALARM RESET | to set alarm delays |
| DUTY SELECT (LEAD SELECT) | to exit and return to normal operation. |

If you pressed ALARM RESET to set alarm delays, press SELECT ONE to set Alarm 1 delays or RESET ONE to set Alarm 2 delays.

The point selected is now displayed on the bar graph.

The bar graph is fully illuminated except for one segment. Read the delay from the table column labelled Delay Sec./Min. to the right of the bar graph. The extinguished segment denotes the current value.

**Note:** If the SWITCH ON/PEAK LEVELS/MINUTES light at the bottom of the bar graph panel is off, then the delay values are in seconds. If it is on the delay values are in minutes.

3. Increase or reduce the delay using one of these keys:

| | | |
|---|---|---|
| SELECT ONE | (▲) | to increase the delay |
| RESET ONE | (▼) | to reduce the delay |

4. To return to normal operation , press either :

| | |
|---|---|
| ALARM RESET (SET) | To return and **save** the new settings, or |
| DUTY SELECT (LEAD SELECT) (EXIT) | To return and **discard** the changes. |

## 6.3. Setting Peak Delays

This procedure for setting peak delays is the similar to the one for setting Normal Delays except you must place the controller into Peak Level mode prior to setting delays. Refer to section 8.1.1 for information on how to place the controller into Peak Levels mode.

## 6.4. Muting or Disabling Level Alarms

### 6.4.1. Muting Level Alarms

When a Level Alarm is present it can be muted for a preset period by pushing the ALARM RESET button. The preset period is set using EDS 4—Level Alarm Mute Time. (See section 7.3 for more information).

### 6.4.2. Temporarily Disabling Level Alarms

When a Level Alarm is present it can be temporarily disabled by holding down the ALARM RESET key for five seconds. This mutes the alarm until the deactivation point is reached.

An alarm that has been disabled in this way is indicated by a strobing alarm light. The strobe is a three quarter second on pulse followed by a quarter second off pulse.

To return to normal mute mode, hold down the ALARM RESET key again for five seconds.

**Note:** Only unacknowledged faults may be reset. Present faults may not be reset as the fault condition still exists.

# Chapter 7 Setting Electronic DIP Switches (EDSs)

The MTxPC pump controller has a large number of parameters that may be configured by the user. Instead of being set physically via traditional "DIP" switches, they are set via the front panel. For historical reasons these were known to the customer base as Electronic DIP switches, and therefore we have continued to use this term in the current manual.

There are 87 EDSs in total, grouped into ten sections. These sections are:

- Level
- Pump
- Fault
- LAN
- Analog Output
- Digital Output
- Well Washer
- SCADA Communications (SPC versions only)
- Configurable Inputs
- Sump Clean-out

The EDS value is displayed using the bar graph and the lights in the PUMP 1 column. The bar graph displays the units (0–9) while the PUMP 1 column represents the tens.

For an interactive guide to setting the EDSs, see the MultiTrode web site at www.multitrode.com.au. Follow the menu items to "Training & Support", followed by "Interactive Training". This training is also available on CD. Please request this from your local MultiTrode sales office.

## 7.1. Types of EDS

There are three types of EDS, On/Off EDSs, Numerical Value EDSs and Settings EDSs.

### 7.1.1. On/Off EDS

An On/Off EDS may only have one of two possible values, On or Off. While you are setting or inspecting it, the state of the EDS is indicated by the SWITCH ON light as shown in Figure 17.

### 7.1.2. Numerical Value EDS

A Numerical Value EDS has a numerical value between limits for that particular parameter. Absolute limits are 0 and 255. The value may be the actual number used for a parameter (such as in EDS 10—Pulse start number of pump, where the value is the number of pumps to start), or it can refer to a value or description in a lookup table (such as EDS 5—Level Sensing Device, where 0 indicates a probe, 1 indicates an analog input, etc.).

While you are setting or inspecting it, the value of the EDS is displayed on the bar graph as shown in Figure 17.

- The "1's" digit of the value is shown on the Level bar graph. All the segments will be lit except one. Read the value next to the unlit segment from the list of numbers (1–9) to the left of the bar graph.

  If the "1's" digit is 0, all the segments will be lit.

- The "10's" digit of the value is shown on the Pump 1 LEDs. Read the value next to the lit LED from the list of numbers (10–90) to the left of the LEDs.

  If the "10's" digit is 0, none of the LEDS will be lit.

- The "100's" digit of the value is shown on the Pump 2 LEDs. The LED that is lit will indicate the value as with tens digit, but starting with 100 at the bottom of the LEDs and working up. I.e., the Seal Failure LED indicates 100, Motor Overtemp indicates 200, and so on.

  If the "100's" digit is 0, none of the LEDS will be lit.

The LEDs pictured in Figure 17 are showing a value of 145.

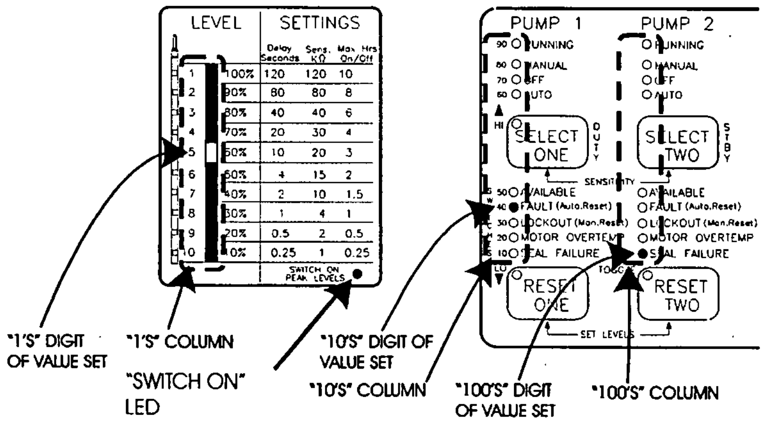



*Figure 17 how to read an EDS numerical value*

### 7.1.3. Settings EDS

A Settings EDS has a range of possible values that are indicated in the table beside the bar graph, as shown in Figure 18.

While you are setting or inspecting it, the value of the EDS is displayed on the bar graph.

- The bar graph will be fully lit apart from one segment.
- Read the value from the Settings table that corresponds to the unlit LED, in the column that corresponds to the type of values for the EDS being set. E.g. If the EDS value is a delay, read the value in the column under Delay Sec./Min.. The Switch On light distinguishes between minutes and seconds. The delay values are in minutes if the light is on and seconds if the light is off.

The LEDs pictured in Figure 18 show a setting of 10 minutes.

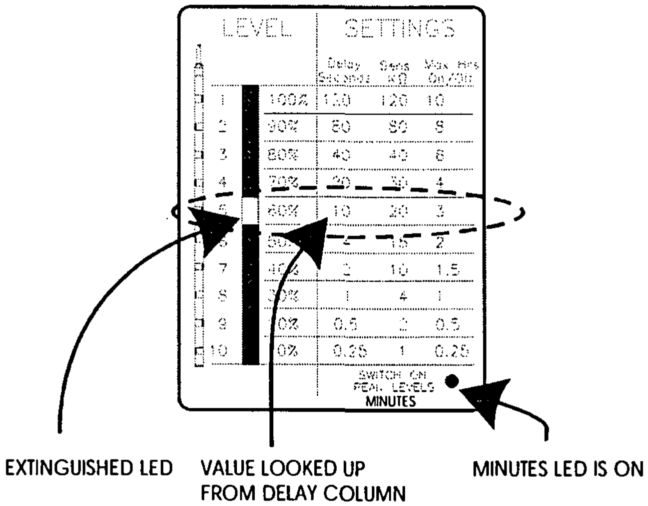



*Figure 18 Bar graph displaying a time for a settings type EDS*

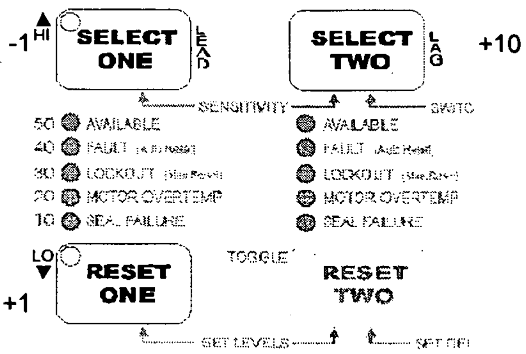
## 7.2. EDS setting procedure

Note that if the pump controller is networked to a MultiTrode MonitorPro, the text display on the MonitorPro will display context sensitive help while the EDSs are being edited, which will describe the use of the EDS currently selected, and the function of the current value of that EDS.

1. Press the 'EDS Key Combo'. The currently selected EDS number will be displayed in the format shown in Figure 17. The flashing HI and LO lights are a prompt to change the current EDS number.

2. Now select the desired EDS number. Press:

| | | |
|---|---|---|
| RESET ONE | (▲) | to increase the EDS number by 1 |
| SELECT ONE | (▼) | to decrease the EDS number by 1 |
| SELECT TWO | | to increases the EDS number by 10. |




Note that EDS settings not valid for the current setup will be skipped. See Section 7.2.3.

3. Now that the number of the required EDS is displayed, you may display or change its value.
   - For **On/Off** type EDSs:

   The current value will be displayed on the SWITCH ON LED as soon as the EDS is selected. If the LED is lit, the EDS is on and vice versa.

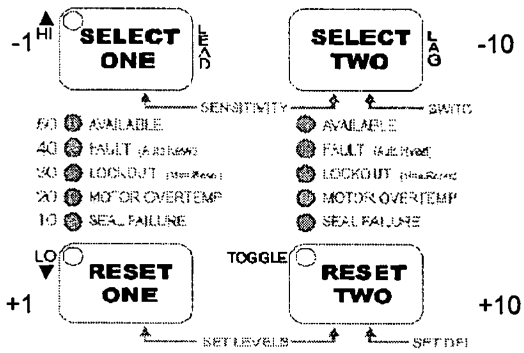
   To toggle the value of that EDS between On and Off, press RESET TWO (TOGGLE). The LED will show the new value of the EDS.

- o <u>For **Numerical Value** type EDSs:</u>

To display the current value, you must press RESET TWO (TOGGLE).

To change the value, use

| | | |
|---|---|---|
| RESET ONE | (▲) | to increase the values by 1 |
| SELECT ONE | (▼) | to decrease the value by 1 |
| SELECT TWO | | to decrease the value by 10 |
| RESET TWO | | to increase the value by 10 |




**Note** that the key usages are slightly different from those used to select the EDS number.

When you are satisfied with the value, press ALARM RESET (SET) to enter the new value and return to EDS selection mode. If you wish to abandon the setting procedure, press DUTY SELECT (LEAD SELECT) (EXIT) to return to EDS selection mode without changing the value of the current EDS.

- o <u>For **Settings** type EDSs:</u>

The procedure for setting values for Settings EDSs is similar to the procedure used for Numerical Value EDSs, except that you must read the values from the bar graph, and you may use only SELECT ONE and RESET ONE to change values. In the case of an EDS that specifies a time, as you successively press RESET ONE to move up through the values, they cycle through 0.25 second, 0.5 second, and on to 120 seconds. The next in sequence is 0.25 minute, so the lowest LED lights, and the MINUTES indicator also lights. 0.25 minute is then followed by 0.5 minute, and through to 120 minutes. Pressing SELECT ONE cycles back down in the reverse manner.

Note that it is possible to set periods of 15, 30 and 60 seconds—these are 0.25, 0.5 and 1 minute.

4. Press ALARM RESET again to save all settings. Remember that you can press DUTY SELECT (LEAD SELECT) (EXIT) at any time during the procedure to discard **all** the changes and return to the default display.

### 7.2.1. Example: updating an On/Off EDS

In this example we will change the Level Alarm from steady to a flashing output.

According to the EDS table on following pages, EDS 3 selects this function.

1. Enter EDS setting mode by pressing the 'EDS Setting Key Combo'.
2. The HI and LO lights flash to prompt you to select the EDS number. Press the RESET ONE key once then release it. The EDS changes from 1 to 2. Press and release RESET ONE once again to move to EDS 3.

Now that we have located the correct EDS, we need to change the value. The Toggle light in the RESET TWO key is a prompt to do this.

3. The SWITCH ON LED displays the current status of the EDS. If the LED is not lit, the EDS is off. (According to the EDS table, EDS 3 off means Level Alarm output is steady on.) If the LED is lit (red), the EDS is on. (Again, referring to the EDS table, EDS 3 on means Level Alarm output is flashing.)
4. Press RESET TWO (TOGGLE). The SWITCH ON light will change state with each press of this key. When the SWITCH ON light is on, as required, press ALARM RESET (SET) to save the change and return to normal operation.

### 7.2.2. Example: updating a Settings EDS

In this example we will configure the controller to acquire level information from a pressure transducer.

According to the EDS table on following pages, EDS 5 configures the level sensing device, and this EDS must be set to 1 because a pressure transducer is a single analog input.

1. Enter the EDS setting mode by pressing the EDS key combo.
2. The HI and LO lights flash to prompt you to select the EDS number. Press and release RESET ONE. The EDS changes from 1 to 2. Each additional press of RESET ONE increases the EDS number by 1 (and if you press SELECT ONE, the EDS number reduces by one). Press RESET ONE until EDS 5 is displayed (segment 5 on the bar graph is ON).
3. To display the current value, press RESET TWO (TOGGLE). You have now entered value setting mode for EDS 5.
4. With all bar graph lights ON, the value is ZERO or OFF. Press RESET ONE and SELECT ONE until the value is the required 1. The level bar graph will indicate this with all lights on except number 1.
5. Press ALARM RESET (SET) to return to EDS setting mode.
6. Press ALARM RESET (SET) key once more to save the change and return to normal operation.

The controller is now set to operate from a single analog input, e.g. pressure transducer.

### 7.2.3. EDSs not available

In certain circumstances, particular EDSs will not be available to be programmed. One example is mentioned above—if you are programming a non-SCADA controller, the controller will skip EDSs relating to SCADA.

For another example, consider EDS 21, which sets the Maximum Starts per Hour for Pump 3. This EDS is not available on a 2-pump controller (MT2PC or MT2SPC), so while programming a 2-pump controller, this can occur:

1. In EDS Editing mode, scroll through the EDS Numbers until EDS 19 is selected.
2. Press RESET ONE to increase the EDS number. The EDS number jumps to 20.
3. Press RESET ONE to increase the EDS number again. EDS 21 is not valid on a 2-pump controller, so the controller now shows the next valid EDS, which is EDS 22.

### 7.2.4. Disabling Restrictions set in EDSs

Note that there are several EDSs that affect the station behaviour by limiting a certain parameter to certain constraints. Examples of this are the Maximum Pumps to Run at one time in EDS 15 and the Consecutive Standby Starts before Duty Lockout in EDS 16. For these types of EDSs, a value of 0 disables the particular restriction on the control of the system.

## 7.3. Full EDS List

The following table is a list of all EDSs with their descriptions, defaults and allowable ranges.

| EDS | Switch Function | Default Setting | Range |
|---|---|---|---|
| | **LEVEL EDSs** (See section 8.2 for more information) | | |
| 1 | Charge (ON) / Discharge Mode (OFF) | Off = Discharge | On/Off |
| 2 | Level Alarm Reset Mode (Off= Alarm condition resets automatically when alarm condition not present, On=manual reset required) | Off = Auto Reset | On/Off |
| 3 | Level Alarm Flash (Off=steady, On=flash) | Off = Steady | On/Off |
| 4 | Level Alarm Mute Time<br>(Enables muting of alarm by pushing Alarm Reset button) | 10 mins | 0.25s – 120m |
| 5 | Level Sensing Device<br>Off = probe,<br>1 = analog input,<br>2 = analog input with probe backup<br>4 = dual analog input<br>7 = remote level device (via SCADA) | Off = Probe | Off – 10 |
| 6 | Level Sensor Timeout (before backup level sensor operates) | 10 mins | 0.25s – 120m |
| 7 | Probe Single sensor/ Multi-sensor Input<br>(not important if 4–20mA used as level device) | Off = Multi-sensor Probe | On/Off |
| 8 | Use Normal Levels (Off) or Peak Levels (On) | Off = Use Normal Levels | On/Off |
| | **PUMP EDSs** (See Section 8.3 for more information) | | |
| 9 | Duty (Lead) Select Key Operation<br>Off = no changes can be made<br>1 = Lead (Duty) select key cycles through alternation modes (Quickset Operation)<br>2 = customizable Fullset operation) - see MultiTrode web-site | 1 = Quickset Operation | Off – 2 |
| 10 | Pulse Start Number of pumps<br>(when PS input closes or SCADA signal received) | 1 = 1 pump | Off – 9 |
| 11 | Group Configuration | Off = All Groups can run | Off – 5 |
| 12 | Interpump Start Delay | 10 seconds | 0.25s – 120m |
| 13 | Interpump Stop Delay | 0.25 seconds | 0.25s – 120m |
| 14 | Random Duty (Lead) Start Delay<br>(for minimizing fat build-up at the pump setpoint) | 0.25 seconds | 0.25s – 120m |
| 15 | Maximum Pumps to Run at One Time | Off = No Limit | Off – 9 |
| 16 | Consecutive Standby (Lag) Starts Before Duty (Lead) Lockout (blocked pump detection) | Off = No Limit | Off – 10 starts |
| 17 | Desired Station Starts per Hour (adaptive level control) | Off = No Limit | Off – 60 |
| 18 | Override Level for Control Functions<br>(Limits adaptive values in EDSs 11, 16, 17, 19 – 21) | Discharge mode = 90%<br>Charge Mode = 10% | 0 – 100% |
| 19 | Maximum Starts per Hour Pump 1 | Off = No Limit | Off – 60 |
| 20 | Maximum Starts per Hour Pump 2 | Off = No Limit | Off – 60 |
| 21 | Maximum Starts per Hour Pump 3 (MT3PC Only) | Off = No Limit | Off – 60 |
| 22 | Maximum Run Time hrs for Any Pumps (Inefficient pump detection) | Off = No Limit | Off – 10hrs |
| 23 | Maximum Off Time hrs for Any Pumps (Odor reduction function) | Off = No Limit | Off – 10hrs |
| | **FAULT EDSs** (See Section 8.4 for more information) | | |
| 24 | Critical Fault Inputs NO /NC | Off = Normally Open | On/Off |
| 25 | Non Critical Fault Inputs NO/NC | Off = Normally Open | On/Off |
| 26 | Delay Fail Inputs NO/NC | Off = Normally Open | On/Off |

| EDS | Switch Function | Default Setting | Range |
|---|---|---|---|
| 27 | Thermal and Seal Fault Sources<br>Off = No seal or thermal protection<br>1 = Conductive Seal (default)<br>2 = PTC Thermistor<br>3 = Conductive Seal and PTC Thermistor<br>4 = Flygt Seal and Thermal<br>5 = Conductive Seal with Delay Fail Disabled<br>6 = Conductive Seal and PTC Thermistor, with Delay Fail Disabled | 1 = Conductive Seal | Off – 6 |
| 28 | Seal/Thermal Fault Buffer Time | 0.25 seconds | 0.25s – 120m |
| 29 | Thermal Fault Display (0 = Off, 1 = Non Critical, 2 = Critical) | Off = Display Only | Off – 2 |
| 30 | Seal Fault Display (0 = Off, 1 = Non Critical, 2 = Critical) | Off = Display Only | Off – 2 |
| 31 | Seal Sensitivity | 40K Ohms | 1K – 120K |
| 32 | Delay Fault Trip Time | 10 seconds | 0.25s – 120m |
| 33 | Delay Fault Recovery Time | 1 minute | 0.25s – 120m |
| 34 | Consecutive Delay Faults Before Lockout | Off = No Limit | Off – 10 |
| 35 | Decommission Pump 1 | Off = Pump 1 Present | On/Off |
| 36 | Decommission Pump 2 | Off = Pump 2 Present | On/Off |
| 37 | Decommission Pump 3 (MT3PC Only) | Off = Pump 3 Present | On/Off |
| | **LAN EDSs** (See Section 8.6 for more information) | | |
| 38 | LAN Mode (0 = Multi-Pump Mode, 1 = Mimic Mode, 2 = Multi Well Mode) | Off = Multi-Mode | Off – 2 |
| 39 | Master / Slave Mode (Off = Master, On = Slave) | Off = Master Mode | On/Off |
| 40 | Slave 1 / Slave 2 Mode (Off = Slave1, On = Slave2) | Off = Slave 1 | On/Off |
| 41 | Number MT2/3PCs in a Group | 1 | 1 – 3 |
| 42 | Group ID (RS485 comms) | 1 | 1 – 9 |
| 43 | Maximum Groups in LAN | 1 | 1 – 9 |
| 44 | Communications with MultiTrode network<br>Off = no LAN, set while CDS software is used<br>1 = comms with MonitorPro<br>2 = comms with MonitorPro but lockout pumps if comms fail<br>3 (SPC only) = comms with SCADA enabled but LAN disabled<br>4 (SPC only) = comms with LAN and SCADA enabled | 1 = Comms. Enabled (MTxPC)<br>4 = MTxSPC comms enabled (MTxSPC) | Off – 4 |
| 45 | LAN Communications Mode (Off=normal, On= aux. Telemetry device) | Off = Normal LAN Comms | On/Off |
| 46 | Analog/Comms. Level % Change before logging | 10% | 1–20% |
| | **ANALOG OUTPUT EDSs** (See Chapter 10 for more information) | | |
| 47 | Analog Output Mode<br>Off = Analog Output Disabled<br>1 = Analog Output is Linear Level<br>2 = Analog Output is Inverted Linear Level<br>3 = Analog Output is VFD Output<br>4 = Analog Output is Inverted VFD Output<br>5 = Analog Output is set by CMF via comms | Linear | Off – 5 |
| 48 | Analog Output Ramp Time | 0.25 seconds | 0.25s – 120m |
| 49 | VFD Equaliser Group One Compensation Coefficient | 50% | 0–100% |
| 50 | VFD Equaliser Group Two Compensation Coefficient | 50% | 0–100% |

| EDS | Switch Function | Default Setting | Range |
|---|---|---|---|
| | **DIGITAL OUTPUT EDSs** (See Section 8.7 for source types) | | |
| 51 | Digital (Relay) Output 1 Source | 1 = Alarm 1 | 0–59 |
| 52 | Digital (Relay) Output 2 Source | 2 = Alarm 2 | 0–59 |
| 53 | Digital (Relay) Output 3 Source | 3 = Common Alarm | 0–59 |
| 54 | Digital (Relay) Output 4 Source | 0 = Null | 0–59 |
| 55 | Digital (Relay) Output 5 Source (MT2PC Only) | 0 = Null | 0–59 |
| 56 | Digital (Relay) Output 1 NO/NC | Off = N/O | On/Off |
| 57 | Digital (Relay) Output 2 NO/NC | Off = N/O | On/Off |
| 58 | Digital (Relay) Output 3 NO/NC | Off = N/O | On/Off |
| 59 | Digital (Relay) Output 4 NO/NC | Off = N/O | On/Off |
| 60 | Digital (Relay) Output 5 NO/NC (MT2PC Only) | Off = N/O | On/Off |
| | **WELL WASHER EDSs** (See section 8.8 for more information) | | |
| 61 | Washer Activation Level | 20% | 0–100% |
| 62 | Washer Maximum Run Time | 2 minutes | 0.25s – 120m |
| 63 | Washer Interstart Period (minimizes water usage) | 2 hrs | Off – 10hrs |
| 64 | Washer Maximum Off Time (minimizes odors) | 3 hrs | Off – 10hrs |
| | **SCADA COMMUNICATION EDSs (MT2SPC AND MT3SPC ONLY)** | | |
| 65 | SCADA Site number | 11 | 11 – 255 |
| 66 | SCADA Quick Poll Region Number (see Outpost manual) | 0 | 1 – 255 |
| 67 | SCADA Quick Poll Sequence Number (see Outpost manual) | 0 | 1 – 255 |
| 68 | Power Up Radio Delay (Multiples of 20ms.) | 20 = 400 ms. | 0 – 100 |
| 69 | SCADA transmission BAUD Rate (0 = 1200, 1 = 2400 and 2 = 4800) | 0 = 1200 | 0 – 2 |
| | **CONFIGURABLE INPUTS EDSs** | | |
| 70 | Key Lock (KL) / Configurable Input Telemetry | Off = Key Lock (KL) | On/Off |
| 71 | Critical Fault Pump A (AC) / Configurable Input Telemetry | Off = Critical fault Pump A | On/Off |
| 72 | Non-critical Fault Pump A (AN) / Configurable Input Telemetry | Off = NC Fault Pump A | On/Off |
| 73 | Delay Fault Pump A (AD) / Configurable Input Telemetry | Off = Delay Fault Pump A | On/Off |
| 74 | Seal Fault Pump A (AS) / Configurable Input Telemetry | Off = Seal Fault Pump A | On/Off |
| 75 | Critical Fault Pump B (BC) / Configurable Input Telemetry | Off = Critical fault Pump B | On/Off |
| 76 | Non-critical Fault Pump B (BN) / Configurable Input Telemetry | Off = NC Fault Pump B | On/Off |
| 77 | Delay Fault Pump B (BD) / Configurable Input Telemetry | Off = Delay Fault Pump B | On/Off |
| 78 | Seal Fault Pump B (BS) / Configurable Input Telemetry | Off = Seal Fault Pump B | On/Off |
| 79 | Critical Fault Pump C (CC) / Configurable Input Telemetry | Off = Critical fault Pump C | On/Off |
| 80 | Non-critical Fault Pump C (CN) / Configurable Input Telemetry | Off = NC Fault Pump C | On/Off |
| 81 | Delay Fault Pump C (CD) / Configurable Input Telemetry | Off = Delay Fault Pump C | On/Off |
| 82 | Seal Fault Pump C (CS) / Configurable Input Telemetry | Off = Seal Fault Pump C | On/Off |
| 83 | Peak Levels (PL) / Configurable Input Telemetry | Off = Peak Levels (PL) | On/Off |
| 84 | Power Fail (PF) / Configurable Input Telemetry | Off = Power Failure (PF) | On/Off |
| 85 | Pulse Start (PS) / Configurable Input Telemetry | Off = Pulse Start (PS) | On/Off |
| | **SUMP CLEAN-OUT EDSs** (See section 0 for more information) | | |
| 86 | Number of full pump cycles between clean-outs | 0 = Off | Off – 255 |
| 87 | Run-on time for clean-out | 10 seconds | 0.25s – 120m |

*Table 3 – EDS functions*

This table is duplicated at the back of the manual for quick reference.

# Chapter 8 Functional Description of the Pump Controller

## 8.1. Advanced interaction with the operating environment

The MultiTrode pump controllers have features to allow dynamic optimisation and protection of the pump station using the following inputs.

### 8.1.1. Spill Management and Energy Efficiency (Peak Levels)

The Pump Controller stores two separate sets of levels and delays for both pumps and alarms. These are known as "Normal" and "Peak" Levels. Peal Levels can be used for energy efficiency during peak periods or for spill management. If a pump station fails, placing upstream stations into peak levels will minimise any spilliage at the failed station by delaying the flow into the failed station. Simply 'holding out' the upstream station is risky, as this may just cause two separate spills.

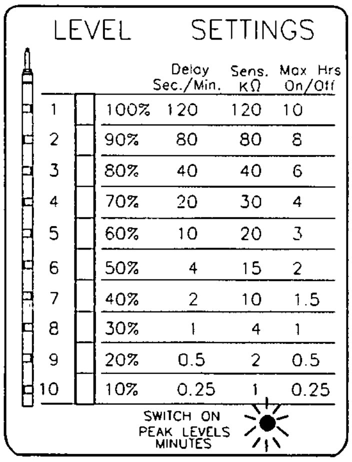



*Figure 19. The PEAK LEVELS LED at the bottom of bar graph is lit when unit is in Peak Levels while showing the normal display*

There are three ways to put the pump controller into Peak Levels mode.

- Set EDS 8 to On.
- Use the PL input on the controller. A voltage free contact closure between PL and E1 will place the controller into Peak Levels mode.
- Set the mode via telemetry. A SCADA message can be delivered via the MultiTrode MonitorPro RTU or directly to the SPC RTU to place the pump controller into Peak Levels mode.

**NOTE THAT IF ANY OF THESE METHODS ARE ACTIVE THEN THE CONTROLLER IS IN PEAK LEVELS MODE.**

### 8.1.2. Power Fail (Hold out)

Use the Power Fail (PF) digital input to hold out all of the pumps. This may be necessary to stop a station from running based upon inputs from limit switches on actuated valves, for process control, to stop pressure fluctuations in pipework for a period or to prevent pumps running on high electrical tariffs.

When the Power Fail digital input is connected to ground the holdout condition will be present. When the digital input is open circuit there will be no holdout condition. The Holdout condition can also be iniated by the SCADA system. If either source (the digital input of the SCADA system) is active, the Holdout condition will be true.

The holdout condition is represented on the display by flashing all of the available lights.

***WARNING: THIS INPUT SHOULD NOT BE USED TO ELECTRICALLY ISOLATE PUMPS. DISCONNECTION FROM THE SUPPLY VIA SUITABLE APPROVED CIRCUIT BREAKING DEVICES IS THE ONLY RECOMMENDED MEANS OF ISOLATION.***

**CAUTION: NO PUMP WILL RUN UNDER ANY CIRCUMSTANCE WHILE THE POWER FAIL (HOLDOUT) CONDITION IS ACTIVE.**

**CAUTION: IF POWER FAIL IS ACTIVATED WHILE PUMPS ARE RUNNING THEY WILL BE STOPPED IMMEDIATELY AND WILL NOT PRESERVE THE INTERPUMP STOP DELAYS.**

### 8.1.3. Pulse Start Operation

Your installation may require pumps to start on some external trigger. This may be for purging components of a system, or maximising use of a particular electrical tariff by trying to empty the pit just before the end of a low-tariff period. The MultiTrode Pump Controller provides functionality for "Pulse Starting" one or more pumps. This means that a configurable number of pumps will start when the trigger occurs, if and only if they are within their working range (i.e. between their activation and deactivation levels). When pumps are started with a Pulse Start, they will operate in "semi-automatic" mode (Refer to section 2.2.1.2), and return to normal operation when they reach their normal deactivation levels.

To understand how this feature operates, suppose two pumps are set to pulse start and no pumps are running. When the trigger occurs then the Duty (Lead) and Standby (Lag) pumps will start if and only if the current liquid level is within their working range. If these pumps were already running then two more pumps **would not** be started. That is, the controller will start pumps—if they are within their operating ranges—until the number of pumps required by the pulse start setting are actually running.

There are two methods of applying a Pulse start.

- A voltage free contact closure between PS and E1. Note: This closure must be present for a minimum of two seconds. To ensure a return to normal operation this must be a momentary closure.
- A SCADA signal from a MultiTrode Monitor Pro RTU.

The number of pumps to start when a Pulse start is applied is set via EDS 10. The Default setting for EDS 10 is 1. Refer to Chapter 7 for information on setting EDS 10.

## 8.2. Level

The pump controller provides control for 2 (MT2PC) or 3 (MT3PC) pumps. The primary determiner is fluid level, acquired from either a MultiTrode probe, or a 4-20 mA device. A 4–20 mA device can have a backup of another 4–20 mA device or a MultiTrode probe. EDS 5 selects how the input devices should be handled to derive the level signal. EDS 6 sets the periodic rechecking time of the primary device after a failure.

For one 4-20mA device with a probe backup, set EDS 5 =2. The controller will continuously check the analog device for correct operation. There must be a minimum of two probe sensors, with one below or equal to the zero level of the analog input, and the other equal to or above the 100% point. The bottom sensor is connected to probe input P10, and the top to probe input P1. The 4-20mA device will be considered to have failed if

- The analog level is less than 95% and the top probe sensor is covered
- The analog level is greater than 5% and the bottom sensor is not covered

During an analog failure, the bar-graph will flash. The current level detected by the probe will be on continuously. The time period for rechecking the primary device is set by EDS 6 (Level Sensor Timeout).

For two 4-20mA devices, set EDS 5 = 4. The controller uses the higher of the two analog inputs to determine liquid level. If both inputs fail (<3.5mA), all pumps will be prevented from running. When a reliable signal is again detected, operation will recommece immediately. EDS 6 has no effect with two 4-20mA devices.

For level input via a MonitorPro (e.g. from SCADA), set EDS 5 = 7. If a level is not received within the time period set in EDS 6, all pumps will be locked out until a new level is received.

There are some specialist options for level sensing, set by EDS 5 & 6. Please refer to the MultiTrode web site at www.multitrode.com.au for application notes on these options.

## 8.3. Station efficiency and optimisation

### 8.3.1. Interpump Start and Stop Delays (EDS 12 and 13)

Standard pump start and stop delays are described in Chapter 6, but in addition the pump controller has an interpump start delay (EDS 12) and an interpump stop delay (EDS 13). These are intended to reduce electrical overload and water hammer respectively. Note that these delays are overridden in the event of manual starts, manual stops or any sort of fault which will stop a pump, including the Power Fail input.

### 8.3.2. Maximum Pumps to run Concurrently (EDS 15)

The maximum pumps to run at any one time can be limited with EDS 15, which can also assist in reducing overload.

Note that if the level continues to rise to the next activation level while the maximum number of pumps is running, the pump that has been running the longest will stop, and another pump will start, in case the first pump was blocked or has a damaged impeller.

### 8.3.3. Fat build-up reduction (Random Duty Start) (EDS 14)

Fat build-up can be reduced with the random duty (lead) start delay set in EDS 14. When this parameter is enabled, the duty (lead) pump will start at a random time after the normal activation point has been reached. More precisely, the random time is a time somewhere between

- the normal activation delay, and
- the sum of the normal activation delay and the value of EDS 14

Note that if a second pump is called to start during the random delay (e.g. if the second setpoint is reached), the random delay function will be temporarily disabled and the duty (lead) pump will start immediately, followed by the second pump after its normal activation delay, which will be the greater of either the second pump start delay or the interpump start delay.

### 8.3.4. Maximum Run Time (EDS 22)

To reduce possible damage caused by running a pump for too long, the Maximum Run Time can be set in EDS 22. If any pump runs for longer than this time, and the well level is below the activation level for that pump, the pump will be stopped.

If the Maximum Run Time is exceeded and the well level is at or above the activation level for that pump, and there is another pump that is able to run (i.e., in Auto mode with no faults), and the pumps are not operating in a fixed duty (lead) sequence, the first pump will be stopped and the second will be started.

If on the other hand the level equals or exceeds the activation level and there are no other pumps available, or if the pumps are operating in a fixed duty (lead) sequence, the pump will not be stopped when the Maximum Run Time is exceeded.

### 8.3.5. Odor Reduction (Maximum Off Time) (EDS 23)

To remove stagnant liquids from the well, thereby reducing odor problems, pumps can be forced to run on a regular basis by setting the maximum off time in EDS 23. If this time has elapsed since the last pump run, and the duty (lead) pump is above its deactivation level, the duty (lead) pump will be started.

### 8.3.6. Blocked Pump Detection (Standby (Lag) Starts before Duty (Lead) lockout) (EDS 16, 18)

If the Standby (Lag) pump starts unusually often during one cycle of the duty (lead) pump, it is a strong (but not certain) indication that the duty (lead) pump has a damaged impeller or is obstructed.

If the number of starts exceeds the value set in EDS 16, the duty pump will be faulted. However, if the liquid in the well reaches the override level set in EDS 18, the duty pump will be re-enabled.

> Care should be taken with this function, and if normal inflow may require the running of two pumps for more than brief periods this should not be used.

### 8.3.7. Achieving Desired Station Starts Per Hour (EDS 17)

Many studies have shown that longer, less frequent pump runs are more efficient than shorter, more frequent pump runs when moving the same volumes of liquid.

Adaptive level control minimises pump starts and extends pump run times by extending the pump activation levels to attempt to match the "Desired Station Starts per Hour" set in EDS 17. Each time the desired pump starts are exceeded in one hour, the activation level is dynamically changed, but cannot be increased past the over-ride level set in EDS 18. Note that if the adaptive level control has increased a starting level, and a subsequent series of pump runs in one hour is less than EDS 17, the adapted level will be reduced, towards the programmed activation level. If adaptive level control has altered the activation points of the pumps, all of the AUTO lights on the display will flash slowly.

#### 8.3.8. Limiting Individual Pump Starts Per Hour (EDS 19–21)

A maximum number of pump starts per hour can be set for individual pump by EDSs 19, 20 and 21 for pumps 1, 2 and 3 respectivley. This functionality is necessary in some instances for station efficiency, to minimise thermal build-up in the motor, or to preserve manufacturer's guidelines for pump operation. When the maximum pump starts per hour has been exceeded for a particular pump, that pump will be prevented from running, and the respective AUTO light for that pump will flash quickly. If the liquid level reaches the override level set by EDS 18 while a pump is being held off, the pump will be made available to run again.

## 8.4. Fault conditions (EDS 24–34)

The pump controller has a number of physical fault inputs for different applications. These are described in detail in section 12.2.4 in the wiring chapter. EDSs 24–34 allow some configuration of these fault inputs:

- Fault inputs can be made normally open or normally closed (EDSs 24–26).
- Buffer times can be introduced to avoid false trips due to noise (EDS 28).
- Some faults can be made to only display, or to act as a non-critical fault (reset when the fault condition disappears), or to act as a critical fault (only reset when an operator clears the fault) (EDSs 29–30).
- The delay fail input is used in conjunction with a flow or pressure sensor to diagnose a damaged impeller, locked rotor or a blockage preventing flow. When a pump turns on the sensor should register a fluid flowing condition within a period of time. This period of time is called the trip time (EDS 32).
- In the event of a delay fail faulting a pump, the pump will be made unavailable for a set period of time before it becomes available again, known as the recovery time (EDS 33). The drop in pressure when the pump stops may have dislodged the blockage so a number or retries may be required. A maximum number of retries can be set with EDS 34 to force a critical (manual reset) fault if the condition persists.
- Thermal and Seal Fault Sources and Seal Sensitivity are as shown in the EDS table (EDSs 27, 31).

Reduced Switchboard components: Thermistors, Flygt FLS sensors, and Seal Fail Sensors can all be wired directly into the MT2PC without the need for external Thermistor Relays or MiniCas systems.

## 8.5. Decomissioning Pumps (EDS 35–37)

Individual pumps can be decommissioned by setting EDSs 35, 36 and 37 to "on", for Pumps 1, 2 and 3 respectively. Each of these eliminates all lights and controls for the specified pump, and prevents it from running under any circumstances.

## 8.6. Communications for LAN (EDS 44)

Up to three pump controllers can be grouped together for complex pumping applications including multi-well mode. See the MultiTrode web site at www.multitrode.com.au for more details on these applications.

When communicating with CDS software directly, EDS 44 must be set to off. When communicating with CDS via a MonitorPro, or when CDS is not actually in use, EDS 44 should be set to 1 to enable normal communications between the Pump Controller and the MonitorPro.

For convenience **(On non-SPC versions)** you may use these shortcut methods for changing EDS 44:

- To set EDS 44 to Off, press SELECT ONE, SELECT TWO and ALARM RESET simultaneously.
- To set EDS 44 to 1, press RESET ONE, RESET TWO and DUTY SELECT (LEAD SELECT) simultaneously.

## 8.7. Configurable Digital Outputs (EDSs 51–60)

The pump controller can connect to RTUs or to other panel logic via configurable outputs, which can be individually set to Normally Open or Normally Closed. EDSs 51–55 determine the source of the condition used to set the Digital Outputs 1 to 5 respectivley, and EDSs 56–60 determine if these outputs are used in N/O or N/C mode.

The sources are conditions with the product as in this table.

| Nr | Description | Nr | Description |
|---|---|---|---|
| 0 | None | 33 | Critical Fault Pump 1 |
| 1 | Alarm 1 Present | 34 | Critical Fault Pump 2 |
| 2 | Alarm 2 Present | 35 | Critical Fault Pump 3 |
| 3 | Common Alarm | 36 | Critical Fault Any Pump |
| 4 | Pump 1 Running | 37 | Non Critical Fault Pump 1 |
| 5 | Pump 2 Running | 38 | Non Critical Fault Pump 2 |
| 6 | Pump 3 Running | 39 | Non Critical Fault Pump 3 |
| 7 | Any pump running | 40 | Non Critical Fault Any Pump |
| 8 | No pumps running | 41 | Delay Fault Pump 1 |
| 9 | All pumps running | 42 | Delay Fault Pump 2 |
| 10 | All pumps Available to Run | 43 | Delay Fault Pump 3 |
| 11 | All pumps Available | 44 | Delay Fault Any Pump |
| 12 | Any Pump Unavailable | 45 | Seal Fault Pump 1 |
| 13 | All Pumps Unavailable | 46 | Seal Fault Pump 2 |
| 14 | Pump 1 Unavailable | 47 | Seal Fault Pump 3 |
| 15 | Pump 2 Unavailable | 48 | Seal Fault Any Pump |
| 16 | Pump 3 Unavailable | 49 | Thermal Fault Pump 1 |
| 17 | Any Pump Off or Unavailable | 50 | Thermal Fault Pump 2 |
| 18 | All Pumps Off or Unavailable | 51 | Thermal Fault Pump 3 |
| 19 | Pump 1 Off or Unavailable | 52 | Thermal Fault Any Pump |
| 20 | Pump 2 Off or Unavailable | 53 | Max pump starts exceeded pump 1 |
| 21 | Pump 3 Off or Unavailable | 54 | Max pump starts exceeded pump 2 |
| 22 | All pumps off | 55 | Max pump starts exceeded pump 3 |
| 23 | Pump 1 off | 56 | Max pump starts exceeded any pump |
| 24 | Pump 2 off | 57 | Desired station starts exceeded |
| 25 | Pump 3 off | 58 | Peak Levels |
| 26 | Any pump off | 59 | Well Washer |
| 27 | Communications Fault | 60 | Level Activation |
| 28 | Level Device Fault | 61 | Level Activation with Interstart |
| 29 | Probe sensor fail | 62 | Analog Compare Unidirectional 1 |
| 30 | Analog Input 1 fault | 63 | Analog Compare Unidirectional 2 |
| 31 | Analog Input 2 fault | 64 | Analog Compare Bi-directional |
| 32 | Remote Telemetry Source | | |

*Table 4 – Digital Output Sources.*

## 8.8. Well Washer functions (EDSs 61–64)

The pump controller has built in well washer control, with four configurable functions to minimise odors while minimising water usage.

After the delay set in EDS 63 has passed since either the previous well washer cycle or a controller reset, the pump controller will activate the Well Washer digital output (any digital output whose source has been set to "Well Washer" as described in section 8.7) as soon as the level in the well falls below the activation level set in EDS 61 (for discharge mode, or above this level for charge mode). This output will stay activated for the period set by the Well Washer Run Time, in EDS 62, irrespective of the pump status'. The Well Washer digital output will become active regardless of the level and the pump statuses if the Well Washer Maximum Off Time set in EDS 64 has expired since either the previous well washer cycle or a controller reset, and again, will stay activated for the period set in EDS 62.

If any pump is placed in manual or semi-automatic mode, this output will be activated.

## 8.9. Analog Compare Outputs

Three configurable digital output sources are linked to the well washer Level Activation, EDS 61 and use the analog input states for sources.

> Note: If either of the Analog Inputs have failed (IE below 3.5mA) all of the Analog Compare Outputs will be in the inactive state. To determine if an input has failed refer to the Digital Output Sources which specifically deal with analog failures.

### 8.9.1. Analog Compare Unidirectional 1

This output is active when Analog 1 exceeds Analog 2 by the amount set in level set in EDS 61, and remains inactive while Analog 2 exceeds Analog 1.

### 8.9.2. Analog Compare Unidirectional 2

This output is active when Analog 2 exceeds Analog 1 by the amount set in level set in EDS 61, and remains inactive while Analog 1 exceeds Analog 2.

### 8.9.3. Analog Compare Bi-directional

This output is active when the difference between Analog Input 1 and Analog Input 2 exceeds the level set in EDS 61. This is referred to as bi-directional because the output will become active irrespective of whether Analog 1 or 2 is the higher value, as long as the difference between them exceeds the set value.

## 8.10. Sump Clean-Out functions (EDSs 86 and 87)

The Sump Clean-Out function will keep the pumps running past their normal deactivation level and stop delay by the time set in EDS 87, every time the number of pump cycles specified in EDS 86 have elapsed. Note that if EDS 86 is set to 0, the extra run-on time will never be used.

## 8.11. Configurable Telemetry Inputs (SPC Only) (EDS 70–85)

Many of the inputs to the MultiTrode MT2SPC can be used as general-purpose digital inputs for monitoring from the CMF using MultiTrode Outpost SCADA. Typical uses for these general purpose inputs might be door open or passive infra-red intruder detector, low level of additive, overflow level or dry well flooded.

To use such a digital input, choose one of the EDSs 70–85 and set it On. That input is now configured as a telemetry input, and its normal functionality is disabled.

**CAUTION: CONFIGURABLE TELEMETRY INPUTS PROVIDE INDICATION ONLY. THEY <u>DO NOT</u> GENERATE FAULT CONDITIONS.**

For example, suppose there is an additive reservoir with a low-level detector and you wish to pass the condition of the detector back to the CMF. Wire the output of the level detector into Pump B Delay Fail input (BD), then set EDS 77 to On. Thus it no longer has its default function Pump B Delay Fail, but indicates additive level (low or adequate) instead—and will not generate a fault condition.

You will then configure your CMF to show the appropriate indication.

A closed dry contact making a circuit between the input terminal and the E1 terminal activates that digital input. For the Critical, Non-critical and Delay Fault inputs, set EDS 24, 25 or 26 respectively to make those inputs Normally Open or Normally Closed when used as telemetry digital inputs.

# Chapter 9 Configuring Level Devices

MultiTrode's pump controllers can be used with almost any kind of level sensing device. Common sensors include probes, ball floats and 4–20 mA pressure sensors.

## 9.1. Adjusting Probe Sensitivity

MultiTrode's probe is a conductive sensing device, which creates a path back to the controller from earth as each sensor is submerged in liquid. In some cases it may be necessary to adjust the sensitivity of the probe to allow for the conductive properties of different types of liquid. To do this, follow the procedure shown below:

1. Press SELECT ONE and SELECT TWO simultaneously.
2. If the Level Source in EDS 5 **is set** to 2, 3, 5 or 6, PUMP 1 RUNNING and ALARM lights will flash alternately to prompt you to choose between probe sensitivity and analog calibration. To adjust the analog zero and span when using any of these settings for EDS 5, see section 9.2 below. To select probe sensitivity, press SELECT ONE. One segment only will be illuminated on the bar graph. If EDS 5 **is not set** to 2, 3, 5, or 6 this step will be skipped.
3. One segment only will be illuminated on the bar graph, which will indicate the current sensitivity, using the Sens. KΩ column in the settings table beside the bar graph.

   Raise or lower the sensitivity by pressing one of the following keys:

   | | | |
   |---|---|---|
   | SELECT ONE | (▲) | to raise the sensitivity |
   | RESET ONE | (▼) | to lower the sensitivity. |

4. To return to normal operation , press either :

   | | |
   |---|---|
   | ALARM RESET (SET) | To return and **save** the new settings, or |
   | DUTY SELECT (LEAD SELECT) (EXIT) | To return and **discard** the changes. |

## 9.2. Setting the analog input zero and span

Analog 4–20 mA devices are often used to detect liquid level in applications where a high resolution is required or the liquid is not conductive. Before using these devices it is necessary to set their operating range. This range is referred to as the zero and the span.

Zero is the current at which the tank or pit is considered to be empty. Span is the current at which the tank is full. The difference between these two settings is the operating range of the device.

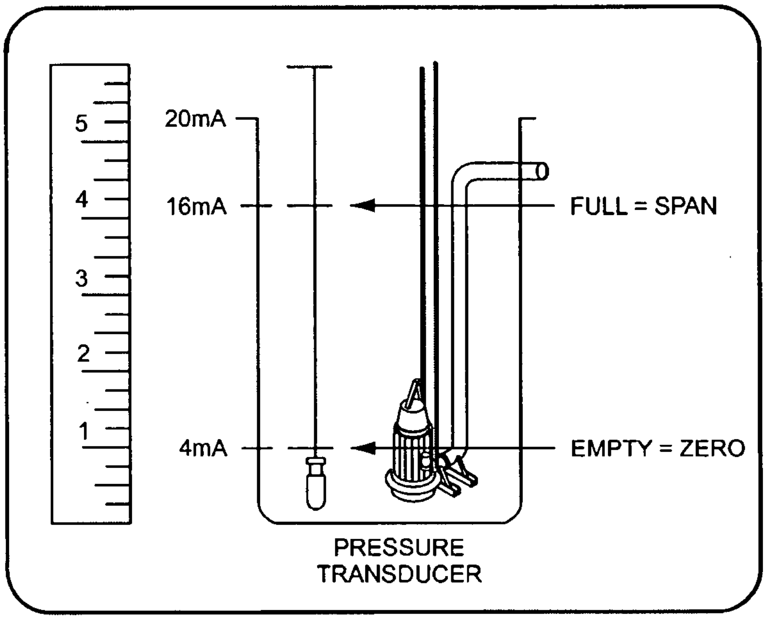



*Figure 20: Understanding Zero And Span*

For example, a 4 metre deep sewerage pit has a 5 m pressure transducer as the level device, and we require the pump controller to register 4 m as 100% and 1 m as empty. These values are the span and the zero respectively.

If the transducer registers 20mA at 5m of depth in the well, and 4 mA at 0m depths, giving (4/5 X 16 +4 = ) 16.8 mA at 4 m and (1/5 X 16 + 4 = ) 7.2mA at 1m. For the pump control, the span point will be 16.8 mA and the zero point will be 7.2mA.

There are two ways to set zero and span. A quick set method allows the value to be set to the current liquid level. A full set method requires a mathematical calculation to determine the correct input levels.

### 9.2.1. Quick Set Zero and Span

This method is used to set the zero or span to the current level. The usual method is to let the level fall to the empty position and set this as the zero, then wait for the level to rise up to the full position and set this level as the span.

Before setting the zero and span, make sure EDS 5 (Level Sensing Device) is set to analog input. See section 7.3.

1. Wait until the current level is at the empty position.
2. Press SELECT ONE and SELECT TWO simultaneously.
3. If two analog sensors are in use, the HI and LO lights will flash in unison with the ALARM 1 and ALARM 2 lights. Select the correct one by pressing SELECT ONE for analog input 1 or RESET ONE for analog input 2. If only one analog input is used the controller will skip this step.
4. Press RESET ONE to set zero to the current level.
5. Wait until the level is at the full position.
6. Press SELECT ONE and SELECT TWO simultaneously again.
7. Once again, choose the correct analog input if more than one is in use.
8. Press SELECT ONE to set the span.

## 9.2.2. Full Set Zero and Span

This method allows you to program the zero and span current values manually. The controller then uses these values to calculate the correct current levels for each setting.

### 9.2.2.1. Calculating the values

The calculations below are used to determine the zero and span values for the full set method:

$$\text{Zero Current} = \left( \frac{\text{Zero Height}}{\text{Transducer Range}} \times 16\text{ mA} \right) + 4\text{ mA} \tag{1}$$

$$\text{Span Current} = \left( \frac{\text{Span Height}}{\text{Transducer Range}} \times 16\text{ mA} \right) + 4\text{ mA} \tag{2}$$

$$\text{Zero Value} = \frac{\text{Zero Current}}{20.5\text{ mA}} \times 255 \tag{3}$$

$$\text{Span Value} = \frac{\text{Span Current}}{20.5\text{ mA}} \times 255 \tag{4}$$

The span value should always be greater than the zero value. Two examples for using the above equations are given below:

### 9.2.2.2. Example 1

A pressure transducer has a 5m range and the target application has a tank height of 4m. The transducer is lowered to the bottom of the vessel and the zero measurement is to be taken 1 m from the bottom of the vessel.

Using equations (1) and (3) to calculate the zero:

$$\text{Zero Current} = \left( \frac{1\text{ m}}{5\text{ m}} \times 16\text{ mA} \right) + 4\text{ mA} = 7.2\text{ mA}$$

$$\text{Zero Value} = \frac{7.2\text{ mA}}{20.5\text{ mA}} \times 255 = 90$$

Now using equations (2) and (4) to calculate the span:

$$\text{Span Current} = \left( \frac{4\text{ m}}{5\text{ m}} \times 16\text{ mA} \right) + 4\text{ mA} = 16.8\text{ mA}$$

$$\text{Span Value} = \frac{16.8\text{ mA}}{20.5\text{ mA}} \times 255 = 209$$

The steps below show how to enter the zero (90) and span (209) values into the pump controller.

#### 9.2.2.3. Example 2

A pressure transducer in a sewerage well has 6 mA as the value used to indicate 0%, and 18 mA is the value used to indicate 100%. Using equations 3 and 4:

$$\text{Zero Value} = \frac{6.0\ \text{mA}}{20.5\ \text{mA}} \times 255 = 75$$

$$\text{SpanValue} = \frac{18.0\ \text{mA}}{20.5\ \text{mA}} \times 255 = 224$$

When these values are programmed into the pump controller, 6 mA will correspond to 0% and 18 mA will correspond to 100%.

Before entering these values into the controller, make sure EDS 5 (Level Sensing Device) is set to Analog Input. See section 8.2.

#### 9.2.2.4. To enter the values into the controller:

1. Press SELECT ONE and SELECT TWO simultaneously.
2. If analog input with probe backup is used as the level source (EDS 5 = 2, 3, 5, or 6), the PUMP 1 RUNNING indicator and the ALARM 1 indicator will be flashing. Press SELECT ONE to set the sensitivities for the probes, or ALARM RESET to set the analog zero and span. If probe backup is not used, the controller will skip this step.
3. If two analog sensors are in use, the HI and LO lights will flash in unison with the ALARM 1 and ALARM 2 lights. Select the correct one by pressing SELECT ONE for analog input 1 or RESET ONE for analog input 2. If only one analog input is used the controller will skip this step.
4. Press SELECT ONE and SELECT TWO again. The SWITCH ON/PEAK LEVELS light will turn on.
5. Press RESET ONE to set zero or SELECT ONE to set the span value.
6. Use SELECT ONE or RESET ONE to respectively raise or lower the value to match the figure you calculated above. Units are indicated by the bar graph, tens by the LEDs in the pump 1 column and hundreds by the LEDs in the pump 2 column (similarly to the way numbers are indicated while programming EDS values).
7. Press ALARM RESET (SET) to enter the new value.
8. Press DUTY SELECT (LEAD SELECT) (EXIT) to exit without making any changes.
9. Repeat the steps for both the zero and span values.

# Chapter 10 Variable Frequency Drive Equalizer

The Variable Frequency Drive Equalizer, or VFD Equalizer, controls multiple variable frequency drives. It allows installations using variable frequency drives to take advantage of the advanced alternation and control functionality of the pump controller while providing intelligent and adaptive speed control.

Note: The VFD Equalizer functionality is only available on the -VFD models of the MultiTrode Pump Controller, which are MT2PC-VFD or MT3PC-VFD. Contact your local distributor if you wish to enquire further about obtaining this extra functionality.

In VFD units the Analog Output Source, EDS 47, should be set to 3. Refer to section 7.3.

Note: This is **not** the default setting. In the event of a Defaults Reset being carried out, you will need to set EDS 47 for VFD operation.

## 10.1. Intelligent Pump Control—The VFD Equalizer

One of the main problems affecting installations with multiple VFDs is co-ordinating the drives so that the flow through the installation does not fluctuate as extra pumps are turned on and off. MultiTrode's VFD Equalizer function solves this by automatically adjusting a 4–20 mA control signal to compensate for the extra pump. This is achieved with only one extra set point when setting up the pump controller. No extra hardware is required.

The 4–20 mA signal produced by the equalizer is used to control the VFD's speed range. For example, the VFD might change the motor frequency from 38 Hz to 50 Hz in order to vary the motor from off to full speed. This is the operating range of the drives. Therefore, the 4–20 mA range is here equivalent to the speed range of the drive, which is 38–50 Hz.

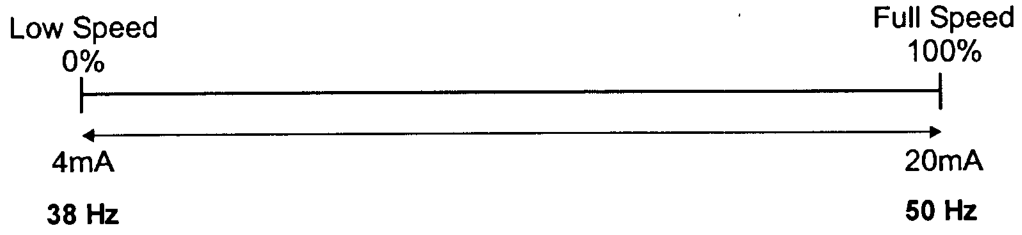



*Figure 21—Analog output compared to speed range set on VFD*

A single analog output from the pump controller is used to control multiple VFDs in the installation. As pumps turn on and off, the analog output signal is recalculated so the net flow through the installation is averaged over the two pumps. The controller always tries to adjust the controlling signal so that both pumps are running at the same speed to produce the required flow.

For example, in Figure 22, pump 1 is running at full speed (100%r) by the time pump 2 starts (level 60%). The controller drops the speed of pump 1 to 65%r and starts pump 2 at 65%r instead of 30%r. This is because 65%r speed is the average of 30%r + 100%r. The controller continues to calculate this average as long as the well level is in pump 2's operating range.

When the level drops to 30%, pump 2 will turn off and pump 1 reverts to its normal curve.

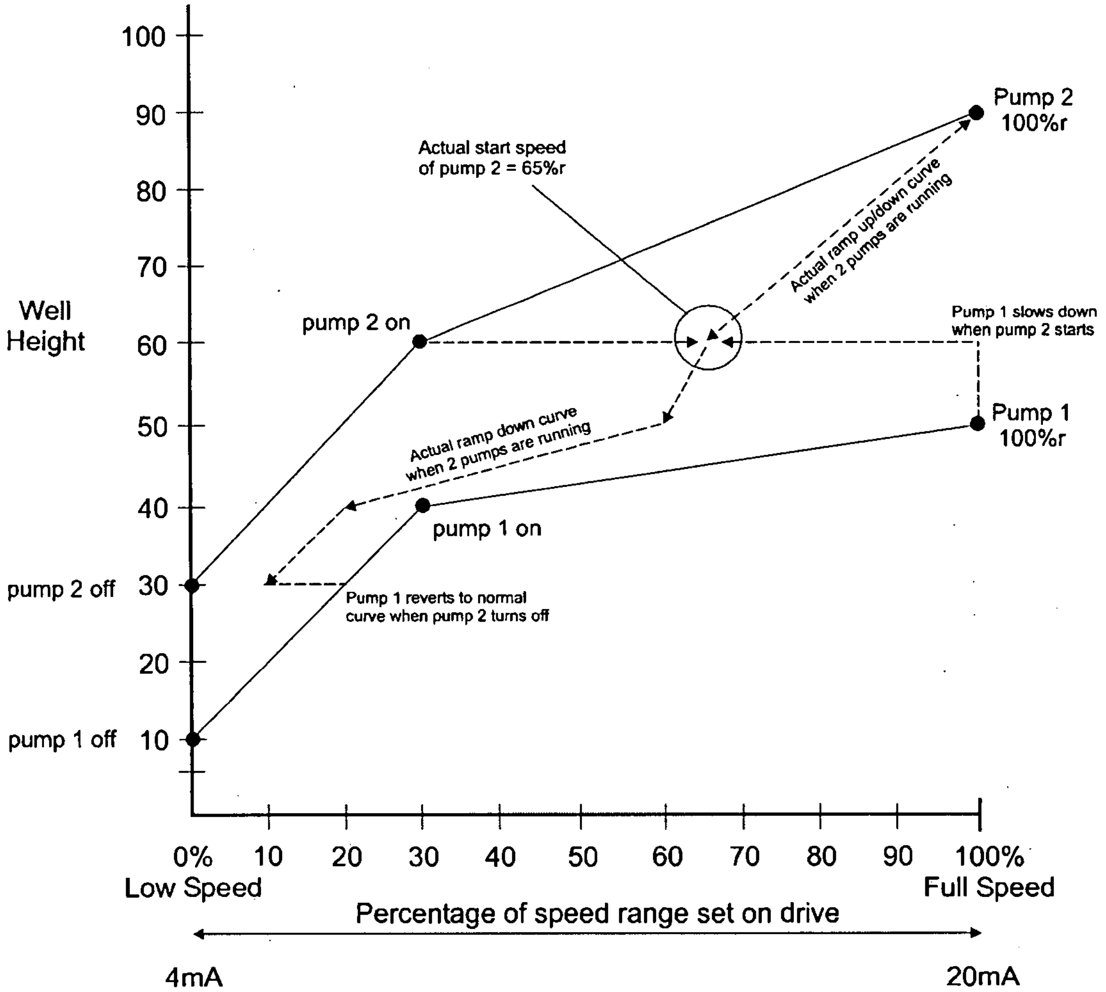



*Figure 22—Pump speeds relative to well height*

Figure 23 illustrates a typical sequence of events sequence of events during the filling and emptying of a well controlled by a MultiTrode VFD Pump Controller. The numbered steps in the explanation refer to the time events on the bottom of the graph.

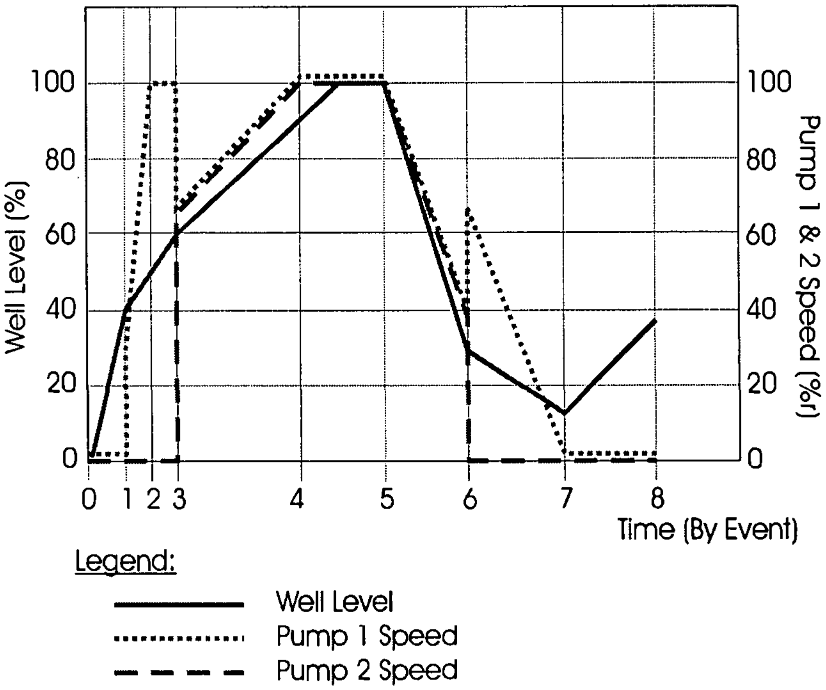



*Figure 23—VFD control sequence*

Time Event:

0. Well starts filling, no pumps running.
1. Well level reaches Pump 1 activation level (40%), pump 1 starts at the speed set by the VFD Start Speed key combo (30%r).
2. Pump 1 increases its speed in proportion to the well level, until it reaches 100% at it's 100% level, 50% of well.
3. The well level reaches the Pump 2 activation level (60%), at which point Pump 2 is started. Each pump runs at a speed that is the average of the last Pump 1 speed and the Pump 2 Start Speed (65%).
4. Both pumps increase their speed proportionally to the well level, until they reach 100%.
5. The inflow decreases, to the point where the pumps are able to cope with the flow, and the well level starts to drop.
6. The level reaches the pump 2 deactivation level (30%), so pump 2 stops. Pump 1 runs at its calculated speed for that well level.
7. Pump 1 continues to run until it reaches its deactivation level (10%), at which point it stops.
8. The well level continues to increase again.

## 10.2. VFD Setup Procedure

Three steps are needed to set up the VFD equaliser for operation:

1. Set the activation and deactivation levels for each pump.
2. Set the start speed for each pump.
3. Set the fluid level at which each pump will be at 100% speed (100%r).

Note: The symbol *%r* is used to denote a measurement as a percentage of range. For example 25%r means 25% of the preset range of pump speeds, where the range is from minimum pump speed to maximum pump speed. In a range from 1000 rpm to 1400 rpm, 25%r equates to1100 rpm.

Step 1 uses the procedure described in Chapter 5. Make sure the activation and deactivation levels have been set correctly for the installation before proceeding.

The next two sections describe steps 2 and 3.

### 10.2.1. Setting the VFD Start Speed for each pump

1. Press SELECT ONE and RESET TWO simultaneously.
2. Select one of these keys to select which start speed to adjust:

   SELECT ONE to adjust Duty (Lead) pump start speed
   SELECT TWO to adjust Standby (Lag) start speed
   DUTY SELECT (LEAD SELECT) to exit and return to normal operation.

   The setting is now displayed on the bar graph and pump 2 column as a value 0–100%. The pump 2 column shows the units and half units and the bar graph shows tens.

3. Raise or lower the start speed to the desired value.

   Use these keys to raise or lower the speed:

   SELECT ONE (▲) to raise the start speed in 0.5% steps
   RESET ONE (▼) to reduce the start speed in 0.5% steps
   SELECT TWO to raise the start speed in 10% steps
   RESET TWO to reduce the start speed in 10% steps.

4. Save the new setting by pressing ALARM RESET (SET).

   Or, press DUTY SELECT (LEAD SELECT) (EXIT) to discard the changes and return to normal operation.

### 10.2.2. Setting the 100%r Fluid Levels

The 100%r setting is the liquid level at which a pump will have reached the maximum speed in the VFD's speed range. For example, in Figure 23 above, the 100%r level for pump 1 is 62%, so that when the well liquid level reaches 62%, pump 1 should be running at full speed.

The equalizer overrides this value when pump 2 starts.

1. Press SELECT TWO and RESET ONE simultaneously.
2. Select one of the following three keys to select which 100%r level to adjust:

   SELECT ONE to adjust Duty (Lead) pump 100%r
   SELECT TWO to adjust Standby (Lag) 100%r
   DUTY SELECT (LEAD SELECT) to exit and return to normal operation.

The setting is now displayed on the bar graph and pump 2 column as a value in the range 0–100%. The pump 2 column shows the units and half units and the bar graph shows tens.

3. Raise or lower the 100%r level to the desired value.

   Use these keys to raise or lower the 100%r level:

   SELECT ONE (▲) to raise the level in 0.5% steps
   RESET ONE (▼) to reduce the level in 0.5% steps
   SELECT TWO to raise the level in 10% steps
   RESET TWO to reduce the level in 10% steps.

4. Save the new setting by pressing ALARM RESET (SET).

   Or, press DUTY SELECT (LEAD SELECT) (EXIT) to discard the changes and return to normal operation.

### 10.2.3. Effects on station flow and Compensation

The VFD Equalizer algorithm does not attempt to model station dynamics or flow as each of these quantities is determined by many hydraulic and non hydraulic factors specific and unique to every installation.

A compensation factor is provided to help overcome large steps in the flow rate due to hydraulic inefficiencies in the installation. These inefficiencies can be caused by constrictive discharge piping, dynamic friction and head losses. The minimum pump speed can also affect outflow by having a positive effect on the flow rate when a second pump starts.

The compensation factor (cf) may be positive, negative or unity (no effect). The control signal for a single running pump is not affected because compensation is designed to tune pump transitions.

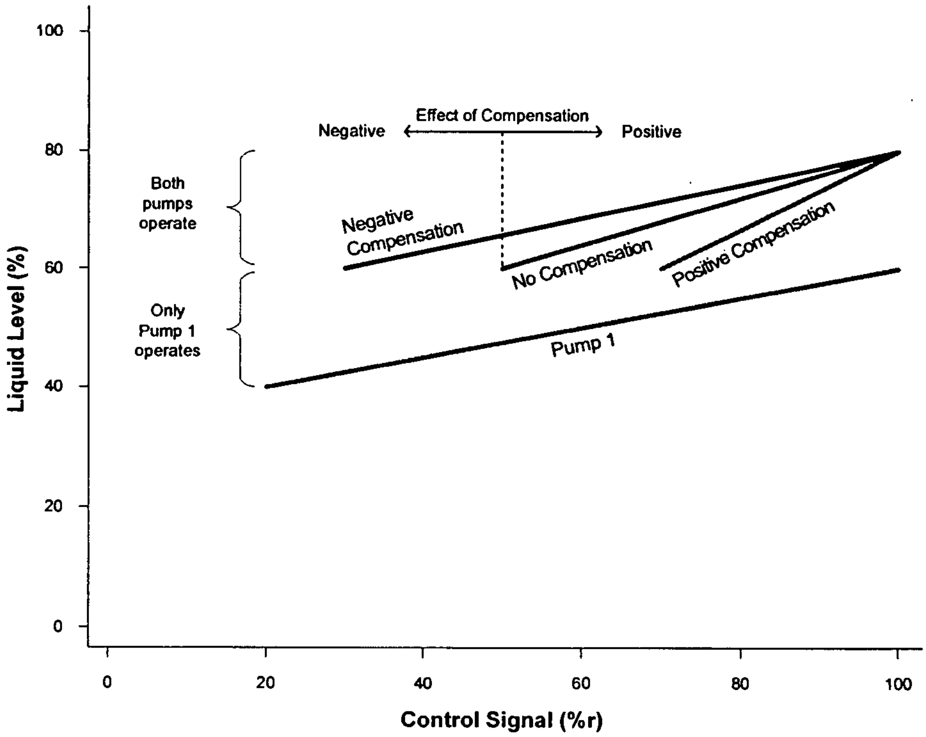



*Figure 24: The Effect of the Compensation Coefficient*

An example of the combined pump VFD output control signal is shown above in Figure 24. In this example the second pump starts when the liquid level reaches the 60% point and the combined control signal lowers to 50%r accordingly. As can be seen, if the compensation factor is positive, the control signal will be greater than 50% i.e. the two pumps will have to work harder to achieve the desired flow. Conversely, if the compensation factor is negative, the result is that the two pumps run at a slower speed than normal to negate the unwanted effects on flow.

The compensation coefficients are set in EDS 49 and 50, and can be set between –50 and +50 in steps of 0.5. The nunber relates to the compensation filter function and does not have a direct numerical equivalent in change of control signal or outflow. This allows for accurate fine-tuning during commissioning and re-tuning of the system during maintenance without changing the pump profiles.

### 10.2.4. Setting Compensation Factors

The VFD Equalizer has two compensation parameters for tuning the VFD system depending on how EDS 11—Group Configuration is set:

- If EDS 11 is Off, only EDS 49 is used.
- If Group One pumps are set to turn off when Group Two pumps turn on, then both EDSs 49 and 50 are used to set compensation. The compensator for Group One pumps is set with EDS 49 and that for Group Two pumps with EDS 50.

The value to enter into the EDS setting will 50 plus the compensation factor to use. (Because negative numbers cannot be represented on the bar graph.) To simplifiy this, the translation table below can be used when entering compensation factors.

| VFD Compensation Coefficient (cf) | Entered Value for EDS 49 or 50 |
|---|---|
| -50cf | 0 |
| -40cf | 10 |
| -30cf | 20 |
| -20cf | 30 |
| -10cf | 40 |
| 0cf | 50 (default) |
| 10cf | 60 |
| 20cf | 70 |
| 30cf | 80 |
| 40cf | 90 |
| 50cf | 100 |

*Table 5 – How to enter VFD Compensation Coefficients*

# Chapter 11 Resetting and Upgrading the Controller

## 11.1. Resetting Controller Defaults

You can return the MultiTrode Pump Controller's settings to their default state by performing either a full or partial reset.

- A **full default reset** returns all EDSs, Levels, Delays, Sensitivities and Alternation information to their default values.
- A **partial defaults reset** only resets the levels and delays.

The default values for all EDS's and other settings are shown in Appendix A.

To perform a full or partial defaults reset:

1. From the default display, reset the unit by pressing RESET ONE, RESET TWO and ALARM RESET simultaneously.
2. During the lamp test press RESET ONE.
3. While the toggle light is flashing,
   - press RESET TWO to perform a **partial** reset, or
   - press SELECT TWO to perform a **full** reset.
4. The controller will confirm the factory defaults reset by performing another reset, indicated by a lamp test. **If the controller does not perform the lamp test, this procedure did not occur correctly. The procedure should be repeated.**

**CAUTION: RESETTING A UNIT WILL STOP ALL RUNNING PUMPS WITHOUT INTERPUMP DELAYS, RESET ALL FAULTS AND ALARMS AND CLEAR ALL PENDING CONDITIONS.**

The tables in Appendix A show the default settings for all controllers in a multi-controller network.

## 11.2. Restarting the Controller

To restart the controller, press SELECT ONE, SELECT TWO and DUTY SELECT (LEAD SELECT) simultaneously. This is equivalent to cycling the power and is necessary when entering the MultiTrode Firmware Upgrade utility.

**CAUTION: A RESTART WILL STOP ALL PUMPS WITHOUT INTERPUMP DELAYS AND RESET ALL FAULTS AND ALARMS.**

## 11.3. Controller Software Version

To determine the current software version of the controller, press ALARM RESET and DUTY SELECT (LEAD SELECT) simultaneously.

The major version number will be displayed on the screen on the bar graph, the minor numbers on the PUMP 1 and PUMP 2 columns. For example, Version 7.2.3 would be shown as the bottom seven segments of the bar graph lit, the bottom two segments of the PUMP 1 column lit and the bottom three segments of the PUMP 2 column lit.

## 11.4. Controller Serial Number

Each Version 7 controller has an individual serial number to uniquely identify the unit.

To read the serial number from the unit:

1. Press ALARM RESET and DUTY SELECT (LEAD SELECT) simultaneously.

   The version number should now be displayed as described in section 11.3.

2. Press ALARM RESET and DUTY SELECT (LEAD SELECT) simultaneously **again** to view the serial number.

3. Now read the serial number:

   The bar graph shows the value. The PUMP 1 column indicates which digit is being displayed. The display moves to the next digit every two seconds.

   For example: The Pump One SEAL FAILURE light turns on to indicate the first digit is being displayed. sensor 1 on the bar graph (read from the top) is lit on the bar to indicate that the first digit is a 1. The display then moves to the MOTOR OVERTEMP light to indicate the second digit is being displayed on the bar graph. This might be, say, sensor 3 to indicate that the second digit is a 3.

   There are eight digits in total. The first three or four digits will normally be zeros.

4. The controller continues displaying the serial number until you press DUTY SELECT (LEAD SELECT) (EXIT).

## 11.5. Upgrading Firmware

To upgrade firmware, connect a PC or laptop, running MultiTrode's MTCDS software suit, to the rear of the installed MT2PC using the MultiTrode upgrade lead. See the MTCDS manual for more details.

**CAUTION: ONLY MULTITRODE APPROVED CABLES ARE TO BE USED FOR CONNECTING TO THE COMMUNICATIONS PORT. HARDWARE DAMAGE MAY OCCUR IF OTHER CABLES ARE USED.**

# Chapter 12 Installing and Wiring the MT2PC

## 12.1. Installation Instructions

The following sections describe the two methods of mounting the MT2PC.

### 12.1.1. Method 1—DIN Rail (Preferred)

This is the preferred method of mounting. The controller is mounted on the gear plate using the DIN rail clips and the keypad is screwed to the inner door of the switchboard. The keypad is then plugged into the keypad port on the controller.

**CAUTION: UNDER NO CIRCUMSTANCES SHOULD TWO KEYPAD FRONT PANELS BE CONNECTED TO A SINGLE CONTROLLER.**

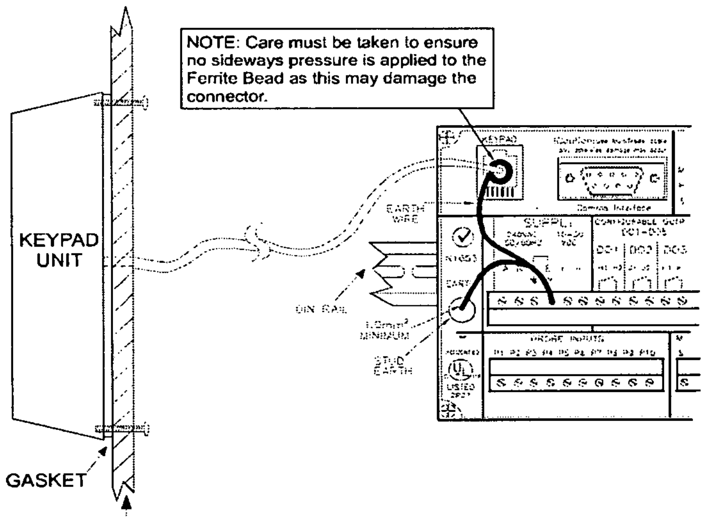



*Figure 25: Standard Installation of MT2PC*

**CAUTION: THE SHIELDED CABLE MUST BE CONNECTED TO THE EARTH TERMINAL AS SHOWN IN FIGURE 25 TO ENSURE COMPLIANCE WITH EMC. THE EARTH STUD MUST ALSO BE CONNECTED TO THE EARTH TERMINAL TO MEET EMC REQUIREMENTS.**

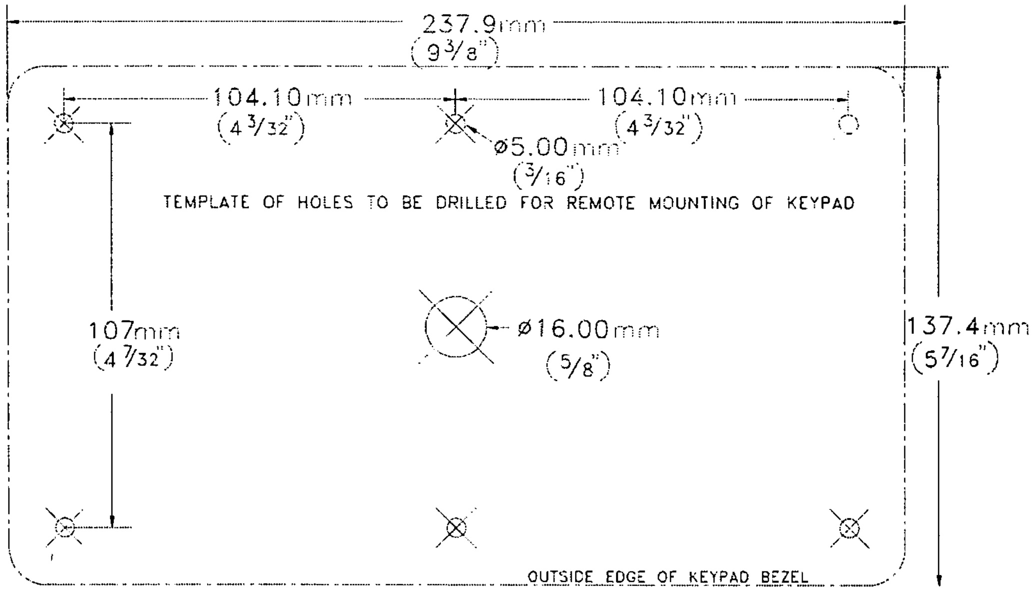



*Figure 26: Mounting template for Keypad (for reference only; not actual size)*

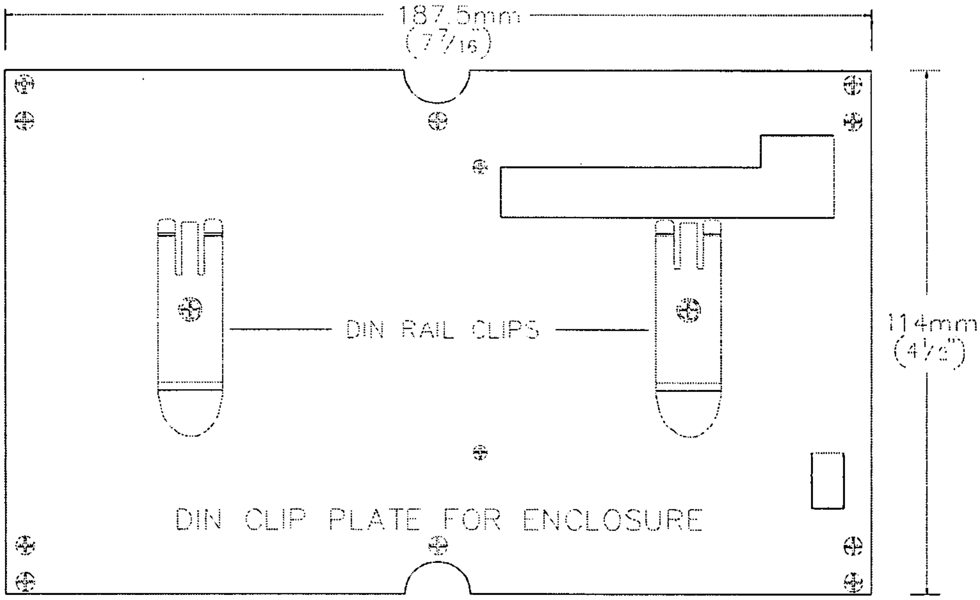



*Figure 27: Mounting template for controller showing DIN mounting clips (for reference only; not actual size)*

### 12.1.2. Method 2—Panel Mount

The MT2PC can be panel mounted as a complete unit on an inner door, as shown in the diagrams following.

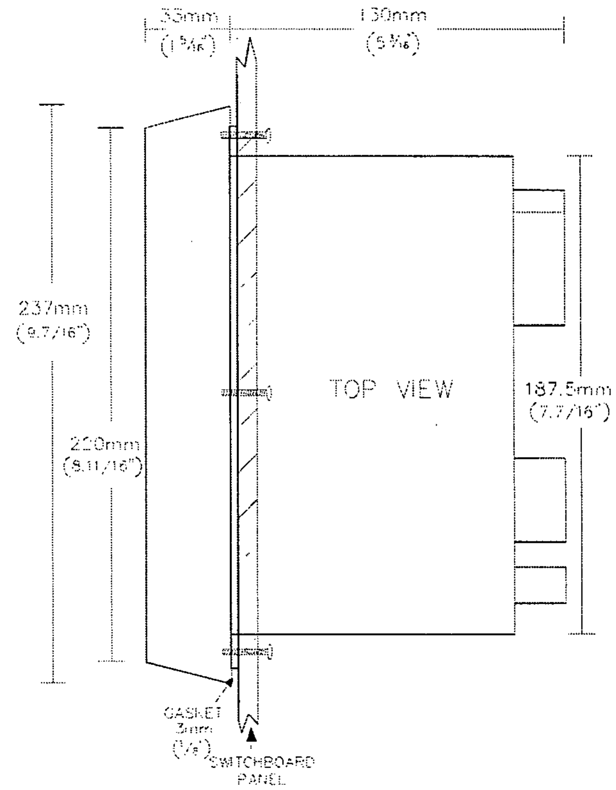



*Figure 28: Top View of a Panel Mounted MT2PC*

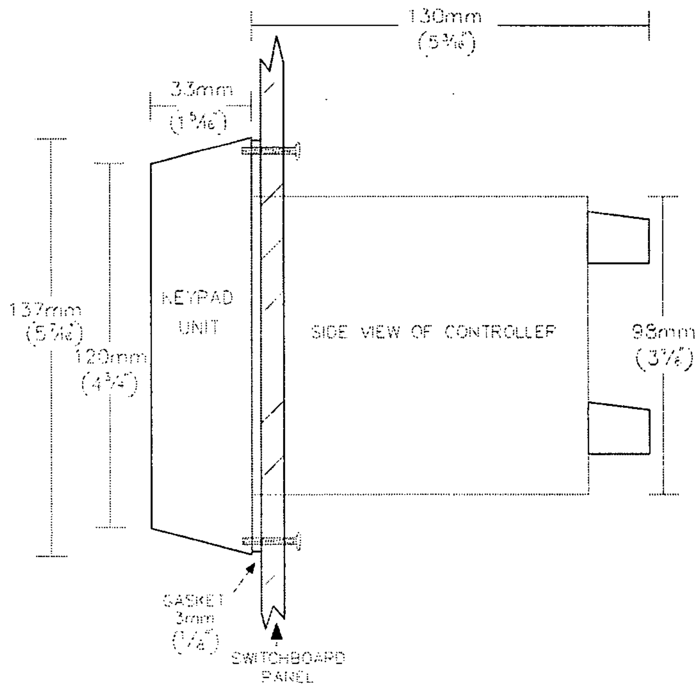



*Figure 29: Side View of a Panel Mounted MT2PC*

If this method of installation is used, connect the short cable (optionally supplied in the MTxPC Panel Mounting Kit) between the keypad and the controller as shown below, then screw the two sections together with the screws supplied in the Panel Mounting Kit. Ensure that the keypad cable is placed in the recess at the back of the keypad unit and not pinched as the controller is screwed on to the keypad.

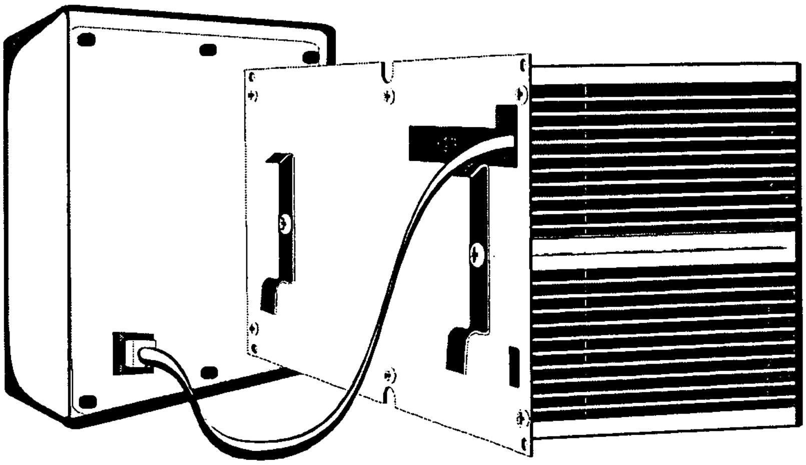


*Figure 30: Connecting the short keypad cable between the keypad and controller.*

## 12.2. Wiring Instructions

The following sections provide a detailed description of how to wire the MT2PC.

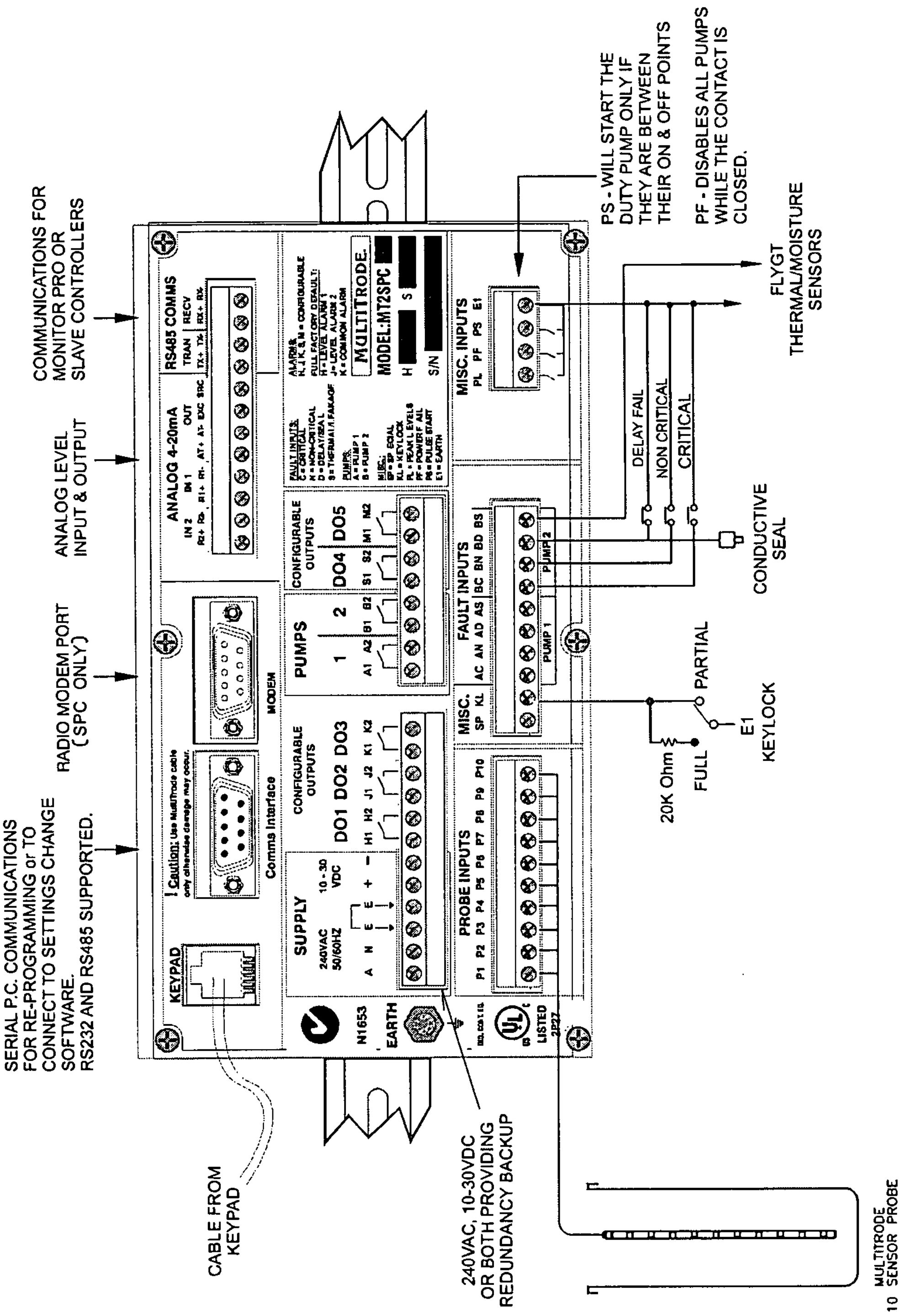



*Figure 31: Back Panel Wiring Connections.*

### 12.2.1. Supply Voltage

The power supply for the MT2PC can be a mains supply (240 V or 110 V) at 50 / 60 Hz, and/or a DC supply between 10 and 30 V simultaneously. Both supplies can be connected at the same time for redundancy.

A suitably rated circuit breaker (20VA, delay acting) should be installed in series with the Active Line, and the equipment should be suitably isolated with an isolation switch, as there is no power switch on the unit.

All installations, including DC powered installations, require the Power Earth to be connected to a secure earth, both for safety and for the correct operation of conductive probes.

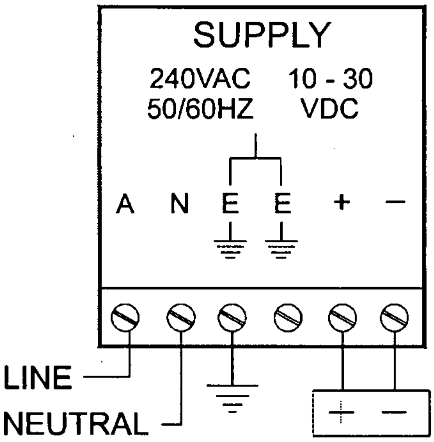



*Figure 32: Power Supply Wiring.*

***WARNING: FAILURE TO CONNECT THE EQUIPMENT TO A SUITABLE EARTH COULD LEAD TO INCORRECT OPERATION, EQUIPMENT DAMAGE, INJURY OR DEATH.***

### 12.2.2. Level Devices

There are many types of level sensing devices compatible with the MT2PC. The most common types are listed below.

#### *12.2.2.1. 10 Sensor Probe*

Wire each cable of the multi-sensor probe into its corresponding probe input terminal. Each wire from the probe is numbered from 1 to 10. Number 1 connects to input P1. Number 10 connects to P10. When the probe is suspended from its cable, number 1 is the top sensor and number 10 is the bottom.

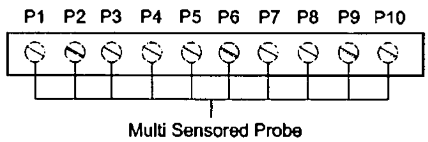



*Figure 33: Probe Inputs*

#### *12.2.2.2. Single Sensor Probes*

Connect the single sensor probes to the appropriate probe terminals on the MT2PC.

When used with single sensor probes, you must configure the MT2PC to operate in Single Sensor Mode with **EDS** 7. A probe sensor must be connected to each level input where an activation or deactivation point has been set..

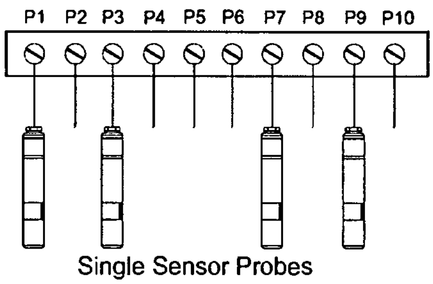



*Figure 34: Probe Inputs.*

### *12.2.2.3. Ball Floats*

Wire each ball float into the desired input terminal on the rear of the MT2PC.

When ball floats are in use, the MT2PC must be set to operate in Single Sensor Mode with EDS 7. A ball float must be connected to each level input which has an activation or deactivation level assigned to it. The ball float N/O contacts should close between the "E" terminal and the corresponding "P" terminal when the float is in its "wet" state.

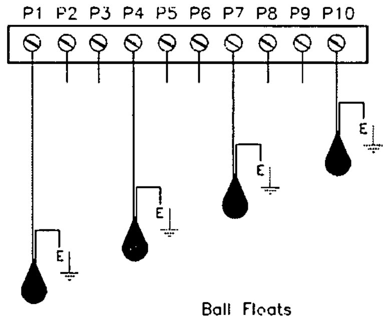



*Figure 35: Ball Float Inputs*

### *12.2.2.4. Analog Input*

Use the following configurations if analog devices are used.

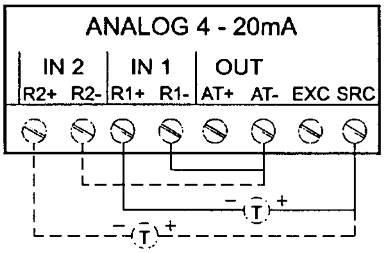



*Figure 36: MT2PC Excitation—Two Wire.*

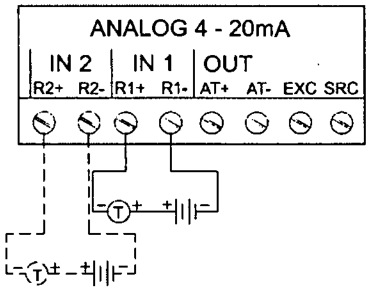



*Figure 37: External Excitation—Two Wire.*

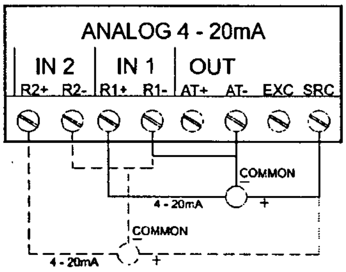



*Figure 38: MT2PC Excitation—Three Wire.*

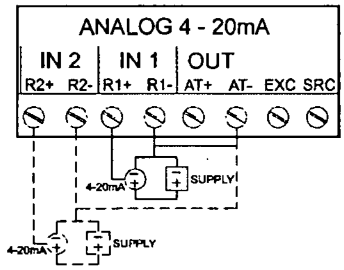



*Figure 39: External Excitation—Three Wire.*

**Notes:**

1. Analog input impedance = 75Ω.

2. If the analog input is to be wired as in Figure 37, it is preferable to earth the negative leg of the loop supply. Check the manuals of your transducer and power supply to determine if this will be acceptable.

3. For instruments using external excitation voltage, where the external source **is** tied to the controller ground (AT-), the excitation voltage of the device can be greater than 13.75VDC (e.g. 24VDC powered devices). If the external source **is not** tied to the controller ground (AT-), the positive analog input terminals (R1+, R2+) should not exceed 13.75V. In other words, the analog input common mode range is 0-13.75V referenced to ground, and the differential mode range is 1.5V (20mA x 75Ω).

### 12.2.3. Outputs

This section describes the wiring for the Pump Controller outputs.

#### *12.2.3.1. Pump Relays*

Connect the Active (Line) to A1 and B1. Wire the pump contactor coils or start relays to outputs A2 and B2. Relays are rated at 250 V, 5 amp resistive or 2 amp inductive.

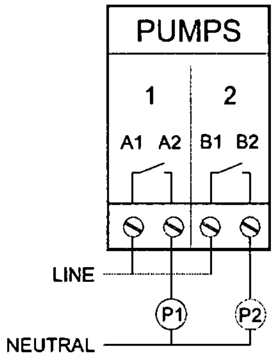



*Figure 40: Relay Contact.*

IMPORTANT: **CONTACT SPIKE SUPPRESSORS**

**EACH RELAY HAS AN RC SUPPRESSOR FITTED. ENSURE THE ACTIVE (LINE) / LOAD CONNECTIONS ARE AS FOLLOWS:**

**CONNECT ACTIVE TO A1, B1, H1, J1, K1, S1 AND M1.**

**CONNECT LOAD TO A2, B2, H2, J2, K2, S2 AND M2.**

**MULTITRODE RECOMMENDS USING SLAVE RELAYS WHEN CONNECTING A VARIABLE FREQUENCY DRIVE TO THESE OUTPUTS. THIS IS TO STOP ANY LEAKAGE CURRENT TURNING ON THE MOTORS.**

**REVERSAL OF THE CONTACT CONNECTIONS WILL RENDER THE CONTACT SPIKE SUPPRESSORS INEFFECTIVE.**

Note: If switching contactors via slave relays directly connected to the controller, the internal RCs will not be effective against spikes generated by these contactors. RCs are available from your local MultiTrode distributor or electrical wholesaler.

#### *12.2.3.2. Configurable Digital Outputs*

A digital output is activated when its selected source condition is met (see section 8.7 for more information on how to configure a digital (relay) output.

**Note:** See 12.2.3.1—Pump Relays for important information concerning spike suppressors present on these outputs.

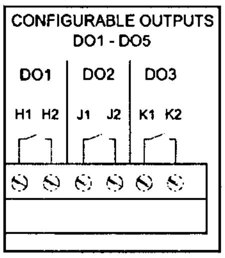



*Figure 41: Configurable Relay Connections.*

#### *12.2.3.3. Analog Output*

A 4–20 mA signal, representing the level being measured, is output at terminals AT+ and AT–.

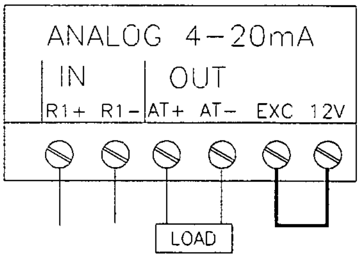



*Figure 42: Internal Excitation for Analog Output*

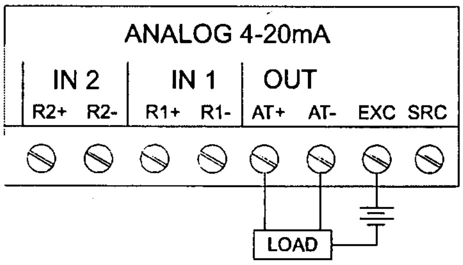



*Figure 43: External Excitation for Analog Output*

**Note**: The load resistance must not exceed 500Ω

### 12.2.4. Inputs

#### *12.2.4.1. Critical, Non-Critical and Delay Fault Inputs*

Wire the pump fault inputs as follows:

AC, BC. Critical faults

AN, BN. Non-critical faults

AD, BD. Delay faults and conductive seals

A closed dry contact making a circuit between the fault-input terminal and the E1 terminal activates that fault.

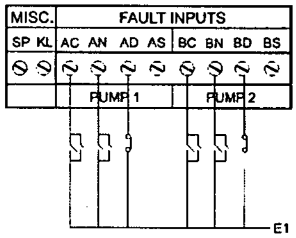



*Figure 44: Fault Connections.*

You can configure the fault inputs to accept open or closed contacts for fault detection (see section 8.4).

#### *12.2.4.2. Flygt FLS*

When using the Flygt FLS sensors connect as shown in the diagram. You can configure the seal fault and thermal fault to lock out the pump if required independently.

After wiring in the sensor, set EDS 27 to 4—Flygt Seal and Thermal so that the controller will operate correctly.

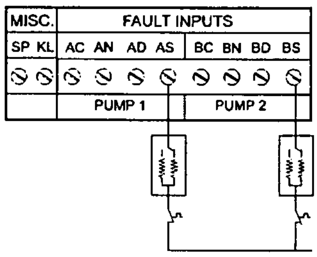



*Figure 45: Flygt /Thermistor Connections.*

#### *12.2.4.3. Thermistor*

Wire a PTC Thermistor into the AS and BS fault inputs. The condition of the fault is as follows:

3.3kΩ–O/C: Fault

1.8kΩ–2.5kΩ: Manually reset.

0–1.8k: Automatic reset.

After wiring, set EDS 27, 28 and 29 to the correct values for your installation.

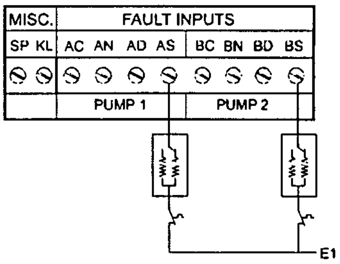



*Figure 46: Thermistor Connections.*

#### *12.2.4.4. Seal Failure Detection*

Conductive seal sensors and relays are wired into the delay fail inputs (AD or BD).

After wiring, set EDS 27, 30 and 31 to the correct values for your installation.

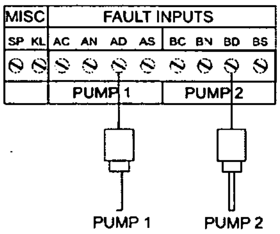
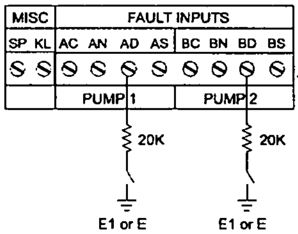



*Figure 47: Inputs for conductive seal sensors*




Insert a 20KΩ±20% resistor when External Seal Fail Relay is used

*Figure 48: External Seal Fail Relay*

#### *12.2.4.5. "MiniCas" Relay*

Minicas Relays have clean contact outputs, and so should just be wired into the Critical or non-Critical fault inputs, as shown in section 12.2.4.1.

#### *12.2.4.6. Bi-Metal Strip*

When using Bi-Metal Strips as a thermal overload device, connect to the Critical Fault inputs as shown in the diagram.

Then program EDS 24—Critical Fault Inputs NO/NC to On = Normally Closed. (i.e. open on fault.)

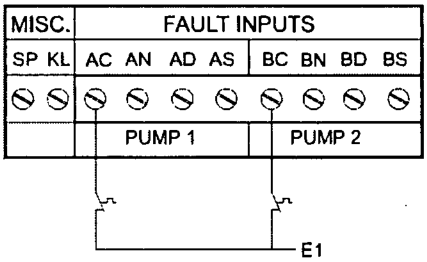



*Figure 49: Bi-Metal Strip Connections.*

#### *12.2.4.7. Multiple Fault devices per motor*

If a motor has both Flygt FLS outputs and Thermistor outputs, connect the FLS outputs as shown above in section 12.2.4.2, then use a separate thermistor relay to drive the thermistor, and connect the clean contact outputs between E1 and the critical fault input.

### 12.2.4.8. PF—Power Fail Input

To monitor the state of mains power when using a DC supply, wire a dry contact from an external relay from terminal PF to E1, e.g. Phase fail or phase rotation relay. This feature ensures that pumps start up in the correct sequence and with the correct delays when mains power returns. This input is also used as a hold out input to hold out pumps during peak electricity periods.

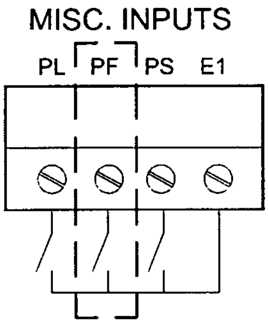



*Figure 50: Power Fail Wiring*

### 12.2.4.9. PS—Pulse Start

Closing a contact across PS and E1 activates a number of pumps. The number of pumps that will be started when this input is activated will determined by EDS 10. The pumps will keep running until their respective Deactivation levels are reached.

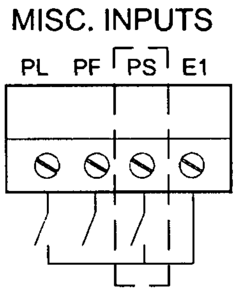



*Figure 51: Pulse Start Wiring.*

### 12.2.4.10. PL—Peak Levels

When the PL contact is closed, the MT2PC will use the controller's Peak Levels, otherwise it will use its Normal Levels.

If any of the Peak Level sources are active (refer to section 8.1.1), the controller will operate in Peak Levels Mode.

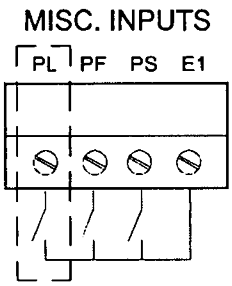



*Figure 52: Peak Levels Wiring*

### *12.2.4.11. KL—Keylock*

There are three levels of key lockout security available.

**No Lock.** When the KL terminal is open circuit there is No Lock. All settings can be accessed via the front panel.

**Partial.** Connect the terminal directly to ground. This disables any programming button operations, but enables normal operation such as fault reset and mode selection.

**Full.** Connect KL to ground through a 20kΩ resistor. This locks out all buttons on the controller (The nearest standard resistor values of 18kΩ or 22 kΩ are acceptable).

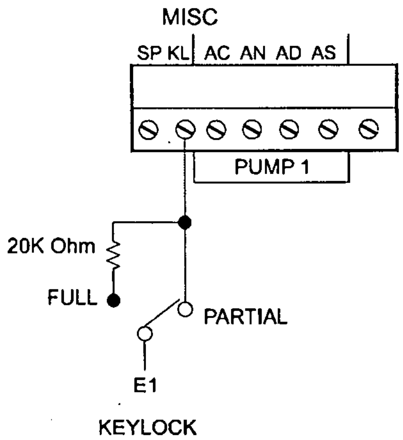



*Figure 53: Keypad Lockout Wiring*

### 12.2.5. Remote Keypad

A shielded cable is supplied to connect the controller to the display via the keypad sockets.

> Note: the earth wire from the shielded cable must be connected to the earth terminal

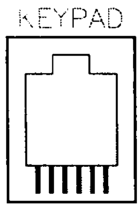



*Figure 54: Keypad Socket*

**CAUTION: CARE MUST BE TAKEN TO ENSURE SIDEWAYS PRESSURE IS NOT APPLIED TO THE CABLE OTHERWISE DAMAGE MAY OCCUR.**

**UNDER NO CIRCUMSTANCES SHOULD TWO KEYPAD FRONT PANELS BE CONNECTED TO A SINGLE CONTROLLER.**

### 12.2.6. Wiring the Well washer

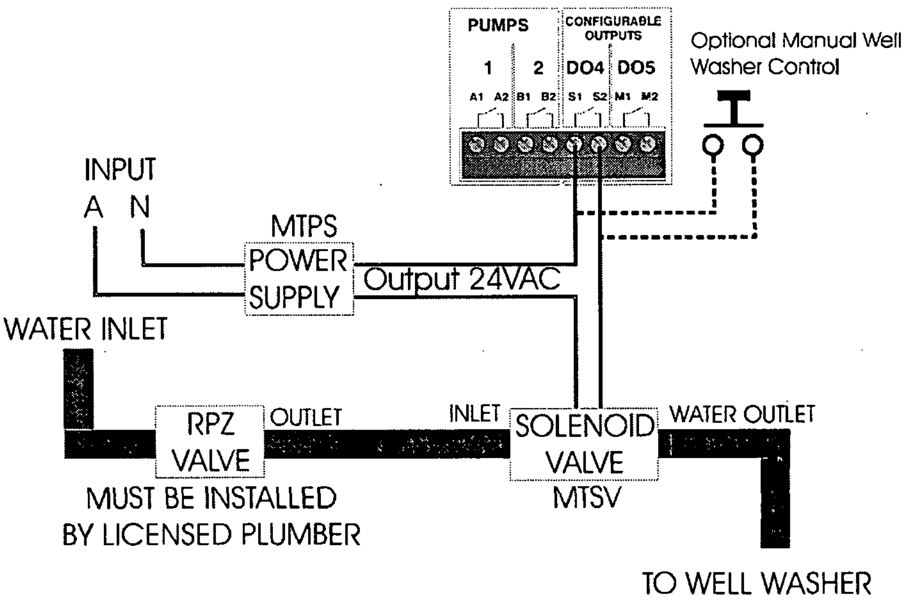



*Figure 55: Wiring diagram for the well washer*

## 12.3. Wiring the MT2PC to Other Units

### 12.3.1. Connecting the MT2PC to a MonitorPro

Follow the diagram below when connecting units together using the RS485 LAN.

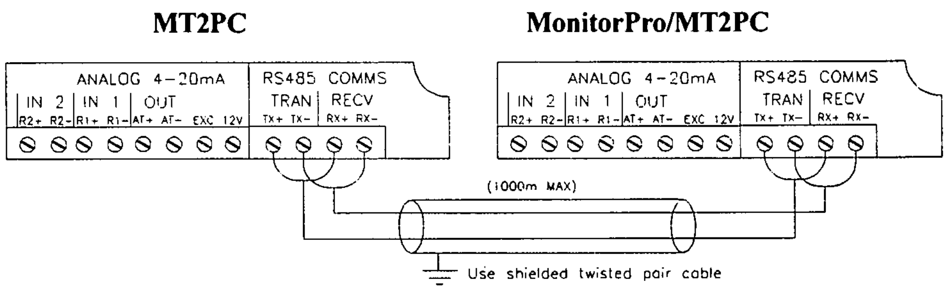



*Figure 56: MonitorPro Wiring Connections with the MT2PC*

#### *12.3.1.1. Communications Interface*

The female DB9 connection is a proprietary RS232/RS485 connection for use with the MTCDS Control and Diagnostics Software, and approved Digital Radios.

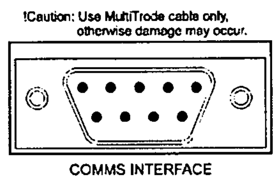



*Figure 57: Communication DB9 Plug*

**CAUTION: ONLY MULTITRODE APPROVED CABLES ARE TO BE USED FOR CONNECTING TO THE COMMUNICATIONS PORT. HARDWARE DAMAGE MAY OCCUR IF OTHER CABLES ARE USED.**

### 12.3.2. Connecting the MT2SPC to an Analog Radio for SCADA communications (SPC Version Only).

The Modem port is used to connect the MT2SPC to a MultiTrode approved analog radio.

The following table is the pinout of the DB9 modem port. All wiring to the radio should be confirmed with the radio manufacturer.

| Pin Number | Function |
|---|---|
| 1 | Transmit—Audio out |
| 2 | Ground |
| 3 | Push to Talk—TX Enable |
| 4 | Receive—Audio in |
| 5 | Not Connected |
| 6 | Not Connected |
| 7 | Not Connected |
| 8 | Not Connected |
| 9 | Not Connected |

*Table 6 — Wiring Connections for the Radio Modem*

### 12.3.3. Connecting the MT2PC to an Indicator Controller (MTIC)

The MT2PC can be connected to a MultiTrode Indicator Controller (MTIC) by wiring the unit as shown in the following diagram.

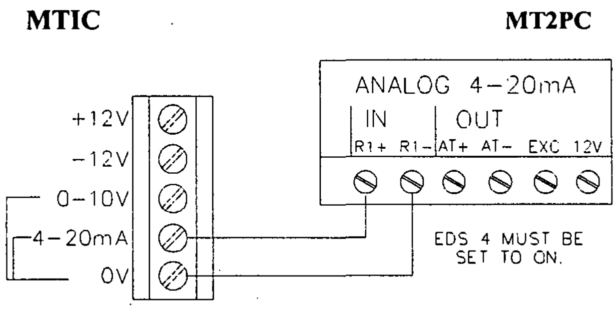



*Figure 58: MT2PC connected to a MTIC*

**Note:** Under no circumstances should R1– be connected to AT–.

## 12.4. Wiring Diagram

### 12.4.1. Non-VFD Versions

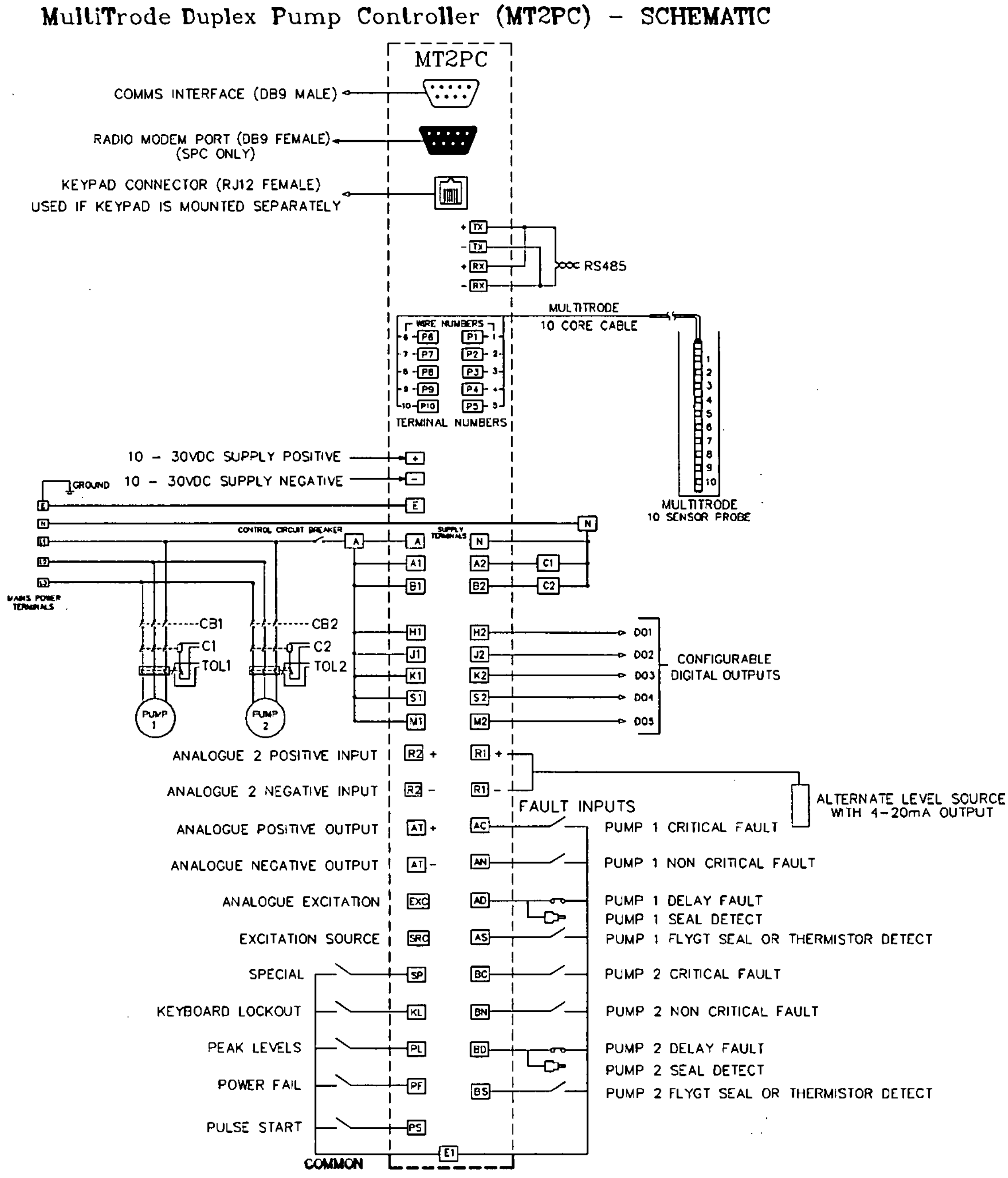



*Figure 59: Non-VFD Schematic Diagram*

### 12.4.2. VFD Versions

MultiTrode Duplex Pump Controller (MT2PCVFD) – SCHEMATIC

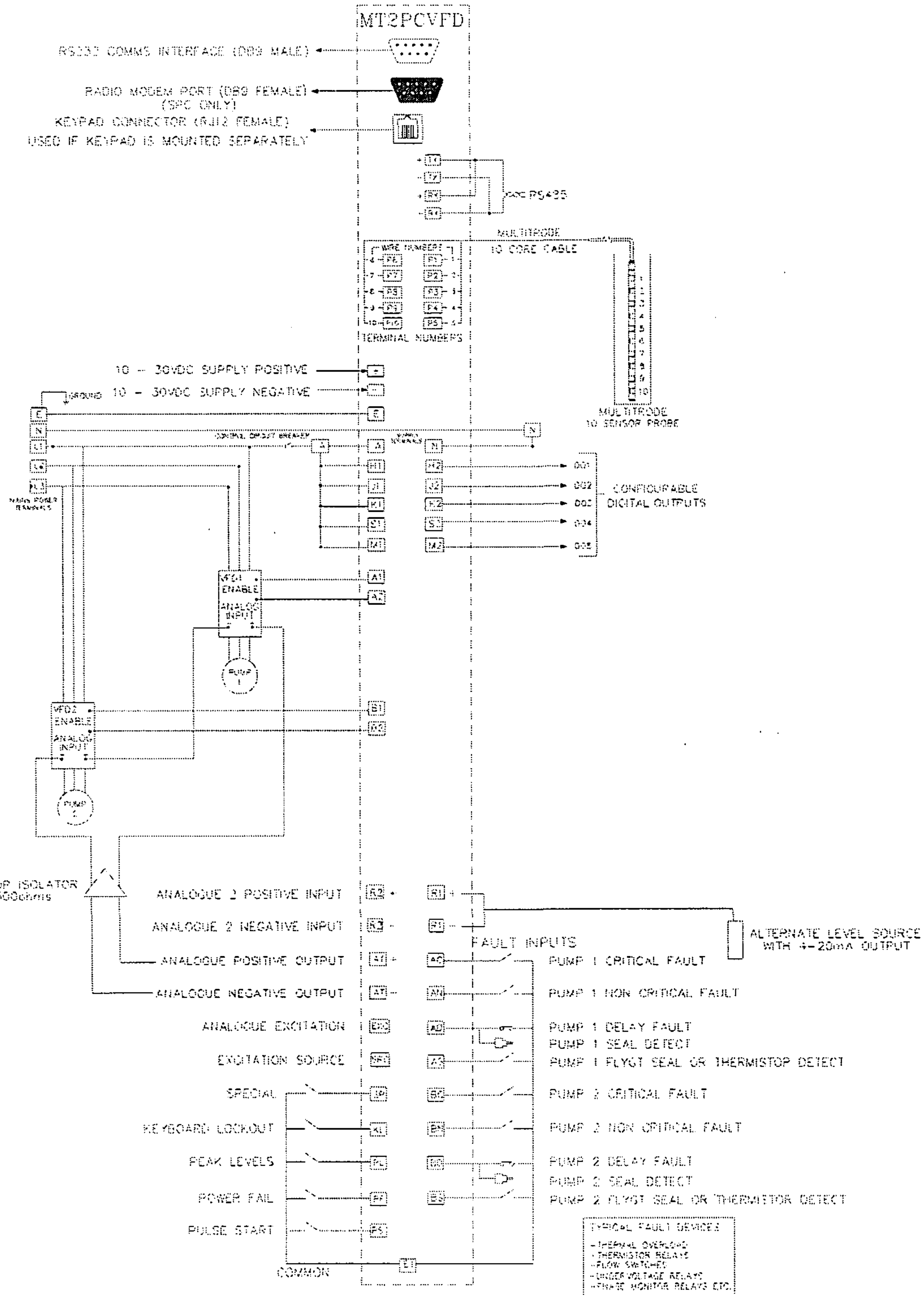



*Figure 60: VFD Schematic Diagram*

# Index

# Appendix A. Settings Quick Reference

## A.1. EDS Quick Reference

| EDS | Switch Function | Default Setting | Range | Your Setting |
|---|---|---|---|---|
| | **LEVEL EDSs** (See section 8.2 for more information) | | | |
| 1 | Charge (ON) / Discharge Mode (OFF) | Off = Discharge | On/Off | |
| 2 | Level Alarm Reset Mode (Off= Alarm condition resets automatically when alarm condition not present, On=manual reset required) | Off = Auto Reset | On/Off | |
| 3 | Level Alarm Flash (Off=steady, On=flash) | Off = Steady | On/Off | |
| 4 | Level Alarm Mute Time<br>(Enables muting of alarm by pushing Alarm Reset button) | 10 mins | 0.25s – 120m | |
| 5 | Level Sensing Device<br>Off = probe,<br>1 = analog input,<br>2 = analog input with probe backup<br>4 = dual analog input<br>7 = remote level device (via SCADA) | Off = Probe | Off – 10 | |
| 6 | Level Sensor Timeout (before backup level sensor operates) | 10 mins | 0.25s – 120m | |
| 7 | Probe Single sensor/ Multi-sensor Input<br>(not important if 4–20mA used as level device) | Off = Multi-sensor Probe | On/Off | |
| 8 | Use Normal Levels (Off) or Peak Levels (On) | Off = Use Normal Levels | On/Off | |
| | **PUMP EDSs** (See Section 8.3 for more information) | | | |
| 9 | Duty (Lead) Select Key Operation<br>Off = no changes can be made<br>1 = Lead (Duty) select key cycles through alternation modes (Quickset Operation)<br>2 = customizable Fullset operation) - see MultiTrode web-site | 1 = Quickset Operation | Off – 2 | |
| 10 | Pulse Start Number of pumps<br>(when PS input closes or SCADA signal received) | 1 = 1 pump | Off – 9 | |
| 11 | Group Configuration | Off = All Groups can run | Off – 5 | |
| 12 | Interpump Start Delay | 10 seconds | 0.25s – 120m | |
| 13 | Interpump Stop Delay | 0.25 seconds | 0.25s – 120m | |
| 14 | Random Duty (Lead) Start Delay<br>(for minimizing fat build-up at the pump setpoint) | 0.25 seconds | 0.25s – 120m | |
| 15 | Maximum Pumps to Run at One Time | Off = No Limit | Off – 9 | |
| 16 | Consecutive Assist (Lag) Starts Before Duty (Lead) Lockout (blocked pump detection) | Off = No Limit | Off – 10 starts | |
| 17 | Desired Station Starts per Hour (adaptive level control) | Off = No Limit | Off – 60 | |
| 18 | Override Level for Control Functions<br>(Limits adaptive values in EDSs 11, 16, 17, 19 – 21) | Discharge mode = 90%<br>Charge Mode = 10% | 0 – 100% | |
| 19 | Maximum Starts per Hour Pump 1 | Off = No Limit | Off – 60 | |

| EDS | Switch Function | Default Setting | Range | Your Setting |
|---|---|---|---|---|
| 20 | Maximum Starts per Hour Pump 2 | Off = No Limit | Off – 60 | |
| 21 | Maximum Starts per Hour Pump 3 (MT3PC Only) | Off = No Limit | Off – 60 | |
| 22 | Maximum Run Time hrs for Any Pumps (Inefficient pump detection) | Off = No Limit | Off – 10hrs | |
| 23 | Maximum Off Time hrs for Any Pumps (Odor reduction function) | Off = No Limit | Off – 10hrs | |
| | **FAULT EDSs** (See Section 8.4 for more information) | | | |
| 24 | Critical Fault Inputs NO /NC | Off = Normally Open | On/Off | |
| 25 | Non Critical Fault Inputs NO/NC | Off = Normally Open | On/Off | |
| 26 | Delay Fail Inputs NO/NC | Off = Normally Open | On/Off | |
| 27 | Thermal and Seal Fault Sources<br>Off = No seal or thermal protection<br>1 = Conductive Seal (default)<br>2 = PTC Thermistor<br>3 = Conductive Seal and PTC Thermistor<br>4 = Flygt Seal and Thermal<br>5 = Conductive Seal with Delay Fail Disabled<br>6 = Conductive Seal and PTC Thermistor, with Delay Fail Disabled | 1 = Conductive Seal | Off – 6 | |
| 28 | Seal/Thermal Fault Buffer Time | 0.25 seconds | 0.25s – 120m | |
| 29 | Thermal Fault Display (0 = Off, 1 = Non Critical, 2 = Critical) | Off = Display Only | Off – 2 | |
| 30 | Seal Fault Display (0 = Off, 1 = Non Critical, 2 = Critical) | Off = Display Only | Off – 2 | |
| 31 | Seal Sensitivity | 40K Ohms | 1K – 120K | |
| 32 | Delay Fault Trip Time | 10 seconds | 0.25s – 120m | |
| 33 | Delay Fault Recovery Time | 1 minute | 0.25s – 120m | |
| 34 | Consecutive Delay Faults Before Lockout | Off = No Limit | Off – 10 | |
| 35 | Decommission Pump 1 | Off = Pump 1 Present | On/Off | |
| 36 | Decommission Pump 2 | Off = Pump 2 Present | On/Off | |
| 37 | Decommission Pump 3 (MT3PC Only) | Off = Pump 3 Present | On/Off | |
| | **LAN EDSs** (See Section 8.6 for more information) | | | |
| 38 | LAN Mode (0 = Multi-Pump Mode, 1 = Mimic Mode, 2 = Multi Well Mode) | Off = Multi-Mode | Off – 2 | |
| 39 | Master / Slave Mode (Off = Master, On = Slave) | Off = Master Mode | On/Off | |
| 40 | Slave 1 / Slave 2 Mode (Off = Slave1, On = Slave2) | Off = Slave 1 | On/Off | |
| 41 | Number MT2/3PCs in a Group | 1 | 1 – 3 | |
| 42 | Group ID (RS485 comms) | 1 | 1 – 9 | |
| 43 | Maximum Groups in LAN | 1 | 1 – 9 | |
| 44 | Communications with MultiTrode network<br>Off = no LAN, set while CDS software is used<br>1 = comms with MonitorPro<br>2 = comms with MonitorPro but lockout pumps if comms fail<br>3 (SPC only) = comms with SCADA enabled but LAN disabled<br>4 (SPC only) = comms with LAN and SCADA enabled | 1 = Comms. Enabled (MTxPC)<br>4 = MTxSPC comms enabled (MTxSPC) | Off – 4 | |
| 45 | LAN Communications Mode (Off=normal, On= aux. Telemetry device) | Off = Normal LAN Comms | On/Off | |
| 46 | Analog/Comms. Level % Change before logging | 10% | 1–20% | |

| EDS | Switch Function | Default Setting | Range | Your Setting |
|---|---|---|---|---|
| | **ANALOG OUTPUT EDSs** (See Chapter 10 for more information) | | | |
| 47 | Analog Output Mode<br>Off = Analog Output Disabled<br>1 = Analog Output is Linear Level<br>2 = Analog Output is Inverted Linear Level<br>3 = Analog Output is VFD Output<br>4 = Analog Output is Inverted VFD Output<br>5 = Analog Output is set by CMF via comms | Linear | Off – 5 | |
| 48 | Analog Output Ramp Time | 0.25 seconds | 0.25s – 120m | |
| 49 | VFD Equaliser Group One Compensation Coefficient | 50% | 0–100% | |
| 50 | VFD Equaliser Group Two Compensation Coefficient | 50% | 0–100% | |
| | **DIGITAL OUTPUT EDSs** (See Section 8.7 for source types) | | | |
| 51 | Digital (Relay) Output 1 Source | 1 = Alarm 1 | 0–59 | |
| 52 | Digital (Relay) Output 2 Source | 2 = Alarm 2 | 0–59 | |
| 53 | Digital (Relay) Output 3 Source | 3 = Common Alarm | 0–59 | |
| 54 | Digital (Relay) Output 4 Source | 0 = Null | 0–59 | |
| 55 | Digital (Relay) Output 5 Source (MT2PC Only) | 0 = Null | 0–59 | |
| 56 | Digital (Relay) Output 1 NO/NC | Off = N/O | On/Off | |
| 57 | Digital (Relay) Output 2 NO/NC | Off = N/O | On/Off | |
| 58 | Digital (Relay) Output 3 NO/NC | Off = N/O | On/Off | |
| 59 | Digital (Relay) Output 4 NO/NC | Off = N/O | On/Off | |
| 60 | Digital (Relay) Output 5 NO/NC (MT2PC Only) | Off = N/O | On/Off | |
| | **WELL WASHER EDSs** (See section 0 for more information) | | | |
| 61 | Washer Activation Level | 20% | 0–100% | |
| 62 | Washer Maximum Run Time | 2 minutes | 0.25s – 120m | |
| 63 | Washer Interstart Period (minimizes water usage) | 2 hrs | Off – 10hrs | |
| 64 | Washer Maximum Off Time (minimizes odors) | 3 hrs | Off – 10hrs | |
| | **SCADA COMMUNICATION EDSs (MT2SPC AND MT3SPC ONLY)** | | | |
| 65 | SCADA Site number | 11 | 11 – 255 | |
| 66 | SCADA Quick Poll Region Number (see Outpost manual) | 0 | 1 – 255 | |
| 67 | SCADA Quick Poll Sequence Number (see Outpost manual) | 0 | 1 – 255 | |
| 68 | Power Up Radio Delay (Multiples of 20ms.) | 20 = 400 ms. | 0 – 100 | |
| 69 | SCADA transmission BAUD Rate (0 = 1200, 1 = 2400 and 2 = 4800) | 0 = 1200 | 0 – 2 | |
| | **CONFIGURABLE INPUTS EDSs** | | | |
| 70 | Key Lock (KL) / Configurable Input Telemetry | Off = Key Lock (KL) | On/Off | |
| 71 | Critical Fault Pump A (AC) / Configurable Input Telemetry | Off = Critical fault Pump A | On/Off | |
| 72 | Non-critical Fault Pump A (AN) / Configurable Input Telemetry | Off = NC Fault Pump A | On/Off | |
| 73 | Delay Fault Pump A (AD) / Configurable Input Telemetry | Off = Delay Fault Pump A | On/Off | |
| 74 | Seal Fault Pump A (AS) / Configurable Input Telemetry | Off = Seal Fault Pump A | On/Off | |
| 75 | Critical Fault Pump B (BC) / Configurable Input Telemetry | Off = Critical fault Pump B | On/Off | |
| 76 | Non-critical Fault Pump B (BN) / Configurable Input Telemetry | Off = NC Fault Pump B | On/Off | |
| 77 | Delay Fault Pump B (BD) / Configurable Input Telemetry | Off = Delay Fault Pump B | On/Off | |
| 78 | Seal Fault Pump B (BS) / Configurable Input Telemetry | Off = Seal Fault Pump B | On/Off | |
| 79 | Critical Fault Pump C (CC) / Configurable Input Telemetry | Off = Critical fault Pump C | On/Off | |
| 80 | Non-critical Fault Pump C (CN) / Configurable Input Telemetry | Off = NC Fault Pump C | On/Off | |
| 81 | Delay Fault Pump C (CD) / Configurable Input Telemetry | Off = Delay Fault Pump C | On/Off | |
| 82 | Seal Fault Pump C (CS) / Configurable Input Telemetry | Off = Seal Fault Pump C | On/Off | |
| 83 | Peak Levels (PL) / Configurable Input Telemetry | Off = Peak Levels (PL) | On/Off | |

| EDS | Switch Function | Default Setting | Range | Your Setting |
|---|---|---|---|---|
| 84 | Power Fail (PF) / Configurable Input Telemetry | Off = Power Failure (PF) | On/Off | |
| 85 | Pulse Start (PS) / Configurable Input Telemetry | Off = Pulse Start (PS) | On/Off | |
| | **SUMP CLEAN-OUT EDSs** (See section 8.8 for more information) | | | |
| 86 | Number of full pump cycles between clean-outs | 0 = Off | Off – 255 | |
| 87 | Run-on time for clean-out | 10 seconds | 0.25s – 120m | |

## A.2. Other Settings Quick Reference

| Normal Levels | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | Activation | | | Deactivation | | | VFD Start Speed | | | VFD 100%r Level | | |
| | Default | | Your Setting | Default | | Your Setting | Default | | Your Setting | Default | | Your Setting |
| | Discharge Mode | Charge Mode | | Discharge Mode | Charge Mode | | Discharge Mode | Charge Mode | | Discharge Mode | Charge Mode | |
| 1 | 50 | 50 | | 10 | 90 | | 50 | 50 | | 65 | 35 | |
| 2 | 60 | 40 | | 20 | 80 | | 50 | 50 | | 75 | 25 | |
| 3 | 70 | 30 | | 30 | 70 | | 50 | 50 | | 85 | 15 | |
| 4 | 80 | 20 | | 40 | 60 | | 50 | 50 | | 95 | 5 | |
| 5 | 90 | 10 | | 40 | 60 | | 50 | 50 | | 95 | 5 | |
| 6 | 90 | 10 | | 40 | 60 | | 50 | 50 | | 95 | 5 | |
| 7 | 90 | 10 | | 40 | 60 | | 50 | 50 | | 95 | 5 | |
| 8 | 90 | 10 | | 40 | 60 | | 50 | 50 | | 95 | 5 | |
| 9 | 90 | 10 | | 40 | 60 | | 50 | 50 | | 95 | 5 | |

| Peak Levels | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pump | Activation | | | Deactivation | | | VFD Start Speed | | | VFD 100%r Level | | |
| | Default | | Your Setting | Default | | Your Setting | Default | | Your Setting | Default | | Your Setting |
| | Discharge Mode | Charge Mode | | Discharge Mode | Charge Mode | | Discharge Mode | Charge Mode | | Discharge Mode | Charge Mode | |
| 1 | 60 | 40 | | 10 | 90 | | 60 | 60 | | 70 | 30 | |
| 2 | 70 | 30 | | 20 | 80 | | 60 | 60 | | 80 | 20 | |
| 3 | 80 | 20 | | 30 | 70 | | 60 | 60 | | 90 | 10 | |
| 4 | 90 | 10 | | 40 | 60 | | 60 | 60 | | 95 | 5 | |
| 5 | 90 | 10 | | 40 | 60 | | 60 | 60 | | 95 | 5 | |
| 6 | 90 | 10 | | 40 | 60 | | 60 | 60 | | 95 | 5 | |
| 7 | 90 | 10 | | 40 | 60 | | 60 | 60 | | 95 | 5 | |
| 8 | 90 | 10 | | 40 | 60 | | 60 | 60 | | 95 | 5 | |
| 9 | 90 | 10 | | 40 | 60 | | 60 | 60 | | 95 | 5 | |

| Alarm Levels | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Normal Levels | | | | Peak Levels | | | |
| Alarm | Activation | | Deactivation | | Activation | | Deactivation | |
| | Default | Your Setting | Default | Your Setting | Default | Your Setting | Default | Your Setting |
| 1 | 100 | | 90 | | 100 | | 90 | |
| 2 | Disabled | | Disabled | | Disabled | | Disabled | |
| 3 | 100 | | 90 | | 100 | | 90 | |
| 4 | Disabled | | Disabled | | Disabled | | Disabled | |
| 5 | 100 | | 90 | | 100 | | 90 | |
| 6 | Disabled | | Disabled | | Disabled | | Disabled | |

| Delays | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Normal Levels | | | | Peak Levels | | | |
| Pump | Activation | | Deactivation | | Activation | | Deactivation | |
| | Default | Your Setting | Default | Your Setting | Default | Your Setting | Default | Your Setting |
| 1 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 2 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 3 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 4 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 5 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 6 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 7 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 8 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |
| 9 | 1 sec | | 1 sec | | 1 sec | | 1 sec | |

| Setting | Default | Your Setting |
|---|---|---|
| Sensitivity | 20KO | |
| Analog Input 1 Zero | 4.08 | |
| Analog Input 1 Span | 20.4 | |
| Analog Input 2 Zero | 4.08 | |
| Analog Input 2 Span | 20.4 | |
| Group 1 Sequence | 123456789 | |
| Group 1 Alternation | On | |
| Group 2 Sequence | - | |
| Group 2 Alternation | On | |
| Software Version Number | - | |

# Appendix B. Technical Specifications

## B.1. Mode of Operation

Charge or Discharge (Fill or Empty)

## B.2. Probe Inputs

| | |
|---|---|
| Sensor Inputs | 10 |
| Sensor Voltage | 12VAC Nominal |
| Sensor Current | 0.8mA max (per sensor) |
| Sensitivity | 1kO, 2kO, 4kO, 10kO, 15kO, 20kO, 30kO, 40kO, 80kO, 120kO |

## B.3. Other Inputs

| | |
|---|---|
| Analogue | 2 x 4-20mA |
| Other inputs | Pulse start / Hold-Out / Peak levels |

## B.4. Relay Outputs

| | |
|---|---|
| MT2PC relay outputs | 2 pumps and 5 configurable |
| MT3PC relay outputs | 3 pumps and 4 configurable |
| Output delays | 0.25 to 120 sec, 0.25 to 120 minutes |
| Relay contact rating | 250VAC 5A Resistive, 2A Inductive |
| Relay contact life | $10^5$ Operations |
| Terminal size | 2 x 2.5mm$^2$, 13# |

## B.5. Other Outputs

| | |
|---|---|
| Analog | 4-20mA RL < 500 O |
| Keypad Remote | |

## B.6. Communications

| | |
|---|---|
| Digital | RS485 / RS422, RS232 |

## B.7. Display

| | |
|---|---|
| LEDs | High Intensity (Red & Green) |

## B.8. Dimensions

| | |
|---|---|
| Dimensions mm | 137H x 237W x 162D |

| | |
|---|---|
| Mounting | Panel mounted or DIN Rail |
| | keypad may be remotely mounted |
| Enclosure | Extruded aluminium |

## B.9. Power Supply

| | |
|---|---|
| Supply Voltage AC | 110VAC ± 10%(MTx[S]PC[-VFD]-**2**) or |
| | 240VAC ± 10%(MTx[S]PC[-VFD]-**3**) Nominal |
| | 50/60Hz |
| Power Consumption | 18VA max |
| Supply Voltage DC | 10-30VDC - 12W max |

## B.10. Environmental Range

| | |
|---|---|
| Operating Temperature Range | -10 C to + 60 C (Celsius) |
| | +14 F to + 140 F (Fahrenheit) |
| Humidity | 90% non condensing |
| Protection | IP20 (controller) |
| | IP56 (Keypad when mounted correctly with gasket) |
| Altitude | <2000m above sea level |

## B.11. Approvals

| | |
|---|---|
| N1653 | C-tick – Emissions AS/NZS2064:1997 Group1, Class A; (EN50081-2) |
| US C LISTED 2P27 | UL Listing to UL507, sixteenth edition. |

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>
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# WARRANTY

This warranty gives you specific legal rights. You may also have other rights according to the state or country in which you purchased this product.

Multitrode warrants its products against defects in materials and workmanship for a period of two years from the date of purchase by the end user.

**Customer Remedies**

During the warranty period, Multitrode will, at its option, either repair or replace the product that proves to be defective.

Should Multitrode be unable to repair or replace the product within a reasonable amount of time, it may refund the purchase price upon return of the product with proof of purchase.

To make a claim under the warranty the product must be returned to the point of purchase or directly to Multitrode with proof of purchase. Previous registration of the product with Multitrode is deemed to be proof of purchase.

Where a product is returned by the end user and is found not to be defective, Multitrode reserves the right to charge a fee for testing and freight to return the product.

Where a product is replaced by Multitrode, the replacement product will be warranted for the remainder of the original warranty period or 30 days whichever is the longer.

**No Liability for consequential damages**

To the maximum extent permitted by applicable law, in no event shall Multitrode or its suppliers be liable for any damages whatsoever (including, without limitation, damages for loss of business profits, business interruption, loss of business information, damage to other equipment or other pecuniary loss) arising out of the use of or inability to use this Multitrode product, even if a representative of Multitrode its suppliers or its distributors has been advised of the possibility of such damages. In any case. Multitrode's entire liability under any provision of this agreement shall be limited to the amount actually paid by the end user for the product. Because some states/jurisdictions do not allow the exclusion or limitation of liability for consequential or incidental damages, the above limitation may not apply to the end user.

**Warranty Exclusions**

The warranty on your Multitrode product shall not apply to defects or damage resulting from:

- Improper or inadequate maintenance by the customer.
- Connection to unapproved non Multitrode products.
- Unauthorised modification or misuse.
- Operation outside of the environmental specifications for the product.
- Lightning, or other power overload.
- Connection to an incorrect power supply
- Contact with water or other extraneous material.
- Installation by an unqualified or inadequately trained person.
- Use in an unapproved application.

**Extended warranties**

Where extended time warranties are provided by Multitrode, either purchased by the end user or provided as a special arrangement for quantity purchases or as a promotion, the same conditions of this standard warranty shall apply.

This agreement is governed by the laws of the State of Queensland, Australia.

finder® The power in relays since 1954

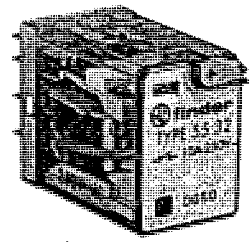
# Miniature general purpose relays

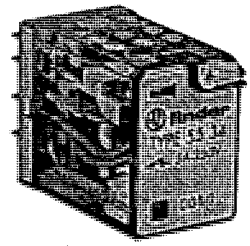
Refer catalogue FI

## Flat pin

- Lockable test button and mechanical flag indicator with LED and built-in suppression (DC only)
- Use with 94 series bases
- Compact

Non-polarised DC relays





| Cat. No. [1] | Price $ | Cat. No. [1] | Price $ |
|---|---|---|---|
| 55.32.0054...V AC | 20.60 | 55.34.0054...V AC | 23.00 |
| 55.32.0074...V DC | 20.60 | 55.34.0074...V DC | 23.00 |

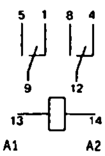
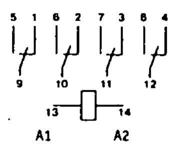
**Contact specifications**

| | | |
|---|---|---|
| Contact configuration | 2 C/O | 4 C/O |
| Rated current | 10 A | 7 A |
| Rated voltage | 250 V AC | |
| Rated load in AC 1 | 2,500 VA | 1750 VA |
| Rated load in AC 15 (230 V AC) | 500 VA | 350 VA |
| Single phase motor rating (230 V AC) | 0.37 kW | 0.125 kW |
| Breaking capacity in DC 1 : 30/110/220 V | 10/0.25/0.12 A | 7/0.25/0.12 A |
| Maximum peak current | 20 A | 15 A |
| Maximum switching voltage | 400 V AC | 250 V AC |
| Minimum switching load | 300 mW | |

**Coil specifications [1] [2]**

| | | | |
|---|---|---|---|
| Nominal voltage ($U_N$) | (50/60 Hz) AC | 12, 24, 32, 48, 110, 240 | 12, 24, 32, 48, 110, 240 |
| | DC | 12, 24, 48, 110 | 12, 24, 32, 48, 110 |
| Rated power AC/DC | | 1.5 VA/1W | |
| Operation range | (50 Hz) AC | (0.8...1.1) $U_N$ | |
| | DC | (0.8...1.1) $U_N$ | |
| Holding voltage AC/DC | | 0.8 $U_N$/0.5 $U_N$ | |
| Must drop-out voltage AC/DC | | 0.2 $U_N$/0.1 $U_N$ | |

**Technical data**

| | | |
|---|---|---|
| Mechanical life AC/DC | $20.10^6/50.10^6$ cycles | |
| Electrical life @ rated load AC 1 | $200.10^3$ cycles | $150.10^3$ cycles |
| Insulation between coil and contacts | 3.6 kV | 2.5 kV |
| Ambient temperature range | -40 °C...+70 °C | |
| Protection rating | IP 50 | |
| Connection diagram |  |  |
| Dimensions | Refer page 9 - 35 | |
| Recommended base and accessories | **94.02** Screw terminal base | **94.04** Screw terminal base |
| | For more information and other bases available refer page 9 - 32 | |
| | **94.06** 6 way jumper link | |

**Note:** New DC relays are non-polarised

**Notes:** [1]) Add coil voltage to Cat. No. when ordering.
[2]) Please contact NHP for other voltages.
**The equipment on this page is rated 230/400 V and is suitable for use on 240/415 V systems as per AS 60038:2000.**

**Price Schedule 'B2'**

9

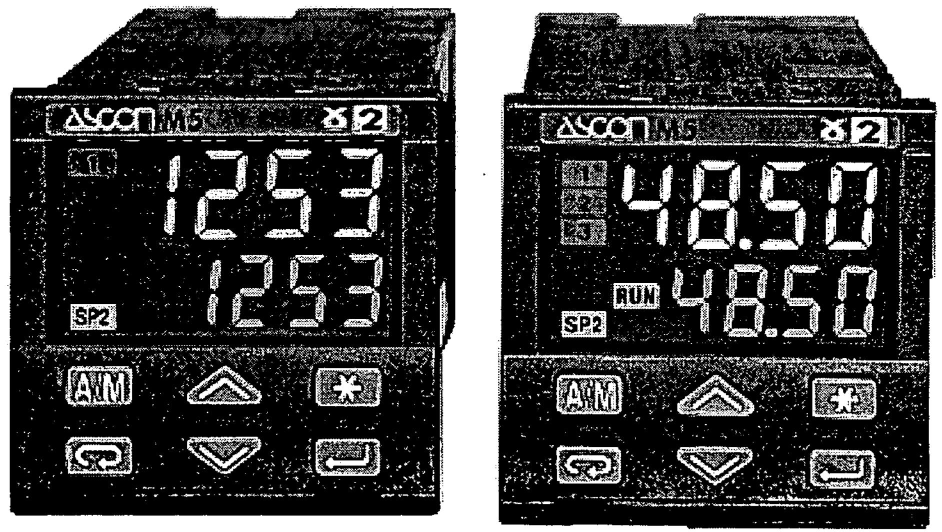
# Process Controller with Setpoint Programmer

## 1/16 DIN - 48 x 48

S E R I E S

# M5 line

User Manual • M.I.U.M5-3/01.02 • Cod. J30-478-1AM5 IE




ASCON spa

ISO 9001

Certified

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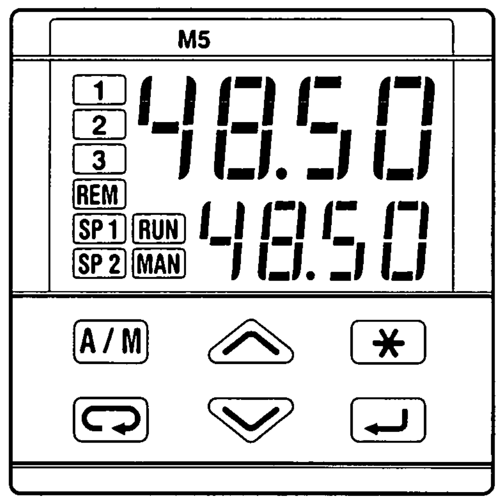
http://www.ascon.it
e-mail info@ascon.it

# Process Controller with Setpoint Programmer

## $^1/_{16}$ DIN - 48 x 48

# M5 line



# NOTES ON ELECTRIC SAFETY AND ELECTROMAGNETIC COMPATIBILITY

**Please, read carefully these instructions before proceeding with the installation of the controller.**
**Class II instrument, rear panel mounting.**

This controller has been designed with compliance to:
**Regulations on electrical apparatus** (appliance, systems and installations) according to the European Community directive 73/23 CEE amended by the European Comunity directive 93/68 CEE and the Regulations on the essential protection requirements in electrical apparatus EN 61010-1 (IEC 1010 - 1) : 90 +A1:92 + A2:95.

**Regulations on Electromagnetic Compatibility** according to the European Community directive n089/336/CEE, amended by the European Community directive n° 92/31/CEE and the following regulations:
Regulations on RF emissions
EN50081 - 2 for industrial environments
Regulation on RF immunity
EN500082-2 for industrial equipment and system

**It is important to understand that it's responsibility of the installer to ensure the compliance of the regulations on safety requirements and EMC.**

The device has no user serviceable parts and requires special equipment and specialised engineers. Therefore, a repair can be hardly carried on directly by the user. For this purpose, the manufacturer provides technical assistance and the repair service for its Customers.
Please, contact your nearest Agent for further information.

**All the information and warnings about safety and electromagnetic compatibility are marked with the ⚠CE sign, at the side of the note.**

# TABLE OF CONTENTS

# 1 INTRODUCTION

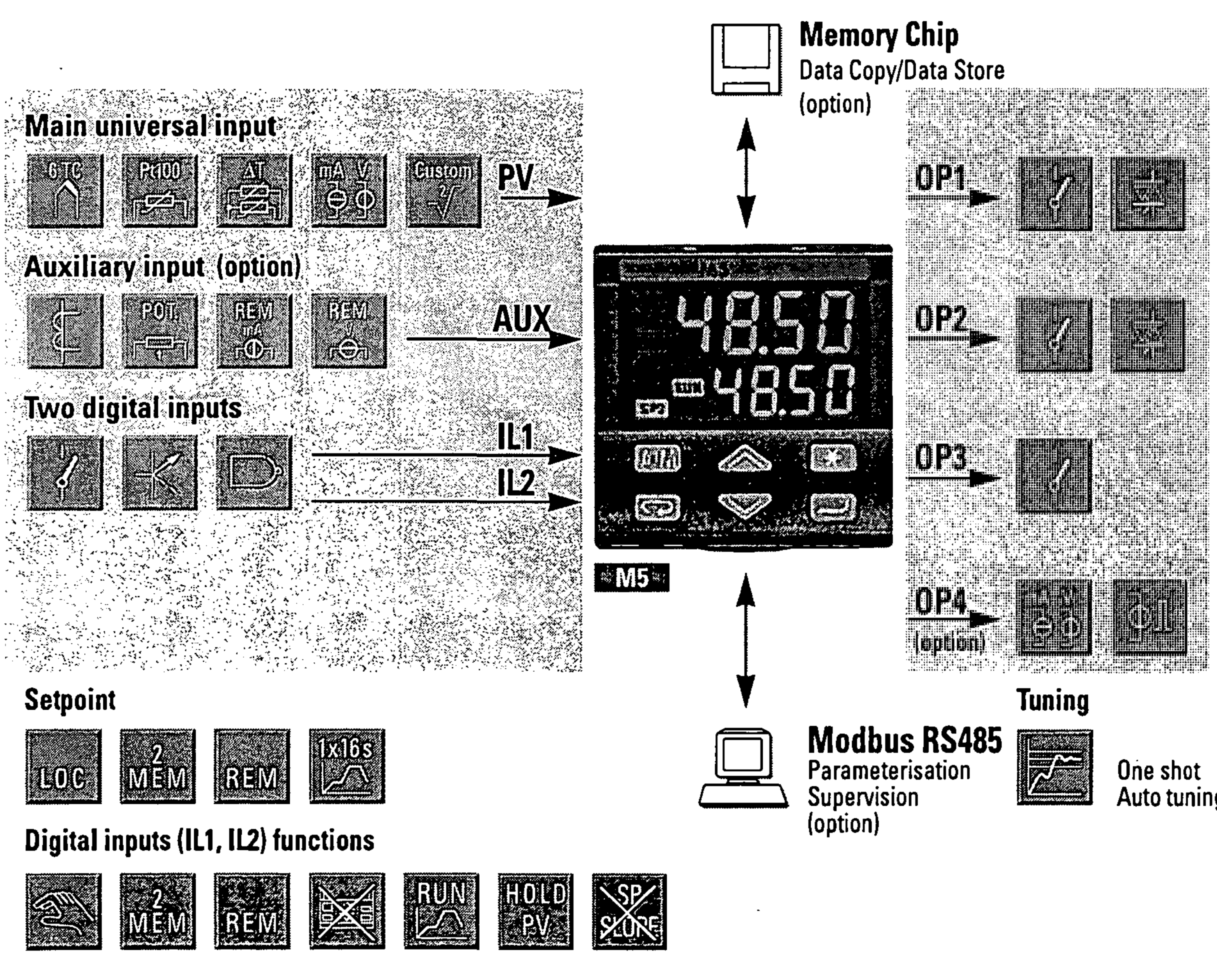
## POWERFUL FEATURES AND A WIDE RANGE OF FUNCTIONALITIES

Congratulations for having chosen these universal controllers. They are the best result of our experience in designing and manufacturing of smart, powerful and high reliable controllers.

The process controllers of the M5 series have been designed for the industrial environment, are provided with a complete set of functions, as a true universal instrument.

They can be used as Controllers-Programmers with 1 Setpoint profile of 16 segments.

### Resources



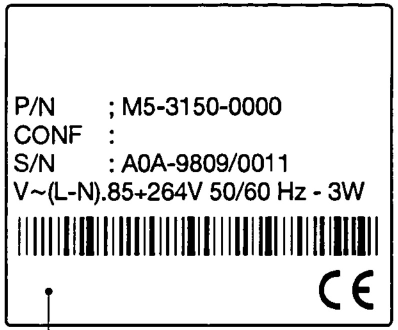

### Operating mode

| | | Control | | Alarms | | | Retransmission |
|---|---|---|---|---|---|---|---|
| | | | | | | | PV/SP |
| 1 | Single action | OP1 | | | OP2 | OP3 | OP4 |
| 2 | Single action | OP4 | | OP1 | OP2 | OP3 | |
| 3 | Double action | OP1 | OP2 | | | OP3 | OP4 |
| 4 | Double action | OP1 | OP4 | | OP2 | OP3 | |
| 5 | Double action | OP4 | OP2 | OP1 | | OP3 | |
| 6 | Valve | OP1 | OP2 | | | OP3 | OP4 |

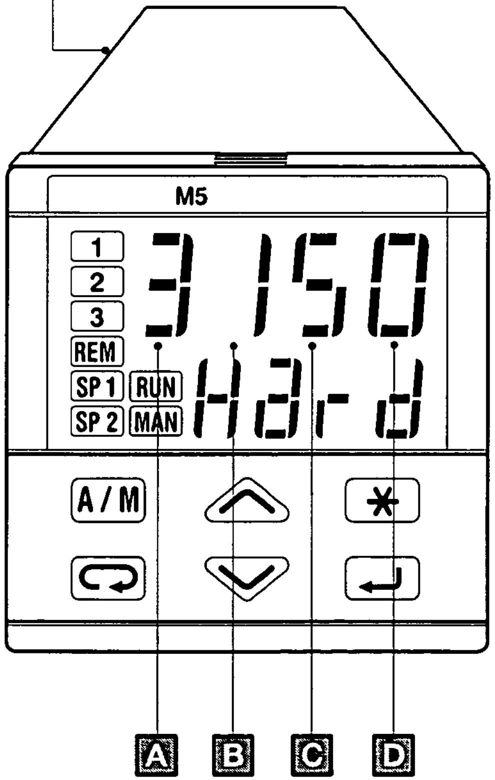
## 1.1 PRODUCT CODING

The complete code is displayed on the instrument label.

The information about product coding are accessible from the front panel by mean of a particular procedure described at section 5.1 pag 29




Instrument label




Basic product code

Line — Model Basic — Accessories

Model: M5 A B C D – E F G 0

- Power Supply (A)
- Outputs (B)
- Serial comm.s/Options (C D)
- Setpoint (E)
- Instruction handbook (F)
- Colour (G)

| Power Supply | A |
|---|---|
| 100 - 240V~ (- 15% + 10%) | 3 |
| 24V~ (- 25% + 12%) or 24V– (- 15% + 25%) | 5 |

| Outputs OP1 (OP2) | B |
|---|---|
| Relay - Relay | 1 |
| Relay - Triac | 2 |
| Triac - Relay | 4 |
| Triac - Triac | 5 |

| Serial Comms. | Options | | C | D |
|---|---|---|---|---|
| Not fitted | None [2] | | 0 | 0 |
| | Auxiliary Input | Feedback potentiometer [2] | 0 | 1 |
| | | Remote Setpoint [1] | 0 | 2 |
| | | Current Transformer | 0 | 3 |
| | Auxiliary Output | SSR drive/analogue | 0 | 4 |
| | | SSR drive/analogue + Remote Setpoint [1] [2] | 0 | 5 |
| RS485 Modbus/Jbus protocol | None [2] | | 5 | 0 |
| | Auxiliary Input | Feedback potentiometer [2] | 5 | 1 |
| | | Remote Setpoint [1] | 5 | 2 |
| | | Current Transformer | 5 | 3 |
| | SSR drive/analogue auxiliary output | | 5 | 4 |

[1] Not available with Setpoint programmer installed (E = 1)
[2] Second digital input (IL2) not available

| Setpoint Programmer | E |
|---|---|
| Not fitted | 0 |
| Fitted | 1 |

| Front panel Colour | G |
|---|---|
| Dark (std) | 0 |
| Beige | 1 |

| Instruction handbook | F |
|---|---|
| Italian-English (std) | 0 |
| French-English | 1 |
| German-English | 2 |
| Spanish-English | 3 |

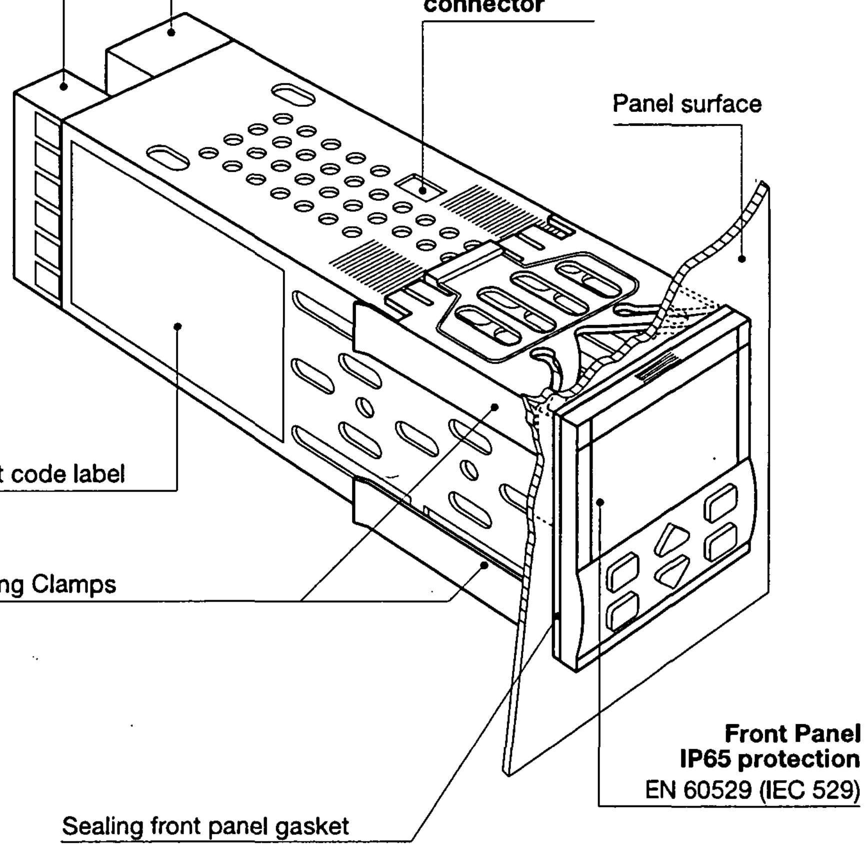
# 2 INSTALLATION

**Installation must only be carried out by qualified personnel.**

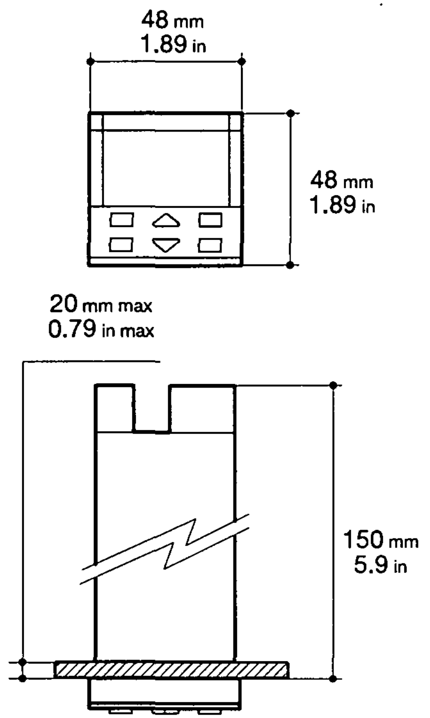
Before proceeding with the installation of this controller, follow the instructions illustrated in this manual and, particularly the installation precautions marked with the ⚠CE symbol, related to the European Community directive on electrical protection and electromagnetic compatibility.

⚠CE
To prevent hands or metal touching parts that may be electrically live, the controllers must be installed in an enclosure and/or in a cubicle.

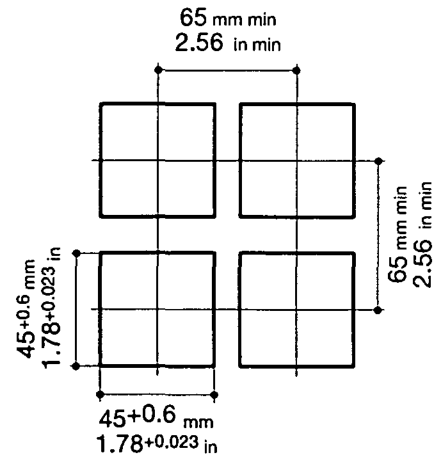
## 2.1 INSTALLATION DESCRIPTION




### 2.1.1 DIMENSIONAL DETAILS




### 2.1.2 PANEL CUT-OUT



## 2.2 ENVIRONMENTAL RATINGS

### Operating Conditions

| | |
|---|---|
| 2000 | Altitude up to 2000 m |
| °C | Temperature 0...50°C |
| %Rh | Relative Humidity 5...95 %Rh non-condensing |

| Special Conditions | | Suggestions |
|---|---|---|
| 2000 | Altitude > 2000 m | Use 24V~ supply version |
| °C | Temperature >50°C | Use forced air ventilation |
| %Rh | Humidity > 95 %Rh | Warm up |
| | Conducting atmosphere | Use filters |

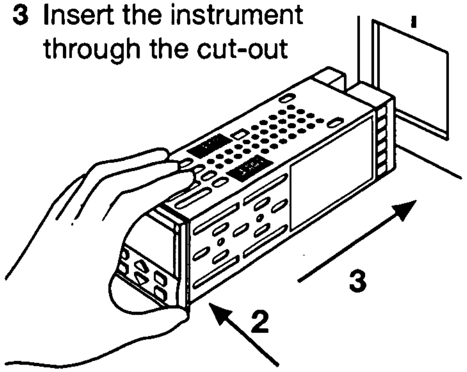
### Forbidden Conditions

| | |
|---|---|
| | Corrosive atmosphere |
| | Explosive atmosphere |

## 2.3 PANEL MOUNTING

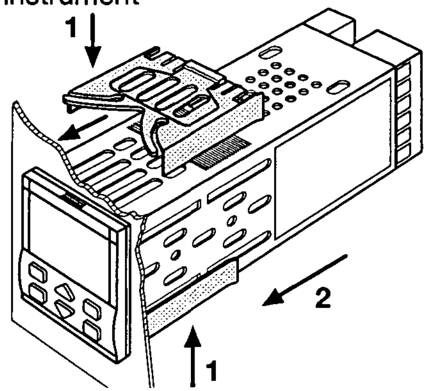
### 2.3.1 INSERT THE INSTRUMENT

1 Prepare panel cut-out
2 Check front panel gasket position
3 Insert the instrument through the cut-out



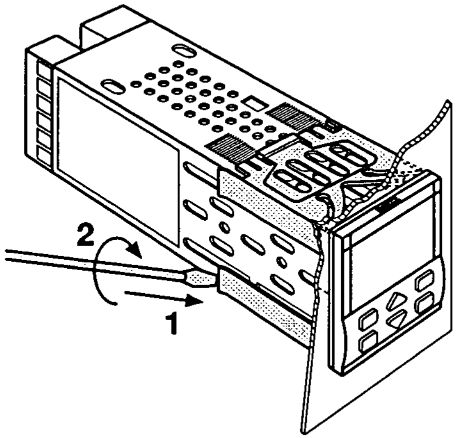

### 2.3.2 INSTALLATION SECURING

1 Fit the mounting clamps
2 Push the mounting clamps towards the panel surface to secure the instrument




### 2.3.3 CLAMPS REMOVING

1 Insert the screwdriver in the clips of the clamps
2 Rotate the screwdriver

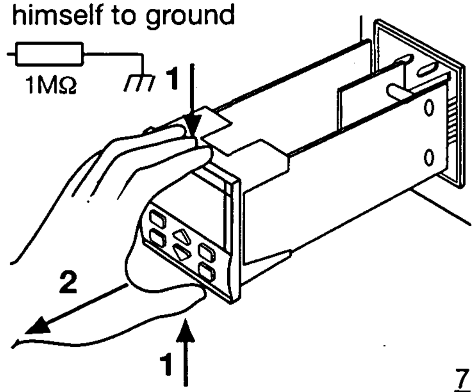



### 2.3.4 INSTRUMENT UNPLUGGING

1 Push and
2 Pull to remove the instrument

Electrostatic discharges can damage the instrument

Before removing the instrument the operator must discharge himself to ground




7

# 3 ELECTRICAL CONNECTIONS

## PRECAUTIONS

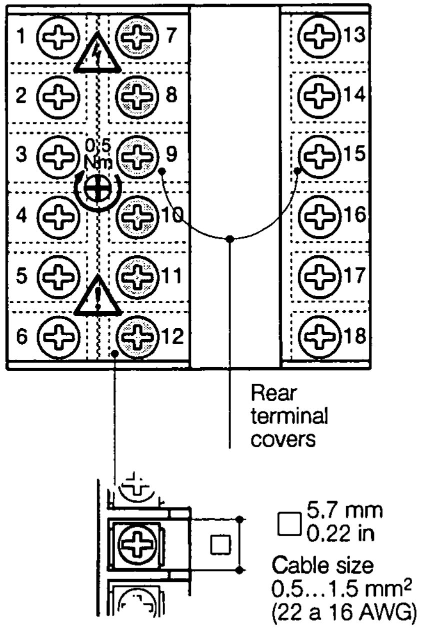
Despite the fact that the instrument has been designed to work in an harsh and noisy environmental (level IV of the industrial standard IEC 801-4), it is strongly recommended to follow the following suggestions.

All the wiring must comply with the local regulations.

The supply wiring should be routed away from the power cables.
Avoid to use electromagnetic contactors, power relays and high power motors nearby.
Avoid power units nearby, especially if controlled in phase angle

Keep the low level sensor input wires away from the power lines and the output cables.
If this is not achievable, use shielded cables on the sensor input, with the shield connected to earth.

## 3.1 TERMINATION UNIT

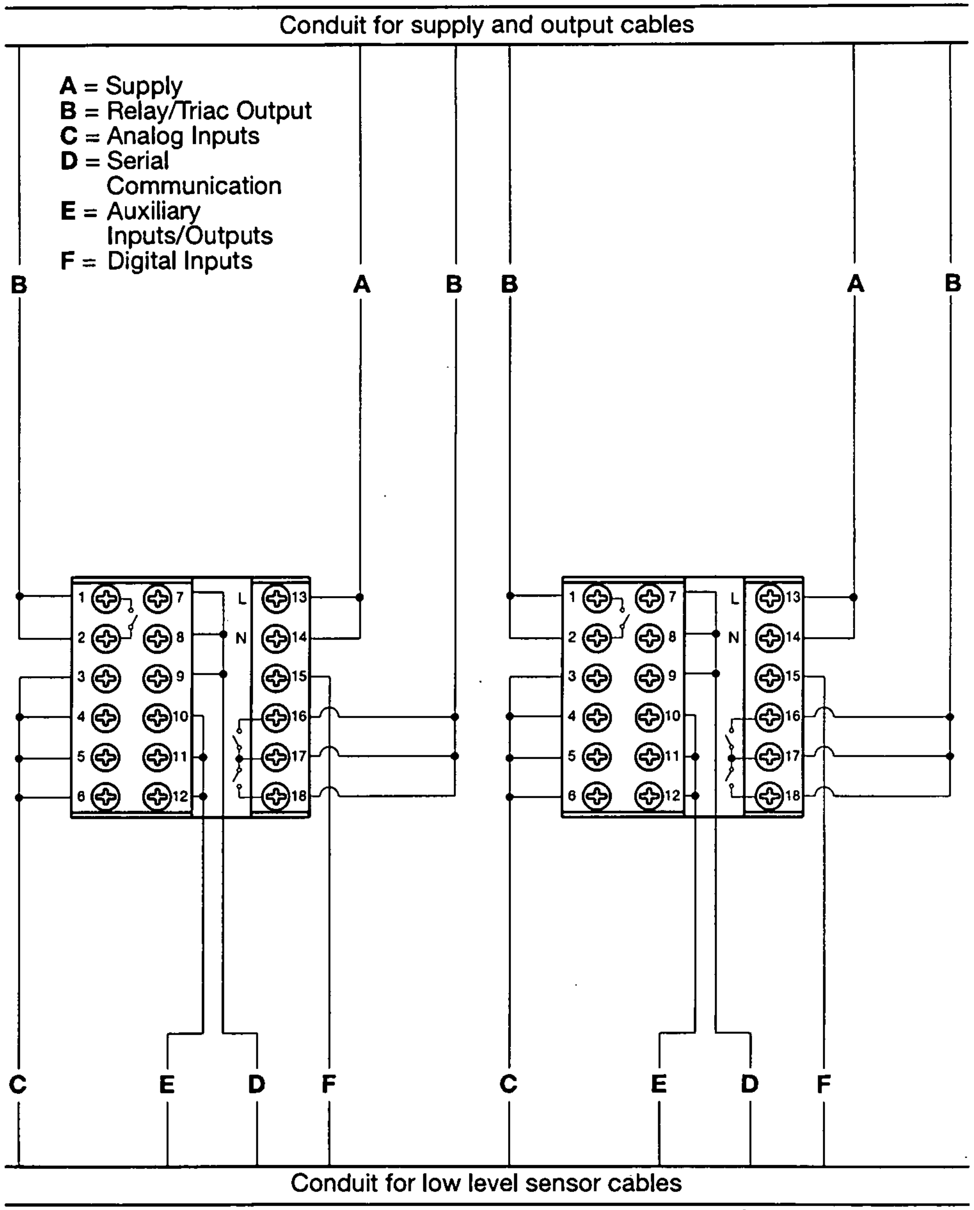



| | |
|---|---|
| | 18 screw terminals |
| | Option terminals |
| | Holding screw 0.5 Nm |
| + | Positive screw driver PH1 |
| – | Negative screw driver 0,8 x 4 mm |

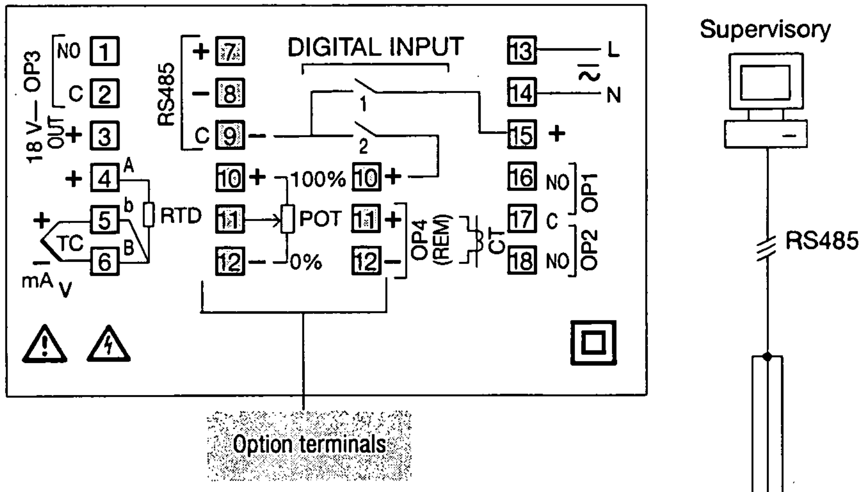
**Terminals**

| | |
|---|---|
| ⌀ | Pin connector ⌀ 1.4 mm 0.055 in max |
| Ø | Fork-shape AMP 165004 Ø 5.5 mm - 0.21 in |
| L | Stripped wire L 5.5 mm - 0.21 in |

## 3.2 RECOMMENDED ROUTING OF WIRES



## 3.3 TYPICAL INSTRUMENT WIRING (valve control)




**Notes:**

1] Make sure that the power supply voltage is the same indicated on the instrument.

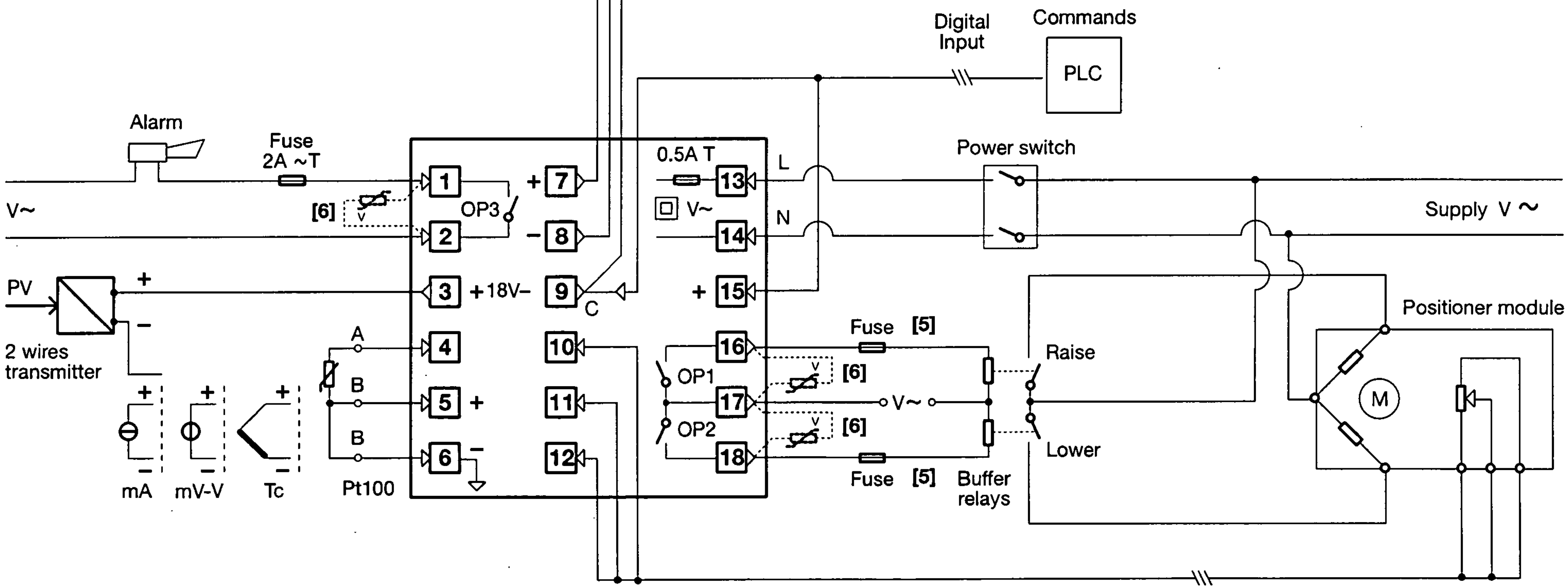
2] Switch on the power supply only after that all the electrical connections have been completed.

3] In accordance with the safety regulations, the power supply switch shall bring the identification of the relevant instrument. The power supply switch shall be easily accessible from the operator.

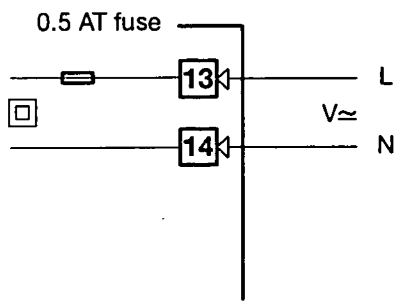
4] The instrument is protected with a 0.5 A~ T fuse. In case of failure it is suggested to return the instrument to the manufacturer for repair.

5] To protect the instrument internal circuits use:
- 2 A~ T fuses for Relay outputs
- 1 A~ T fuses for Triac outputs

6] Relay contacts are already protected with varistors.
**Only in case of 24 V ~ inductive loads, use model A51-065-30D7 varistors (on request)**



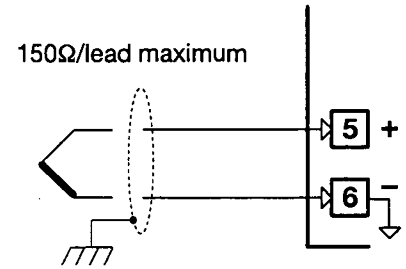
## 3.3.1 POWER SUPPLY




Switching power supply with multiple isolation and internal fuse

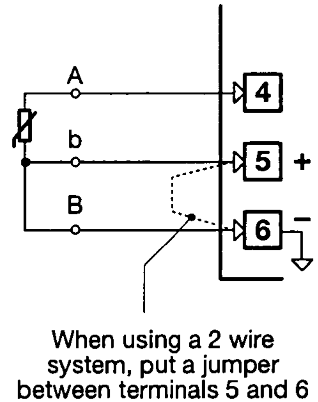
- **Standard version:**
  nominal voltage:
  100 - 240V~ (-15% + 10%)
  Frequency 50/60Hz
- **Low Voltage version:**
  Nominal voltage:
  24V~ (-25% + 12%)
  Frequency 50/60Hz
  or 24V– (-15% + 25%)
- Power consumption 3 VA max

## 3.3.2 PV CONTROL INPUT




**A For J L T K S R thermocouple type**

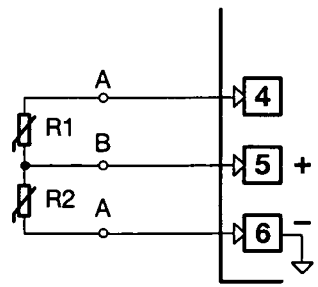
- Use always compensation cable of the correct type for the thermocouple used
- Use always compensation cable of the correct type for the thermocouple used
- The shield, if present, must be connected to a proper earth.




**B For PT100 resistance thermometer**

- If a 3 wire system is used, use always cables of the same diameter (1mm² min).
  20Ω/lead maximum resistance
- If a 2 wire system is used, use always cables of the same diameter (1.5mm² min).

⚠ When the distance between the controller and the sensor is 15 meters, using a cable of 1.5mm² diameter, produces an error in the measure of 1°C .

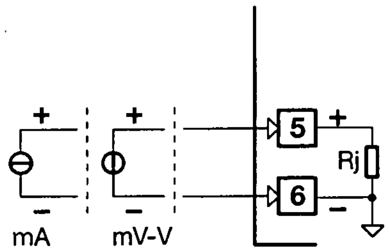



**B1 For ΔT (2x Pt100)**

- Use wires of the same length
  20Ω/lead maximum resistence.

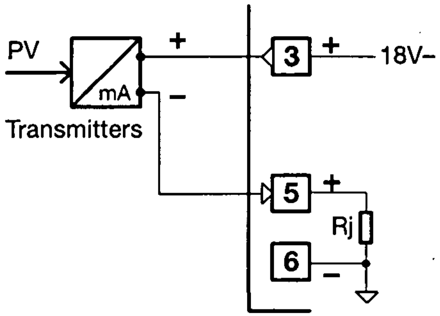
**R1 + R2 must be <320Ω**

## 3.3.2 PV CONTROL INPUTS (cont.)



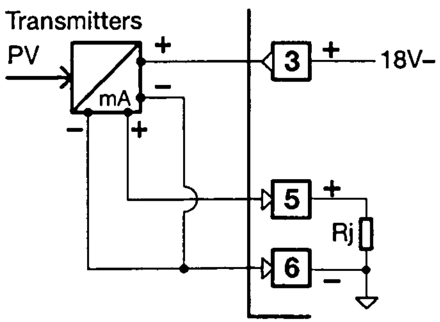

**C For DC input**

Input resistance = 30Ω for mA
Input resistance = 10MΩ for mV
Input resistance = 10KΩ for Volt




**C1 For 2 wires transmitters**

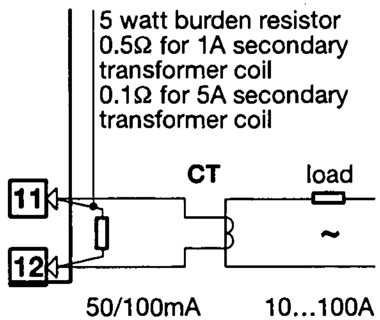
- Power supply to the transmitter
  18V– ±10%
  30mA max
  Input resistance = 30Ω




**C2 For 3 or 4 wires transmitters**

- Power supply to the transmitter
  18V– ±10%
  30mA max
  Input resistance = 30Ω

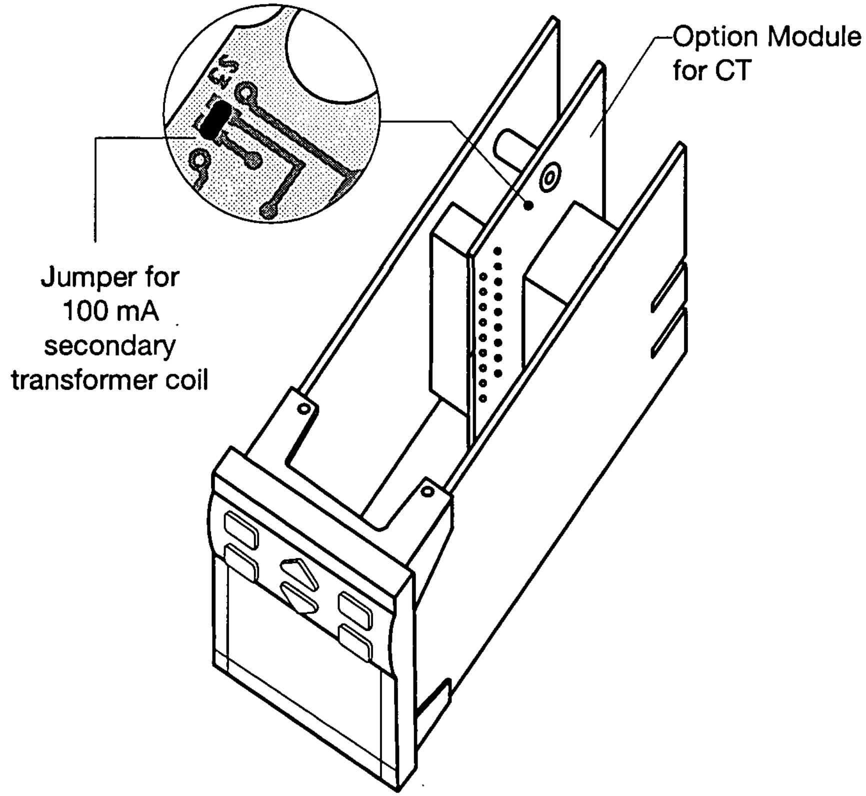
## 3.3.3 AUXILIARY INPUTS (OPTION)




**A For current transformer CT**

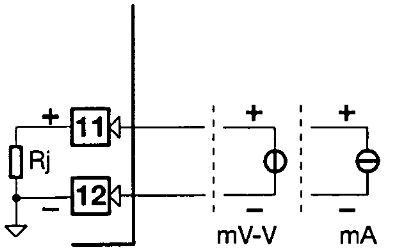
for the measure of the load current

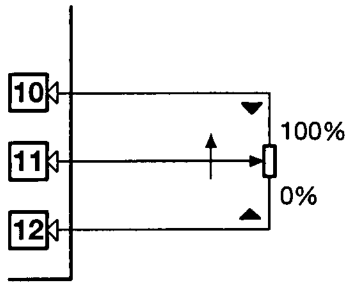
- Primary coil 10A...100A
- Secondary coil 50 mA default 100mA jumper selectable



## 3.3.3 AUXILIARY INPUTS (cont.)

**⚠ If the analogue input is provided, the terminals for the Remote Setpoint are 10(+) and 9(-)**



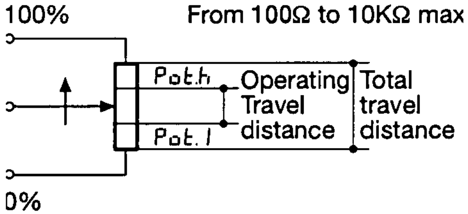

### B From Remote Setpoint

Current
0/4...20mA
Input resistance = 30Ω

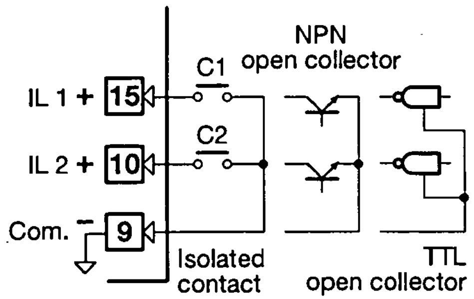
Voltage
1...5V, 0...5V, 0...10V
Input resistence = 300KΩ

### C From Position Potentiometer

To read the real position of the motor or the valve




## 3.3.4 DIGITAL INPUTS




- The associated function is active when the digital input is ON (see table on page 33)
- The second digital input (IL2) is available only with the following options:
  Remote Setpoint (D = 2)
  Current transformer (D = 3)
  SSR drive / analogue output (D = 4)

## 3.3.5 OP1 OP2 OP3 AND OP4 OUTPUTS

The functionality associated to each of the OP1 OP2 OP3 and OP4 outputs is defined during the configuration of the instrument.
The possible choices are:

| | | Control | | Alarms | | | Retransm. PV-SP |
|---|---|---|---|---|---|---|---|
| 1 | Single action | OP1 Heat | | | OP2 | OP3 | OP4-C |
| 2 | Single action | OP4 Heat | | OP1 | OP2 | OP3 | |
| 3 | Double action | OP1 Heat | OP2 Cool | | | OP3 | OP4-C |
| 4 | Double action | OP1 Heat | OP4 [1] Cool | | OP2 [2] | OP3 | |
| 5 | Double action | OP4 [1] Heat | OP2 Cool | OP1 [2] | | OP3 | |
| 6 | Valve | OP1 Raise | OP2 Lower | | | OP3 | OP4-C |

where:

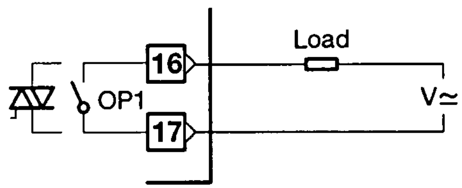
| | |
|---|---|
| OP1 - OP2 | Relay or Triac output |
| OP3 | Relay output |
| OP4 | Analogue or SSR drive output |
| OP4-C | Analogue output |

**Note**

**[1] In case of OP4 analogue output, its status is not visualised by any red led**

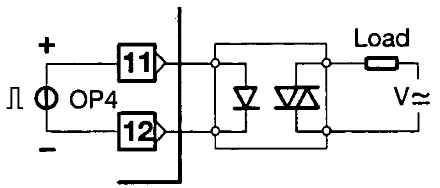
**[2] When the OP4 SSR drive output is selected, the status of OP1 and OP2, as alarms, is not displayed by any red led**

## 3.3.5-A SINGLE RELAY OUTPUT (TRIAC)



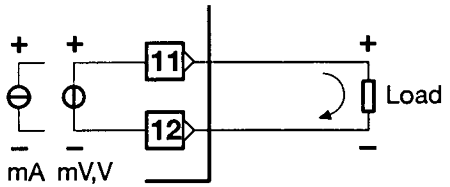

1 NO contact

## 3.3.5-B SINGLE SSR DRIVE OUTPUT (OPTION)



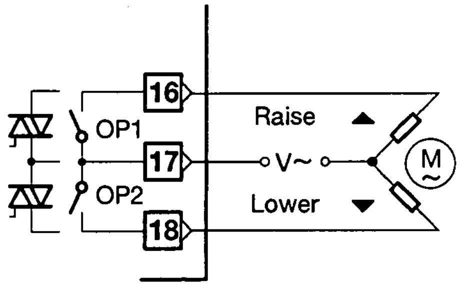

Output 0...22V⎓ ±20% (20mA max)
galvanic isolated

## 3.3.5-C SINGLE ANALOGUE OUTPUT (OPTION)



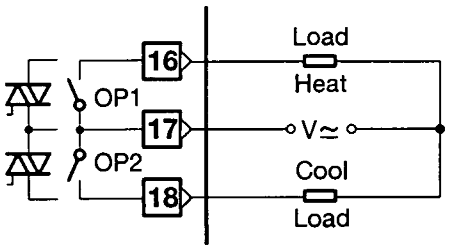

galvanic isolated
500 V∼/ 1min
750Ω / 15V max if current output
500Ω / 20mA max if voltage output

## 3.3.5-D VALVE OUTPUT



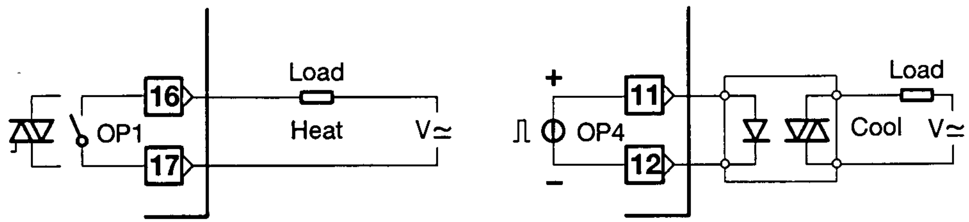

3 pole output with NO contacts
(raise, lower, stop)

## 3.3.5-E HEAT COOL OUTPUT RELAY/RELAY (TRIAC/TRIAC)

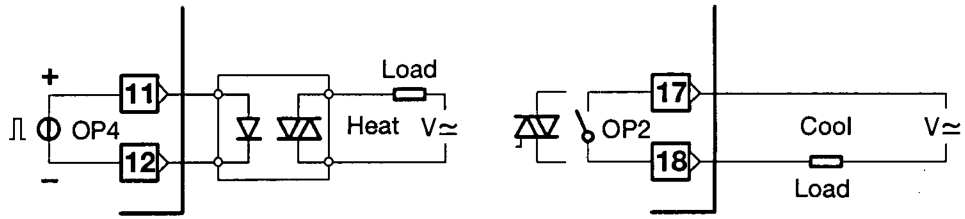



2 NO contacts

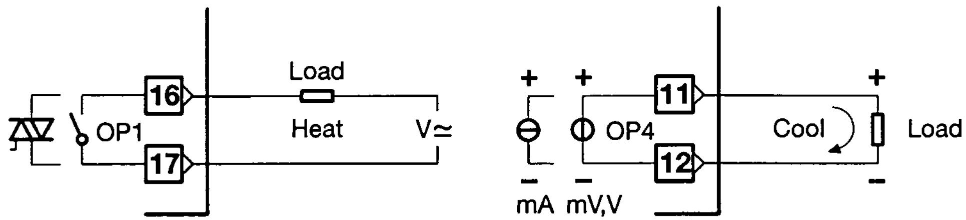
## 3.3.5-F HEAT COOL OUTPUT RELAY (TRIAC)/SSR DRIVE (OPTION)



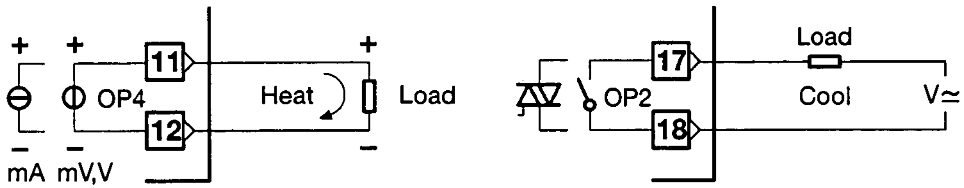

## 3.3.5-G HEAT COOL OUTPUT SSR DRIVE (OPTION)/RELAY (TRIAC)



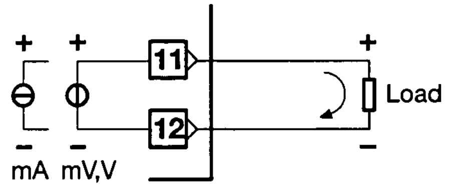

## 3.3.5-H HEAT COOL OUTPUT RELAY(TRIAC)/ANALOGUE (OPTION)



## 3.3.5-I HEAT COOL OUTPUT DC (OPTION)/RELAY (TRIAC)



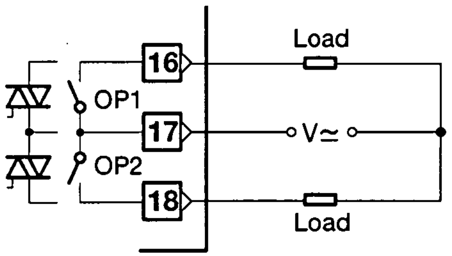

## 3.3.7 RETRANSMISSION OUTPUT (OPTION)



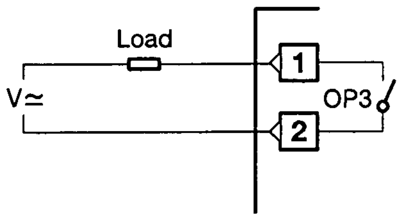

galvanic isolated
500 V~/ 1min
750Ω / 15V max if current output
500Ω / 20mA max if voltage output

⚠ **The analogue/SSR drive output OP4 can be used for signal retransmission only if it is not used as control output.**

## 3.3.6 ALARM OUTPUTS OP1, OP2, OP3



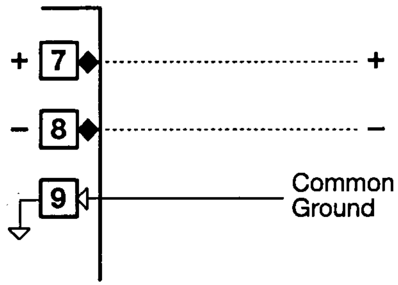

2 NO contacts




1 NO contact

⚠ **The relay/triac output OP1, OP2 and OP3, can be used as alarm outputs only if they are not used as control outputs.**

## 3.3.8 SERIAL COMMUNICATION (OPTION)

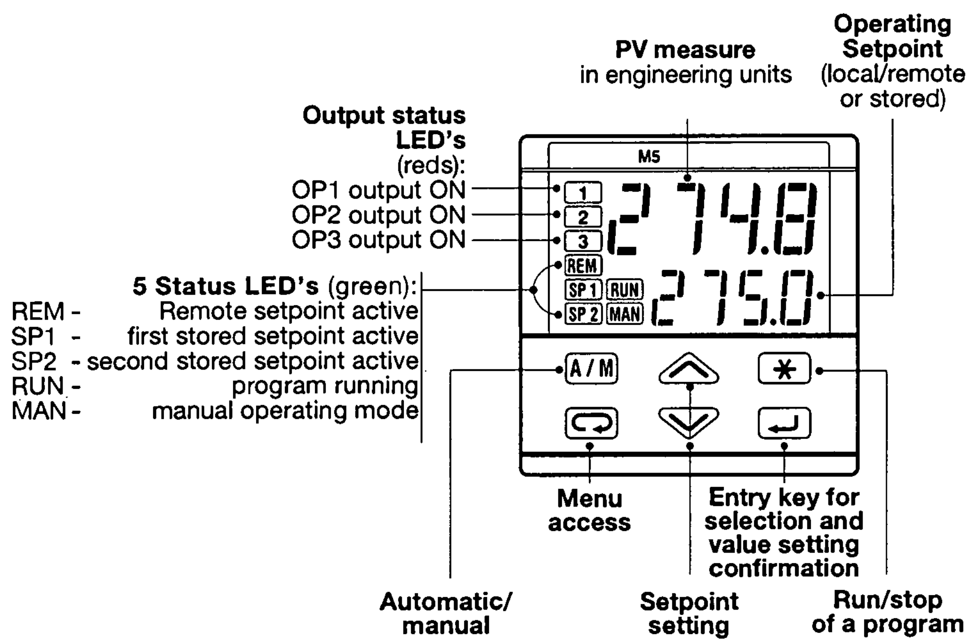



- Galvanic isolation 500V~/1 min Compliance to the EIA RS485 standard for Modbus/Jbus

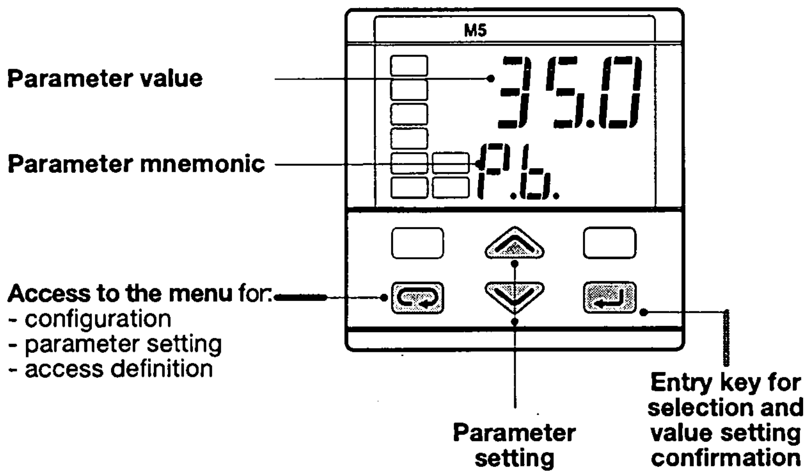
⚠ **Please, read the user instructions on the "M5 controller MODBUS/JBUS protocol"**

# 4 OPERATION

## 4.1.A KEYS FUNCTION AND DISPLAY IN OPERATOR MODE



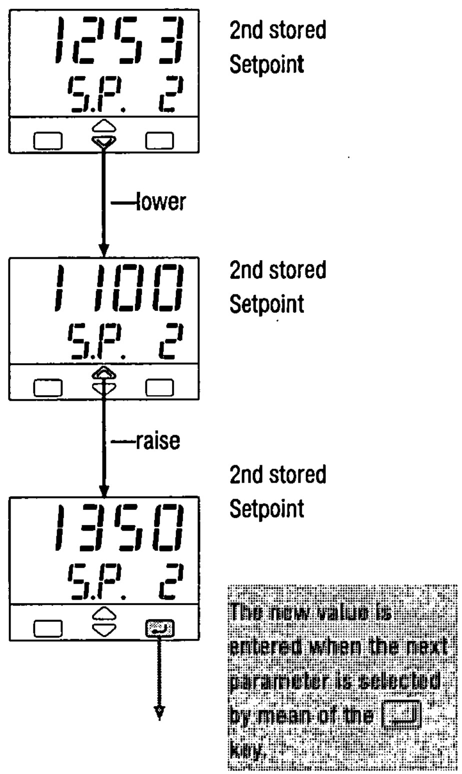

## 4.1.B KEYS FUNCTION AND DISPLAY IN PROGRAMMING MODE




## 4.1.1 NUMERIC ENTRY

(i.e. the modification of the value of a stored Setpoint from 275.0 to 240.0)

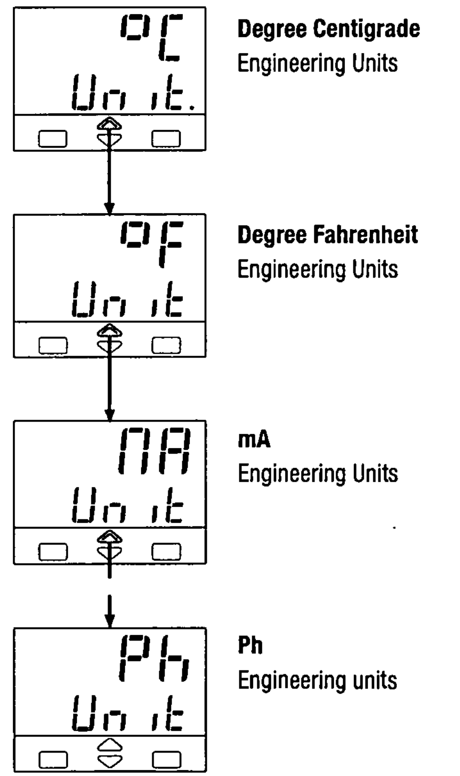
Press ⮝ or ⮟ momentarily to change the value of 1 unit every push. Continued pressing of ⮝ or ⮟ changes the value, at rate that doubles every second. Releasing the button the rate of change decreases.
In any case the change of the value stops when it has reached the max/min limit set for the parameter.



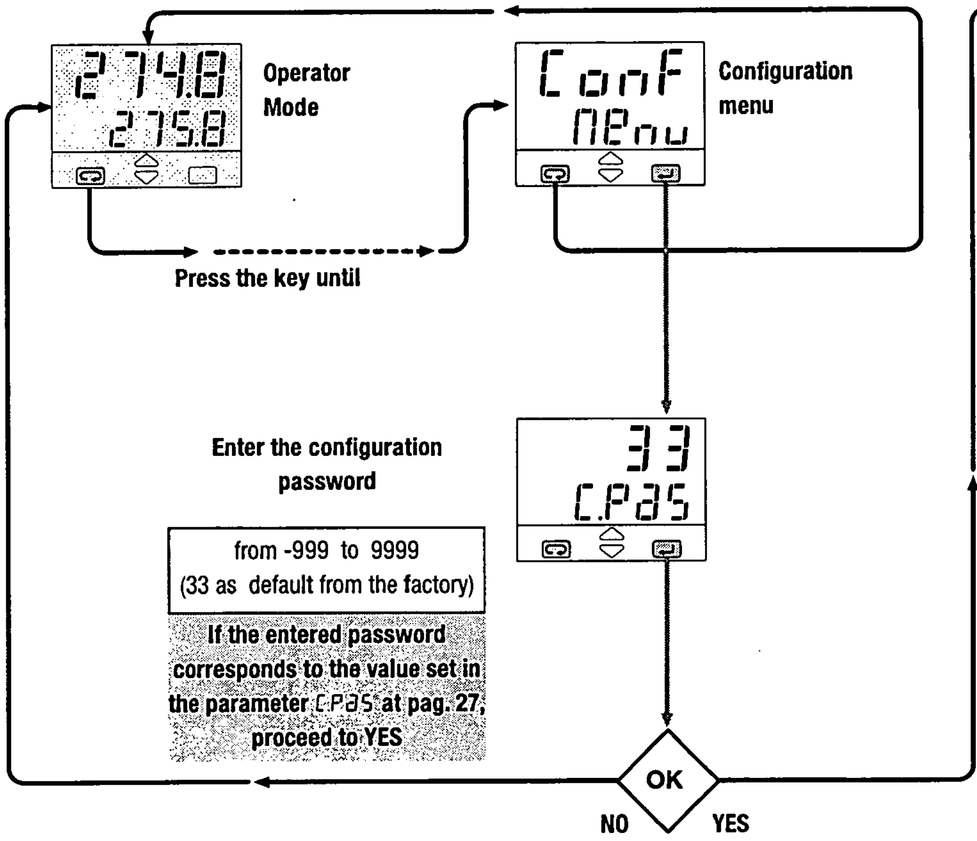

## 4.1.2 MNEMONIC SETTING

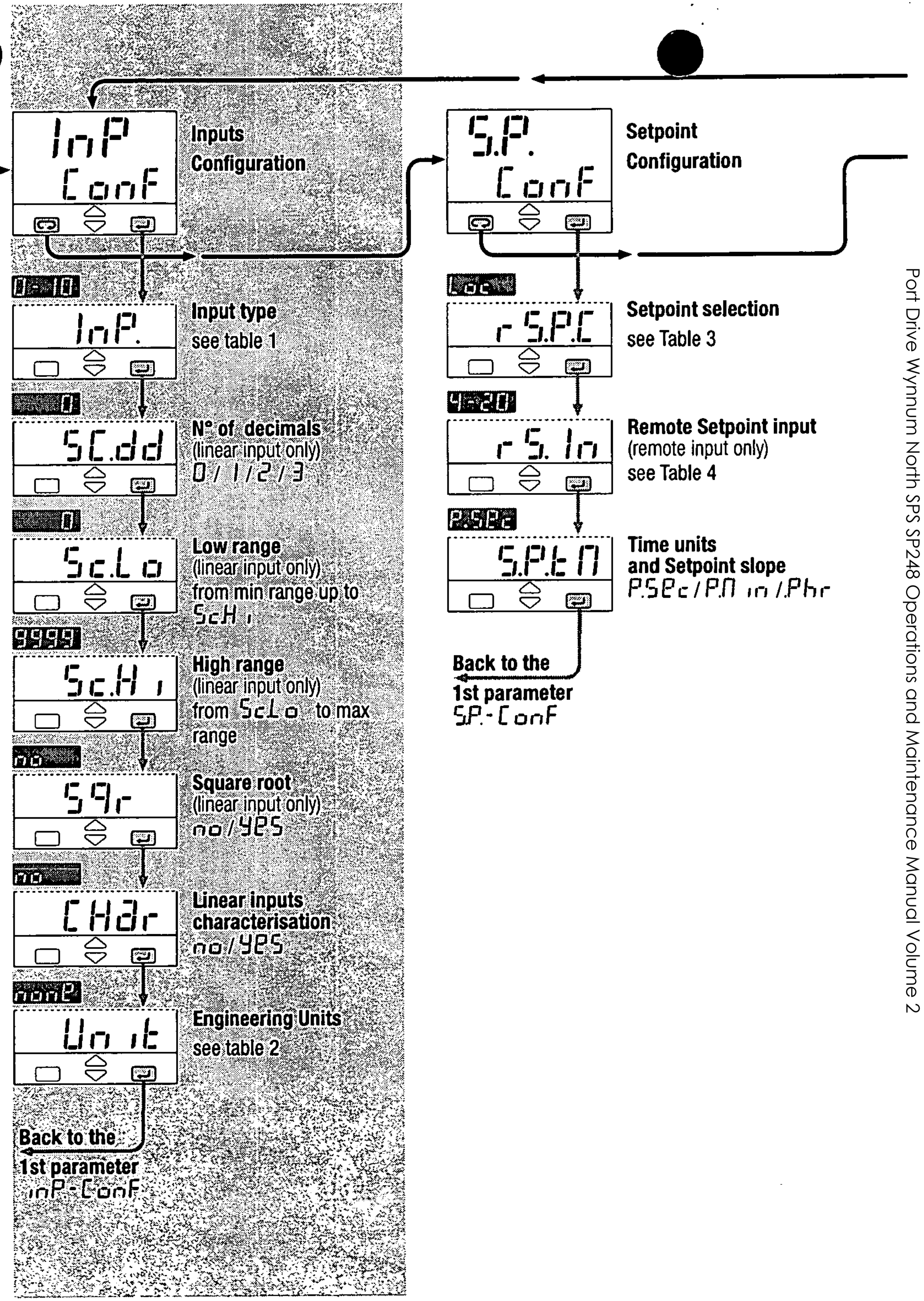
(Way to modified configuration page 16 / 18)

Press the ⮝ or ⮟ to display the next or previous mnemonic for the selected parameter. Continued pressing of ⮝ or ⮟ will display further mnemonics at a rate of one mnemonic every 0.5 sec. The mnemonic displayed at the time the next parameter is selected, is the one stored in the parameter.

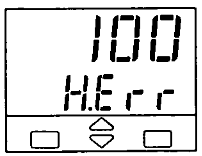


## 4.2 CONFIGURATION PROCEDURE

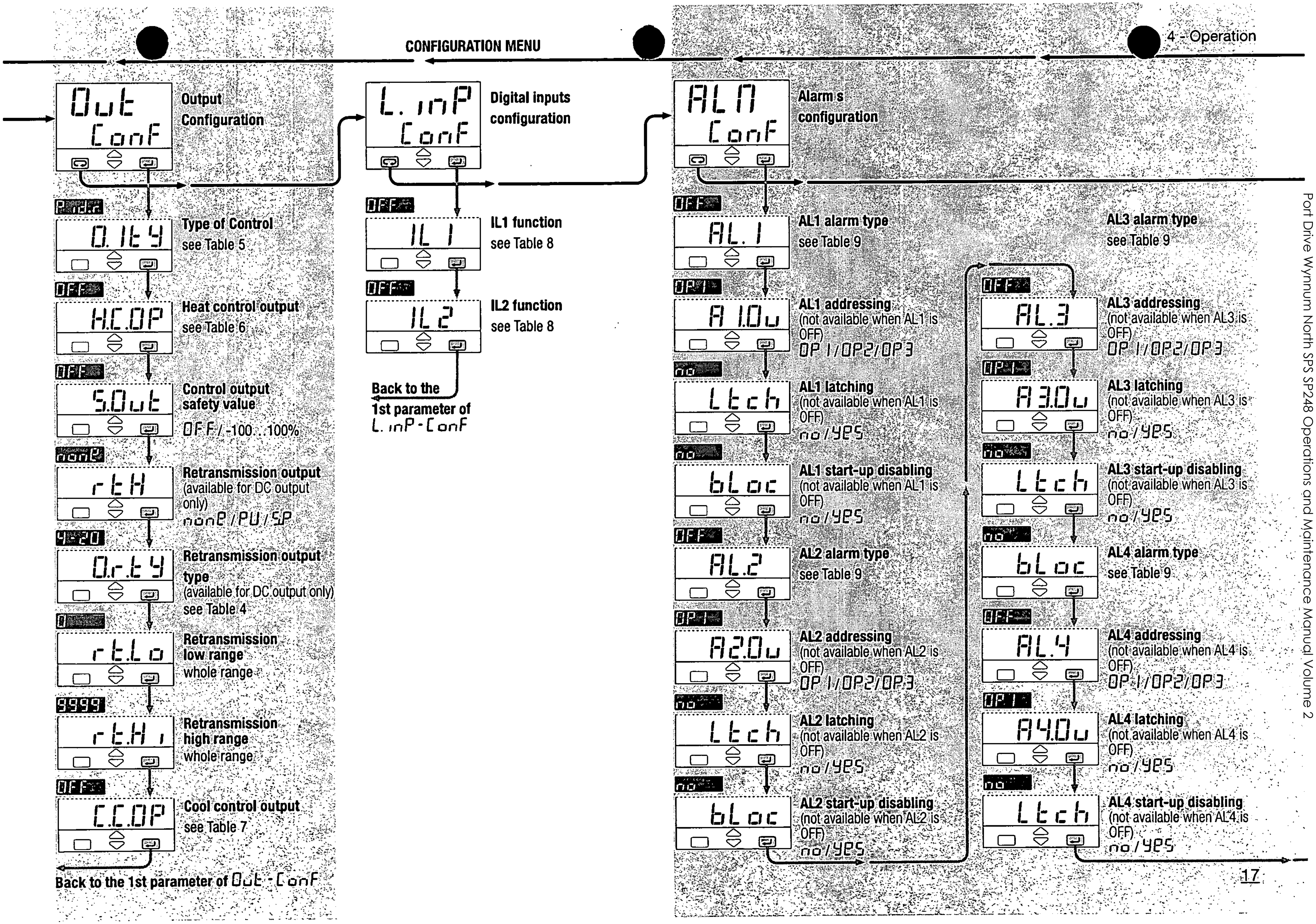


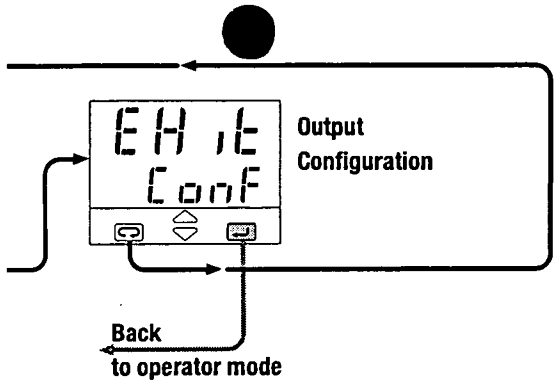



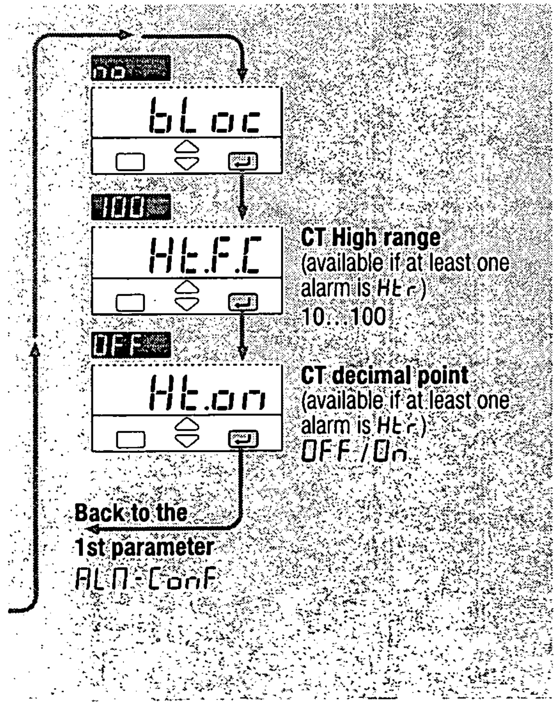

If the configured hardware option is not installed, the display shows an hardware error message




| | |
|---|---|
| 100 | Analog output not installed |
| 101 | Current trasformer not installed |
| 102 | Remote Setpoint input not installed |
| 103 | Potentiometer input not installed |
| 104 | Analogue output + Remote Setpoint not installed |


4 - Operation
CONFIGURATION MENU
Out ConF
Output Configuration
P.idr
O.ItY
Type of Control see Table 5
OFF
H.C.OP
Heat control output see Table 6
OFF
S.Out
Control output safety value
OFF / -100...100%
nonE
rtH
Retransmission output (available for DC output only)
nonE / PU / SP
4-20
Or.tY
Retransmission output type (available for DC output only) see Table 4
0
rt.Lo
Retransmission low range whole range
9999
rt.Hi
Retransmission high range whole range
OFF
CC.OP
Cool control output see Table 7
Back to the 1st parameter of Out - ConF
L.inP ConF
Digital inputs configuration
OFF
IL1
IL1 function see Table 8
OFF
IL2
IL2 function see Table 8
Back to the 1st parameter of L.inP-ConF
ALM ConF
Alarm s configuration
OFF
AL.1
AL1 alarm type see Table 9
OP1
A1.Ou
AL1 addressing (not available when AL1 is OFF)
OP1/OP2/OP3
no
Ltch
AL1 latching (not available when AL1 is OFF)
no/YES
no
bLoc
AL1 start-up disabling (not available when AL1 is OFF)
no/YES
OFF
AL.2
AL2 alarm type see Table 9
OP1
A2.Ou
AL2 addressing (not available when AL2 is OFF)
OP1/OP2/OP3
no
Ltch
AL2 latching (not available when AL2 is OFF)
no/YES
no
bLoc
AL2 start-up disabling (not available when AL2 is OFF)
no/YES
OFF
AL.3
AL3 alarm type see Table 9
OP1
A3.Ou
AL3 addressing (not available when AL3 is OFF)
OP1/OP2/OP3
no
Ltch
AL3 latching (not available when AL3 is OFF)
no/YES
no
bLoc
AL3 start-up disabling (not available when AL3 is OFF)
no/YES
OFF
AL.4
AL4 alarm type see Table 9
OP1
A4.Ou
AL4 addressing (not available when AL4 is OFF)
OP1/OP2/OP3
no
Ltch
AL4 latching (not available when AL4 is OFF)
no/YES
AL4 start-up disabling (not available when AL4 is OFF)
no/YES
17




**Tab. 1 Input type**

| Value | Description | InP. |
|---|---|---|
| tc. J | 0...600°C | 32...1112°F |
| tc. L | 0...600°C | 32...1112°F |
| tc. K | 0...1200°C | 32...2192°F |
| tc. S | 0...1600°C | 32...2912°F |
| tc. r | 0...1600°C | 32...2912°F |
| tc. t | -200...400°C | -328...752°F |
| cuSt | Custom range on request | |
| rtd1 | -200...600°C | -328...1112°F |
| rtd2 | -99.9...300.0°C | -99.9...572.0°F |
| dELt | -50.0...50.0°C | -58.0...122.0°F |
| mV | 0...50 mV | Engineering units |
| 0-5 | 0...5 Volt | |
| 1-5 | 1...5 Volt | |
| 0-10 | 0...10 Volt | |
| 0-20 | 0...20 mA | |
| 4-20 | 4...20 mA | |

**Tab. 2 Engineering units**

| Value | Description Un.it |
|---|---|
| nonE | None |
| °C | Degree centigrade |
| °F | Degree Fahrenheit |
| mA | mA |
| mV | mV |
| U | Volt |
| bar | bar |
| PSI | PSI |
| rh | Rh |
| Ph | Ph |

**Tab. 3 Setpoint type**

| Value | Description r.SP.C. |
|---|---|
| Loc | Local only |
| rEm | Remote only |
| L-r | Local/remote only |
| Loc.t | Local - trim |
| rEm.t | Remote - trim |

**Tab. 4 Rem. Setpoint r.S.In / Retransmission O.r.tY**

| Value | Description |
|---|---|
| 0-5 | 0...5 Volt |
| 1-5 | 1...5 Volt |
| 0-10 | 0...10 Volt |
| 0-20 | 0...20 mA |
| 4-20 | 4...20 mA |

**Tab. 5 Control type**

| Value | Description | O.tY |
|---|---|---|
| OF.r.E | Reverse action | On - Off |
| OF.d i | Direct action | |
| P id.d | Direct action | P.I.D. |
| P id.r | Reverse action | |
| U.d ir | Direct action | Modulating valves |
| U.r EU | Reverse action | |
| H.C.L n | Linear | Heat/ Cool |
| H.C.OL | Oil charac. | |
| H.C.H2 | Water charac. | |

**Tab. 6 Heat control output**

| Value | Description | H.C.OP |
|---|---|---|
| OFF | Not used | |
| r 1 | Relay 1 | Digital signal |
| Lo9 | SSR drive | |
| 0-5 | 0...5 Volt | Analogue signal |
| 1-5 | 1...5 Volt | |
| 0-10 | 0...10 Volt | |
| 0-20 | 0...20 mA | |
| 4-20 | 4...20 mA | |

**Tab. 7 Cool control output**

| Value | Description | C.C.OP |
|---|---|---|
| OFF | not used | |
| r2 | relay 2 | Digital signal |
| Lo9 | SSR drive | |
| 0-5 | 0...5 Volt | Analogue signal |
| 1-5 | 1...5 Volt | |
| 0-10 | 0...10 Volt | |
| 0-20 | 0...20 mA | |
| 4-20 | 4...20 mA | |

**Tab. 8 Digital Inputs function**

| Value | Description IL1 / IL2 |
|---|---|
| OFF | Not used |
| L-r | Local/remote |
| A.mAn | Auto/manual |
| S.P. 1 | 1st stored Setpoint |
| S.P. 2 | 2nd stored Setpoint |
| Pbl | Keyboard lock |
| SLo. I | S.P. slope disable |
| H.PU | Measure hold |
| r.-H. | Run/stop of a program |

**Tab. 9 Alarm type**

| Value | Description | AL1 AL2 / AL3 AL4 |
|---|---|---|
| OFF | Not used | |
| FS.H | High active | Absolute |
| FS.L | Low active | |
| dEU.H | High active | Deviation |
| dEU.L | Low active | |
| bAnd | Out active | Band |
| Htr | High active | Heater Break |
| Lb3 | Loop break alarm (Al1 only) | |

## 4.2.1 AL1, AL2, AL3, AL4 ALARMS CONFIGURATION

It is possible to configure up to 4 alarms: AL1, AL2, AL3, AL4 (see pag. 17), selecting, for each of them:

**A** the type and the operating condition of the alarm
(table 9 page 18)

**B** the functionality of the alarm acknowledge (latching) Ltch

**C** the start-up disabling (blocking) bLoc

**D** the physical output of the alarm
OP 1 OP2 OP3

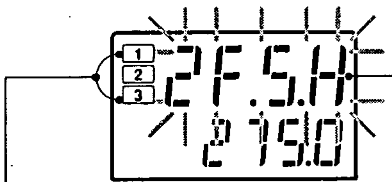
**The outputs can be used for alarms if they are not used as control outputs (see par. 3.3.5 page12)**

It is possible to route up to 4 alarm to a single output (OR of the alarms).

**Alarm occurrence display**

This function can be enabled by the configuration software.
(please read the user instruction on the "M5 LINE MODBUS /JBUS PROTOCOL", supplied separately)

The type of alarm is presented flashing, on the front panel in alternation with the PV value.

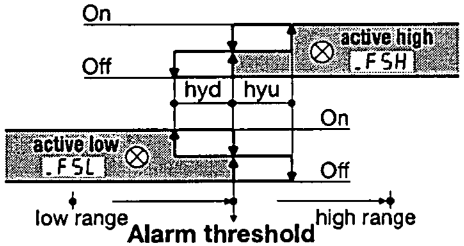



The red led of the activated alarm output is on.

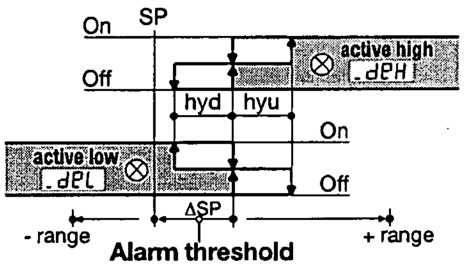
The range of the alarm threshold correspond to the whole span and it is not limited by the SP Setpoint span.

### [A] OPERATING CONDITIONS

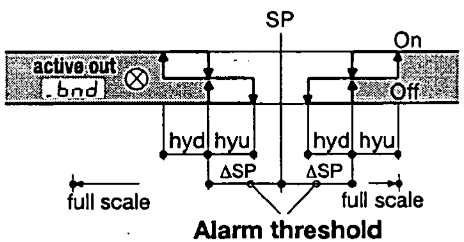
**Absolute alarm**




**Deviation alarm**

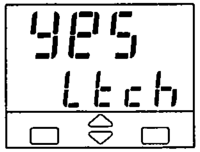



**Band alarm**



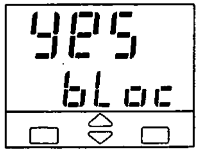

### [B] ALARM ACKNOWLEDGE FUNCTION

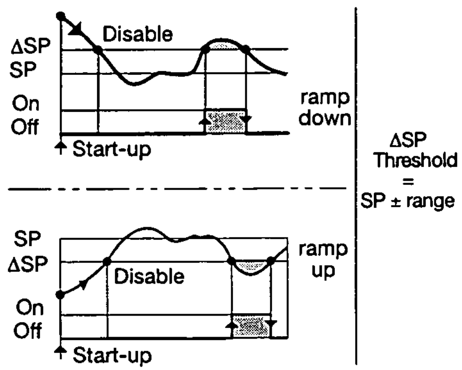
The alarm, once occurred, is presented on the display until to the time of acknowledge. The acknowledge operation consists in pressing any key.




After this operation, the alarm leaves the alarm state only when the alarm condition is no longer present.

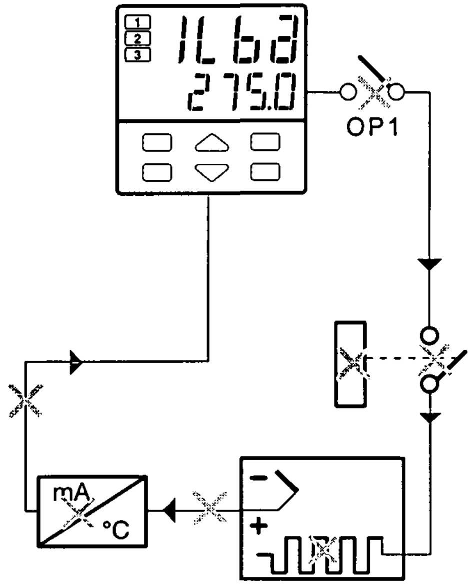
### [C] START-UP DISABLING



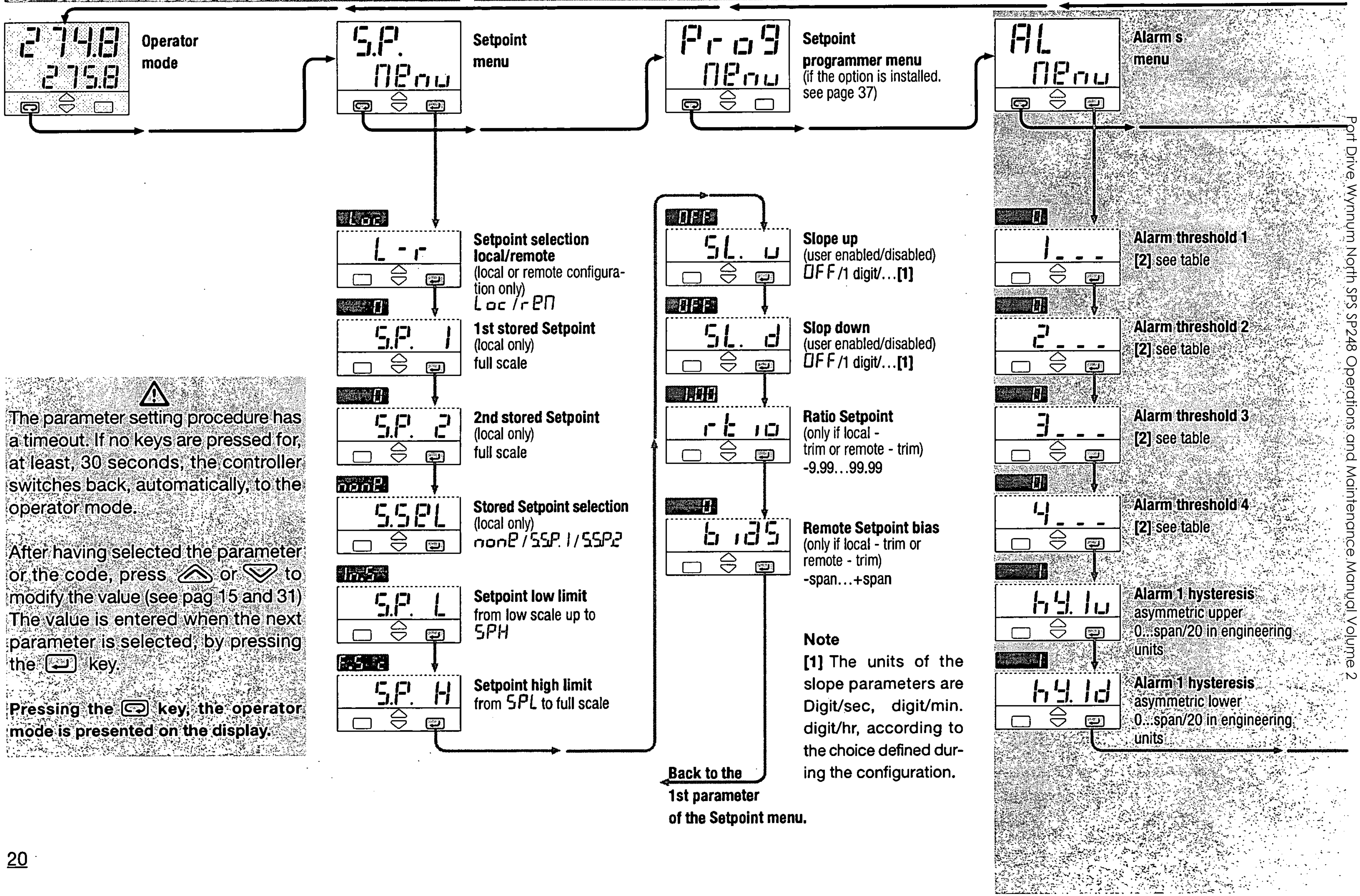

### [D] LOOP BREAK ALARM LBA

When the controller connection to the sensor is discontinued or other faults are detected in the control loop, the AL1 alarm becomes active, after a predefined time of 1 to 9999 sec., from the detection of the failure. (see page 22)
The alarm state ceases when the fault condition is no longer present.




⚠ **In case of ON-OFF control, the LBA alarm is not active.**

## 4.3 PARAMETER SETTING



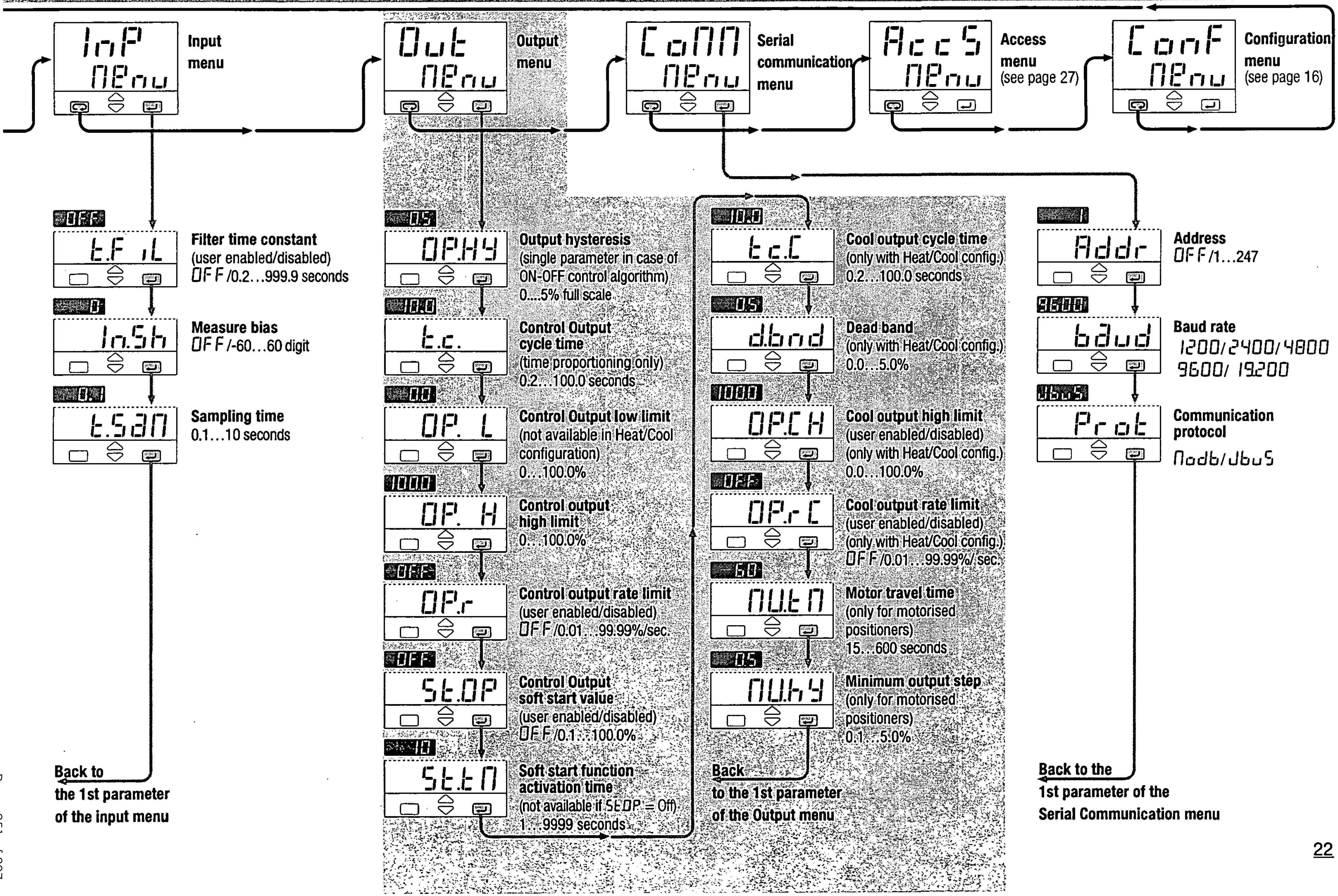

⚠ The parameter setting procedure has a timeout. If no keys are pressed for, at least, 30 seconds, the controller switches back, automatically, to the operator mode.

After having selected the parameter or the code, press ⏶ or ⏷ to modify the value (see pag 15 and 31). The value is entered when the next parameter is selected, by pressing the ↵ key.

**Pressing the ⎘ key, the operator mode is presented on the display.**

**Note**

**[1]** The units of the slope parameters are Digit/sec, digit/min. digit/hr, according to the choice defined during the configuration.


InP MEnu
Input menu
Out MEnu
Output menu
CoMM MEnu
Serial communication menu
AccS MEnu
Access menu (see page 27)
ConF MEnu
Configuration menu (see page 16)
t.F iL
Filter time constant
(user enabled/disabled)
OFF/0.2…999.9 seconds
In.Sh
Measure bias
OFF/-60…60 digit
t.SaM
Sampling time
0.1…10 seconds
Back to the 1st parameter of the input menu
OP.HY
Output hysteresis
(single parameter in case of ON-OFF control algorithm)
0…5% full scale
t.c.
Control Output cycle time
(time proportioning only)
0.2…100.0 seconds
OP. L
Control Output low limit
(not available in Heat/Cool configuration)
0…100.0%
OP. H
Control output high limit
0…100.0%
OP.r
Control output rate limit
(user enabled/disabled)
OFF/0.01…99.99%/sec.
St.OP
Control Output soft start value
(user enabled/disabled)
OFF/0.1…100.0%
St.tM
Soft start function activation time
(not available if StOP = Off)
1…9999 seconds
t.c.C
Cool output cycle time
(only with Heat/Cool config.)
0.2…100.0 seconds
d.bnd
Dead band
(only with Heat/Cool config.)
0.0…5.0%
OP.CH
Cool output high limit
(user enabled/disabled)
(only with Heat/Cool config.)
0.0…100.0%
OP.rC
Cool output rate limit
(user enabled/disabled)
(only with Heat/Cool config.)
OFF/0.01…99.99%/sec.
MU.tM
Motor travel time
(only for motorised positioners)
15…600 seconds
MU.hY
Minimum output step
(only for motorised positioners)
0.1…5.0%
Back to the 1st parameter of the Output menu
Addr
Address
OFF/1…247
bAud
Baud rate
1200/2400/4800
9600/19200
Prot
Communication protocol
Modb/JbuS
Back to the 1st parameter of the Serial Communication menu

## 4.3.1 PARAMETERS

The controller parameters have been organised in group, according to their functionality area.

### SETPOINT MENU

**SP. 1** — **1st stored Setpoint**

**SP. 2** — **2nd stored Setpoint**

Values of the two Setpoints, that are activated by mean of digital inputs, communication parameters, and keyboard. The Setpoint active is indicated by the SP1 or SP2 green led.

**SP. L** — **Setpoint low limit**

**SP. H** — **Setpoint high limit**

High and low limit of the Setpoint SP. The minimum span (SP1-SP2) must be greater than 100 digit.

**SL. u** — **Setpoint ramp up**

**SL. d** — **Setpoint ramp down**

This parameter specifies the maximum rate of change of the Setpoint. Its units are: digit/sec., digit/min. and digit/hour.

When the parameter is OFF, this function is disabled and the new Setpoint value is reached immediately after being entered (through the keyboard, the digital inputs and the serial communication). Otherwise, the value entered is reached according to the configured rate of change.

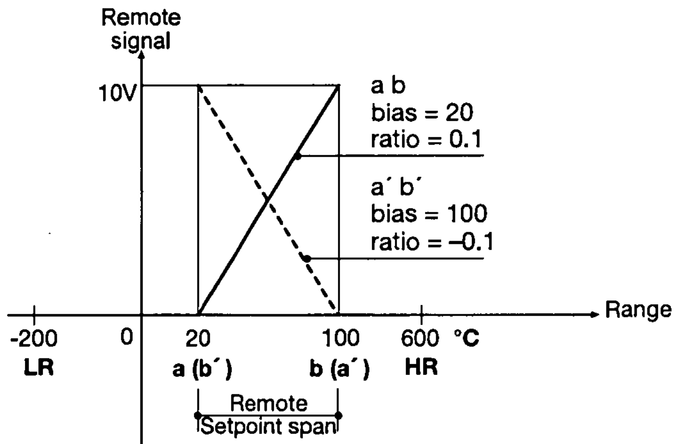
**rt io** — **Remote Setpoint Ratio**

This parameter defines the maximum span of the Remote Setpoint.

**b ids.** — **Remote Setpoint Bias**

It defines the low range of the Remote Setpoint, in engineering units.

**Remote Setpoint Bias and Ratio**




PV = Process variable
LR = PV low limit
HR = PV high limit
SR = Remote Setpoint
a (a') = SR starting point
b (b') = SR ending point

If SR starting point is **lower** then the ending point, both expressed in engineering units:

b iAS = starting point = a

$$rt\ io = \frac{b - a}{HR - LR}$$

Example:
b iAS = 20
rt io =

$$\frac{100 - 20}{600 - (-200)} = \frac{80}{800} = 0.1$$

If SR starting point is **higher** then the ending point, both expressed in engineering units

b iAS = starting point = a′

$$rt\ io = \frac{b' - a'}{HR - LR}$$

Example:
b iAS = 100
rt io =

$$\frac{20 - 100}{600 - (-200)} = \frac{-80}{800} = -0.1$$

**Working Setpoint (SP) as combination of Local Setpoint (SL) and remote signal**

Setpoint type LocL
(table 3, page 18)
SP = SL + (rt io • REM) + b iAS

Setpoint type rEnt
(table 3, page 18)
SP = REM + (rt io • SL) + b iAS

SIGN = Remote signal percentage
SPAN = HR-LR

$$REM = \frac{SIGN * SPAN}{100}$$

Examples:
Local Setpoint (SL) with an external Trim with multiplying coeff. of 1/10:
Setpoint type = LocL
rt io = 0.1
b iAS = 0

Remote Setpoint (SR) with an internal Trim with multiplying coeff. of 1/5:
Setpoint type = rEnt
rt io = 0.2
b iAS = 0

Remote Setpoint range equal to the Input range:
Setpoint type = LocL
rt io = 1
b iAS = LR
SL = 0

**ALARM MENU**
(see page 19)

**PID MENU**

| | |
|---|---|
| P.b. | **Proportional Band** |
| P.b. C | **Cool Proportional Band** |

This parameter specifies the proportional band coefficient that multiplies the error (SP - PV)

| | |
|---|---|
| t. i. | **Integral Time** |
| t. i. C | **Cool integral Time** |

It is the integral time value, that specifies the time required by the integral term to generate an output equivalent to the proportional term
When OFF the integral term is not included in the control algorithm.

| | |
|---|---|
| t.d. | **Derivative Time** |
| t.d. C | **Cool Derivative Time** |

It is the derivative term coefficient that specifies the time required by the proportional term P to reach the level of D.
When OFF the derivative term is not included in the control algorithm.

## 4.3.1 PARAMETERS (cont.)

**O.C.** **Overshoot control**

(Automatically disabled when the adaptive tune is running)
This parameter specifies the span of action of the overshoot control. Setting lower values (1—>0.01) the overshoot generated by a Setpoint change is reduced. The overshoot control doesn't affect the effectiveness of the PID algorithm.
Setting 1, the overshoot control is disabled.

**M.rES** **Manual reset**

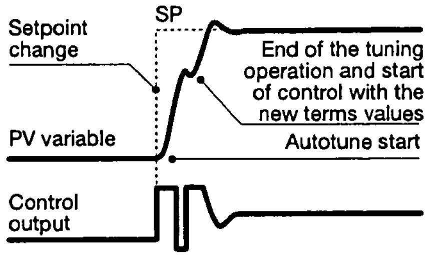
This term specifies the value of the control output when PV = SP, in a PD only algorithm (lack of the Integral term).

## TUNING

Two tuning method are provided:
- Initial one shoot **Autotuning**
- Continuous, self learning **Adaptive Tuning**

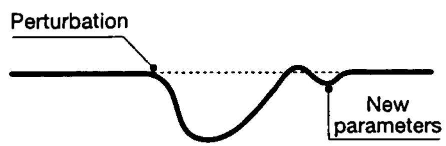
When the **Autotuning** is started, the controller generates a rapid burst of ON - OFF transition and monitors the response, in order to calculate the optimal PID terms parameters. Once calculated the terms values are immediately used in the control algorithm. (a minimun error of 5% of span is needed to start the Autotuning)

One shot initial **autotuning**




The self-learning **adaptive autotune**, developed by ASCON, is not intrusive. It doesn't affect the process, at all, during the phase of calculation of the optimal terms parameters.
**It is particularly suitable for controlling process whose control characteristics change with time or are not linear in relation to the Setpoint values.**
It doesn't require any operation by the user. It is simple and works fine: it samples continuously the process response to the various perturbations, determining the frequency and the amplitude of the signals. On the basis of this data and their statistical values, stored in the instrument, it modifies automatically the PID term parameters.
It is the ideal for all applications where it is required to change continuously the PID terms parameters, in order to adjust the PID to the changes of the process dynamic conditions.

Continuous **adaptive tune**



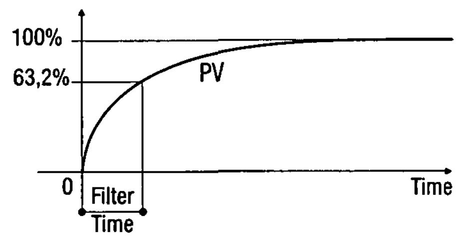

**In case of power off with the Adaptive Tune enabled, the values of the PID terms parameters are stored, in order to be reused at the next power on.**
**At power on the Adaptive Tune starts automatically.**

## INPUT MENU

**t.FiL** **Input filter**

Time constant, in seconds, of the RC input filter on the PV input. When this parameter is OFF the filter is bypassed.

Filter reponse




**In.Sh** **Measure Bias**

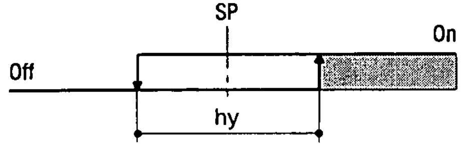
This value is added to the measured PV input value. Its effect is to shift the whole PV scale of its value (±60 digits).

**t.SAM.** **Sampling Time**

Sampling time, in seconds, of the instrument. This parameter is normally used when controlling slow process, increasing the sampling time from 0.1 to 10 seconds.

## OUTPUT MENU

**OP.hy** **Control output hysteresis**




Control output hysteresis span, hy, set in % of the full scale.

**t.c.** **Control output cycle time**

**t.c. C** **Cool cycle time**

It's the cycle time of the time proportioning control output. The PID control output is provided by the pulse width modulation of the waveform.

**OP. L** **Control Output low limit**

It specifies the minimum value of the control output signal.
It is applied in manual mode, too.

**OP. H** **Control output high limit**

**OPC.H** **Cool output high limit**

It specifies the maximum value the control output can be set. It is applied in manual mode, too.

**OP.r** **Heat output maximum rate**

**OP.r C** **Cool output maximum rate**

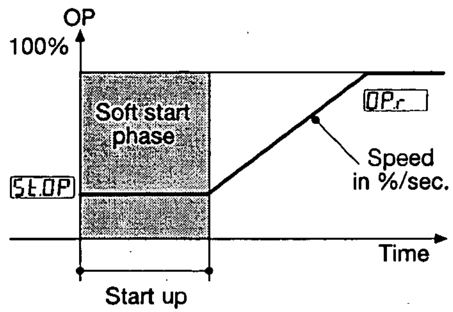
This value, specified in %/seconds, with range from 0.01 to 99.99%/sec. provides the maximum rate of change of the output. When set to OFF this function is disabled.

**St.OP** **Soft start of the control output**

It specifies the value at which the control output is set during the start up phase.

**St.tm** **Soft start time**

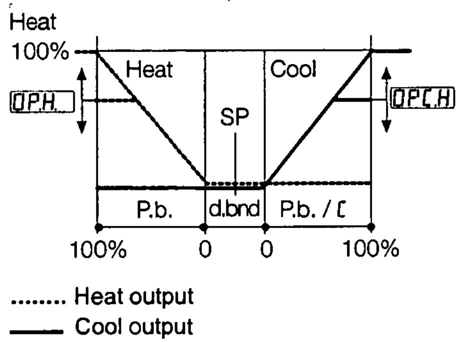
This value specifies the time the start up phase lasts. The start up phase starts at power up of the controller.




**d.bnd** **Heat/Cool deadband**

This parameter specifies the width of the deadband between the Cool and the Heat channel

**Heat / Cool algorithm**




**mU.tm** **Travel time**

It provides the time required to the motor positioner to go from the 0% position to 100%

**mU.hy** **Minimum step**

It specifies the minimum allowed time of activation of the output to a motor positioner that produces a sensible effect. It is related to the deadband of the positioner

## SERIAL COMMUNICATION MENU

**Addr** **Controller address**

The address range is from 1 to 247 and must be unique for each controller on the communication bus to the supervisor.
When set to OFF the controller is not communicating

**bAud** **Baud rate**

It provides the baud rate in the range from 1200 to 19.200 bit/sec.

**Prot** **Communication protocol**

Modb/Jbus

This Slave protocol allows the supervisor to read and write (when it is possible) all the parameters of the controller.

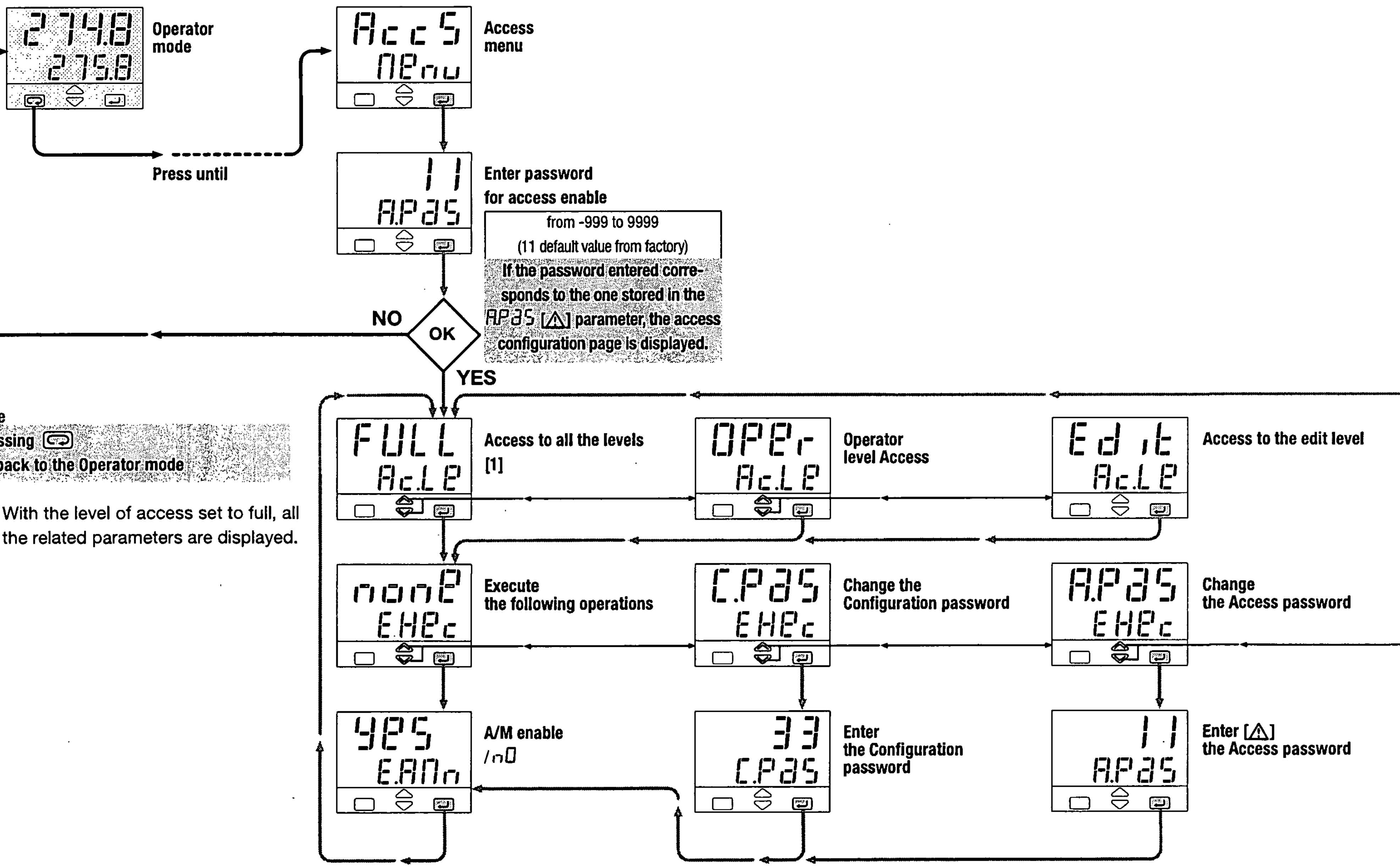
## ACCESS MENU

(see page 27)

## CONFIGURATION MENU

(see page 16)

## 4.4 ACCESS LEVEL - PASSWORD - CALIBRATION




**Note**
Pressing [button] go back to the Operator mode

[1] With the level of access set to full, all the related parameters are displayed.

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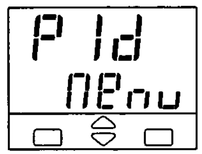
## 4.4 ACCESS LEVELS PASSWORD CALIBRATION

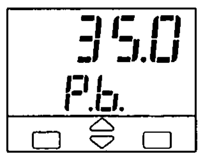
**With the access level Edit, the user defines which groups and parameters are accessible to the operator**

After selecting and confirming the access level Edit, enter in the parameters menu.
The code of the access level is displayed on the front panel.

Press the ⩓ and ⩔ keys to select the proper level.




| Group of parameters | Code | Access level |
|---|---|---|
| | rEAd | Visible |
| | HidE | Not visible |

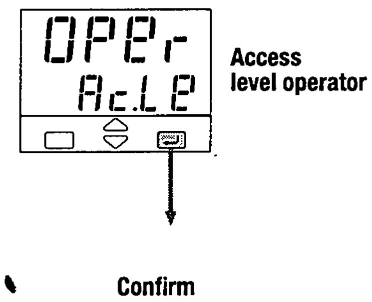


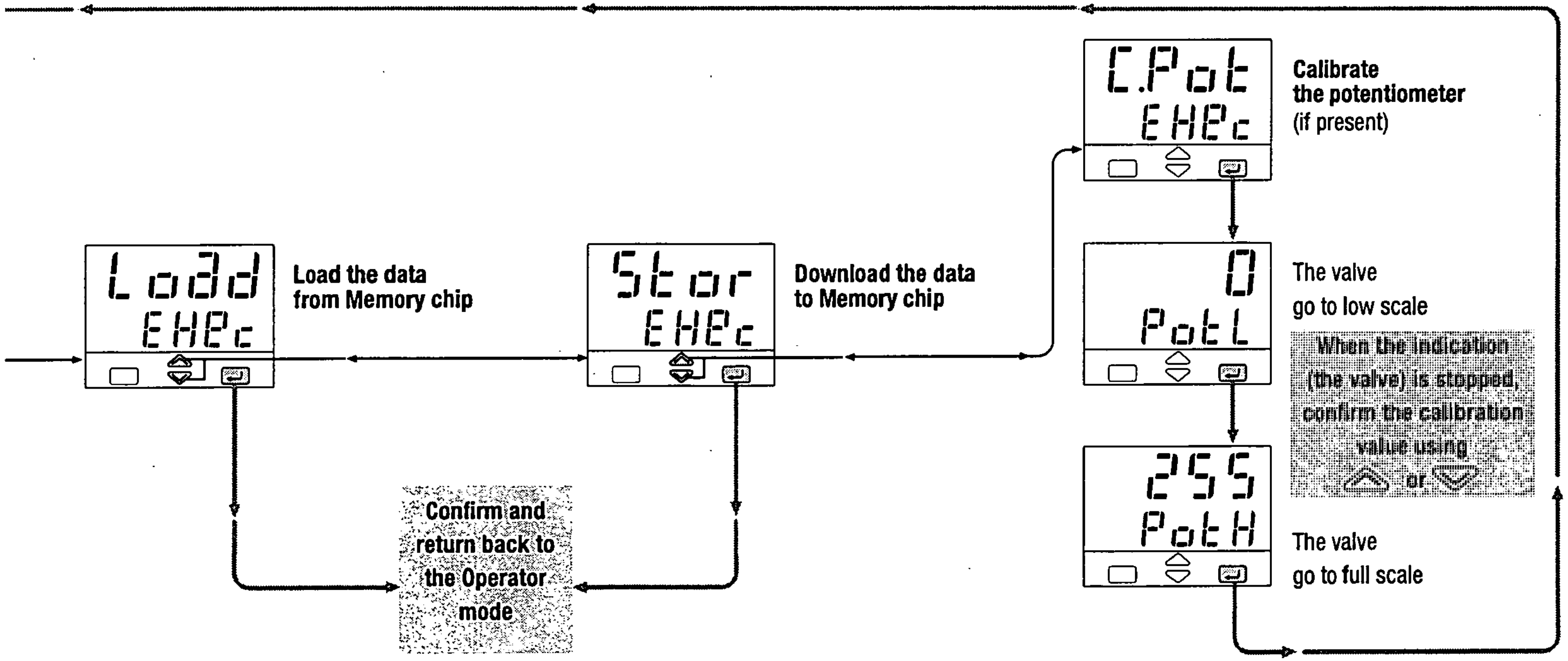

| Parameters | Code | Access level |
|---|---|---|
| | AltR | Visible and changeable |
| | FASt | Included in "Fast view" |
| | rEAd | Visible only |
| | HidE | Not visible and not changeable |

The parameters in the access level FASt are recalled on the front panel through the procedure of fast parameter access illustrated in par. 5.2 pag 29. The maximum number of fast parameters is 10.

At the end of the parameter list of the selected group, the controller quits from the Edit access level.
**Therefore, the Edit level must be selected for each group of parameters**

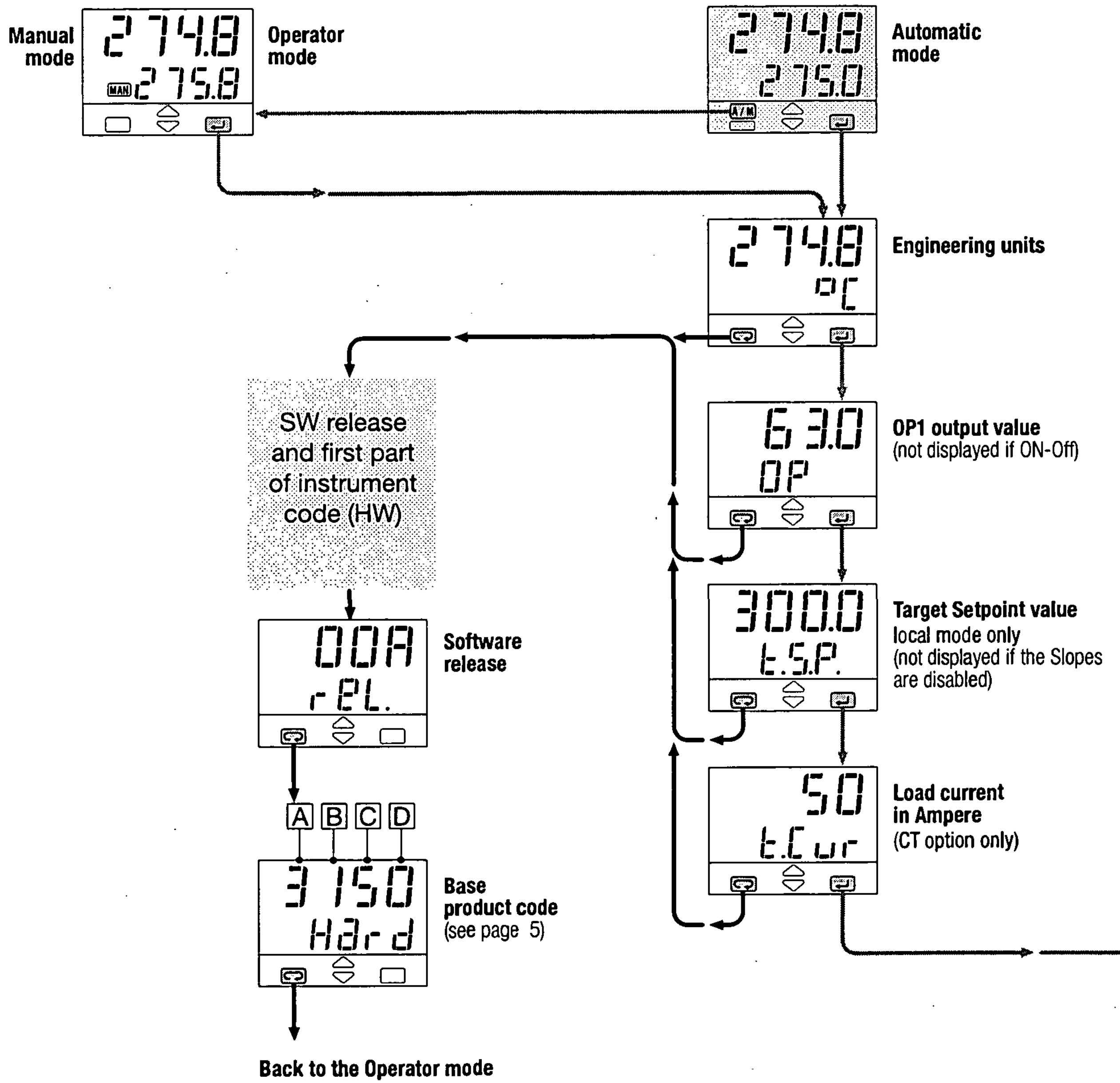
The access level of groups and parameters, is activated through



# 5 DISPLAYS

## 5.1 STANDARD DISPLAY



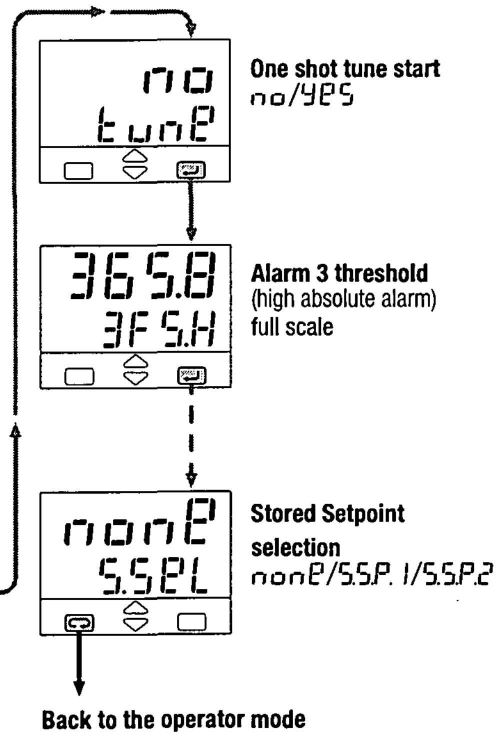

## 5.2 FAST VIEW (fast access to the parameters)

With this procedure, simple and fast, up to 10 parameters, selected through the fast view (see par 4.4 page 28) are displayed and can be modified by the operator without requiring the standard parameter setting procedure.

Press ⇧⇩ in order to modify the parameters

The value is entered by pressing ↵ key

Example of common parameters included in the fast view (fast access)



# 6 COMMANDS

## COMMANDS TO THE CONTROLLER AND OPERATING PHASES

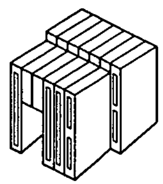
The commands can be entered in 3 ways:


### 6.1 KEYBOARD

- Setpoint modification (page 31)
- local/remote selection (page 31)
- stored Setpoint display (page 31)
- manual mode (page 32)
- tuning start (page 32)
- programmer stop (page 38)

### 6.2 DIGITAL INPUTS

see page 33



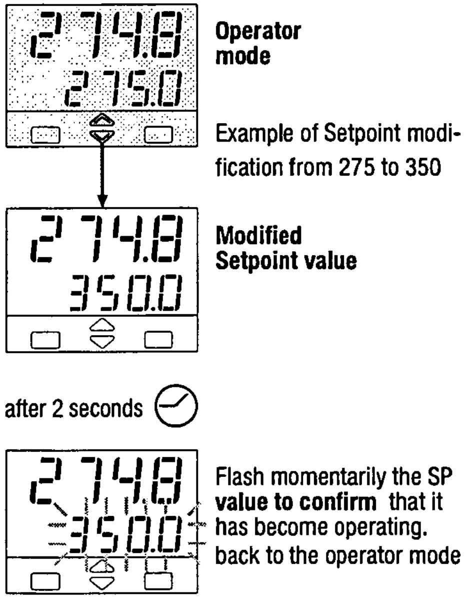
### 6.3 SERIAL COMMUNICATIONS

see the manual on this topic

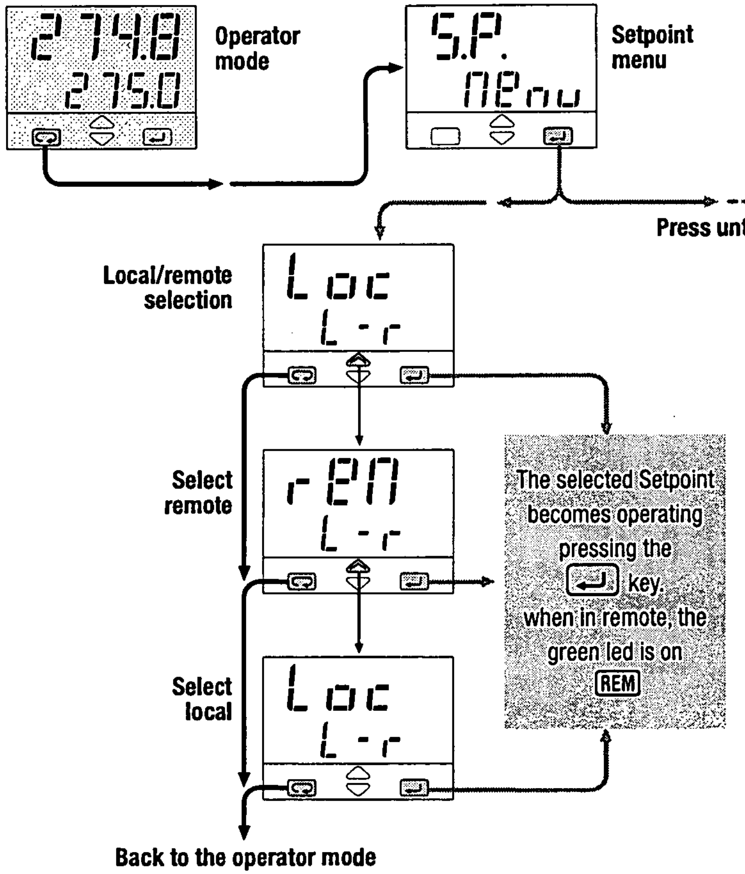
## 6.1 KEYBOARD COMMANDS

### A. SETPOINT MODIFICATION

The Setpoint is directly modified with the keys.
Once entered, the new value is checked and becomes operating after 2 seconds.. The end of this phase is flagged by flashing momentarily the display with SP.

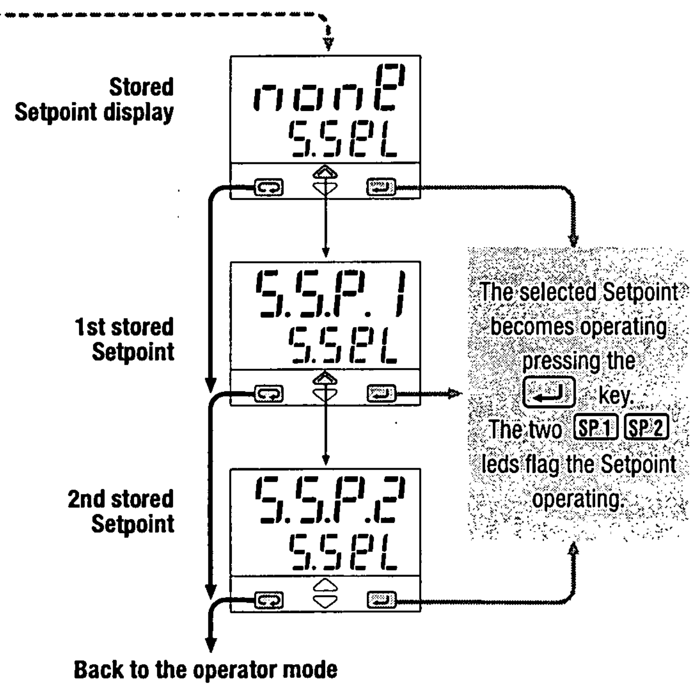



### B. LOCAL/REMOTE

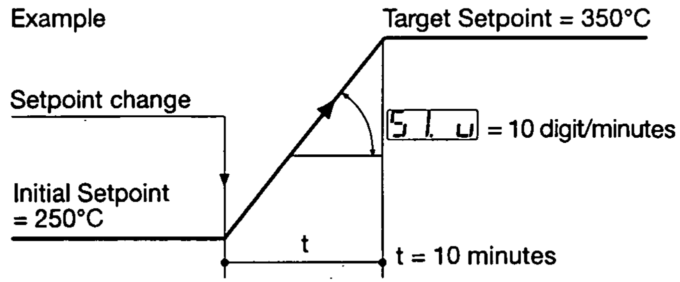



### C. STORED SETPOINTS SELECTION

The Setpoint is directly modified with the keys. Once entered, the new value is checked and becomes operating after 2 seconds.. This phase is flagged by flashing momentarily the display with SP.




**Note:** When the Setpoint value is changed, the entered value is reached with a maximum rate set by the ramp up SL.u and ramp down, SL.d parameter. This applies to all the models and in all the operating modes.
It is suggested to set SL.u and SL.d to OFF when the remote Setpoint is operating.
The entered Setpoint is defined as target Setpoint. It is displayed in the function menu at the parameter t.-S.P.
**If the slope parameter is set to zero the Setpoint variation occurs instantaneously.**

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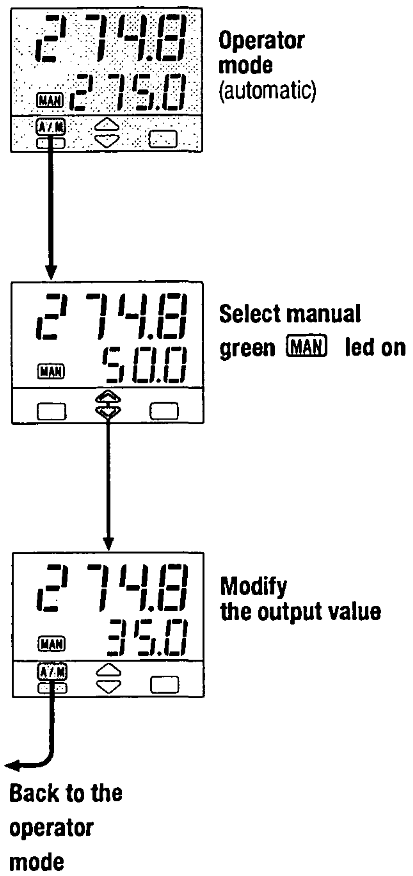
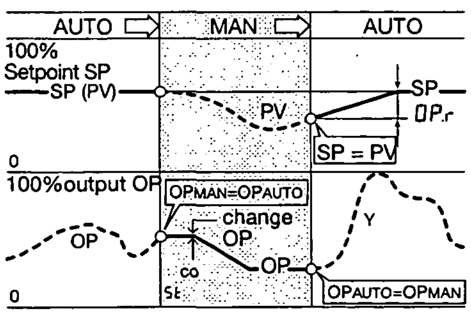
## 6.1.2 AUTO/MANUAL MODE

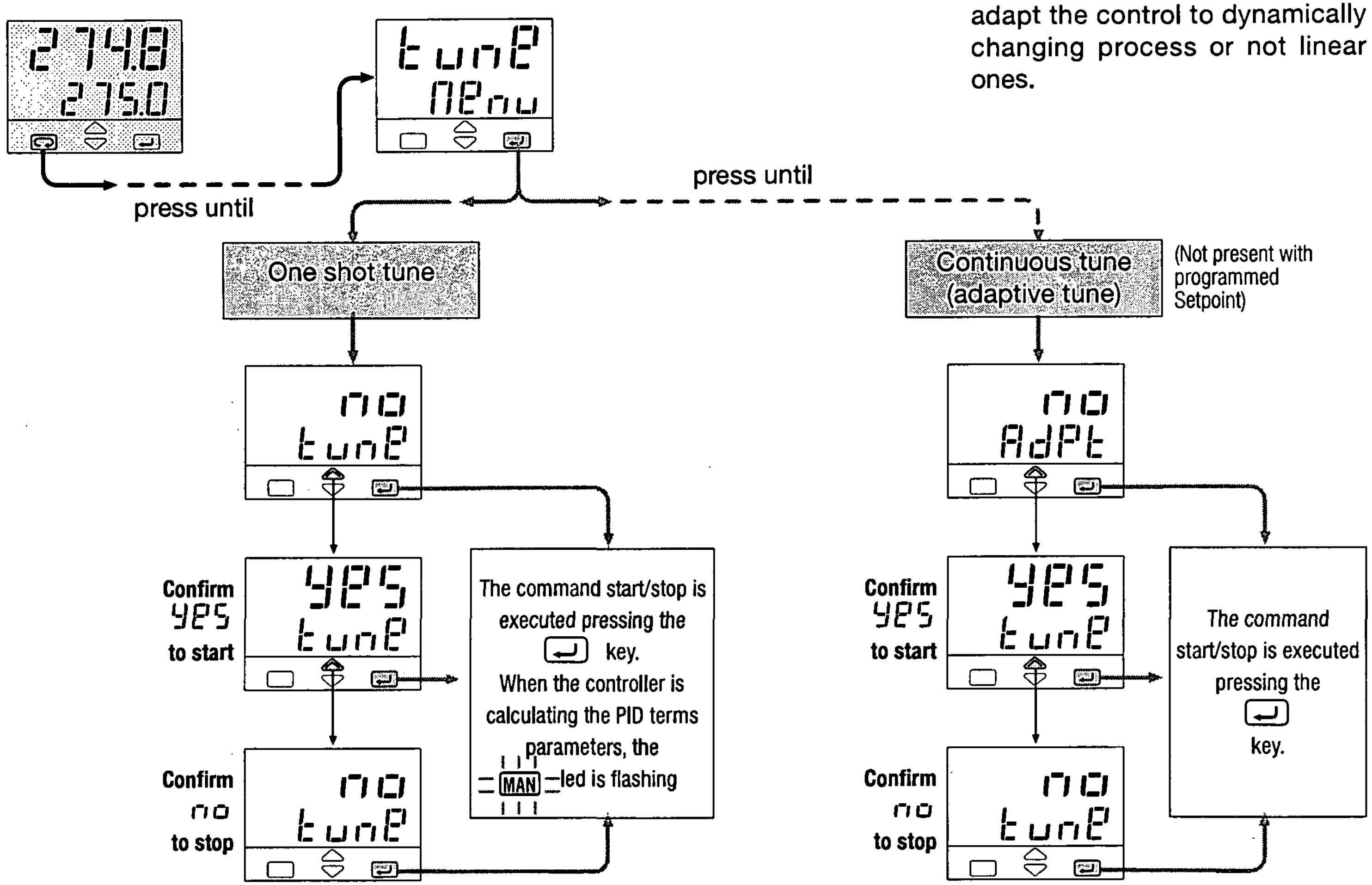



## 6.1.3 TUNING

This controller is provided with 2 different Tuning algorithm

- One shot tune for calculating the optimal PID terms parameters.
- Continuous tuning (adaptive tune) for a continuous calculation of the PID terms parameters in order to adapt the control to dynamically changing process or not linear ones.




After the execution of the tuning, the calculated values are automatically presented in the PID menu.

When this function is in progress, the calculated values are visible in the Tuning menu but cannot be modified. (see page 21)

## 6.2 DIGITAL INPUT COMMANDS

A function is assigned, through the configuration procedure to each IL1 and IL2 digital input. (see the parameters setting at tab 8 at pag 17). The configured function is activated when the digital input (free voltage contact or open collector output) is in the On state . It is deactivated by setting the input to the Off state. The activation of the function through the digital input has the highest priority than through the keyboard or through the serial communication.

| Function | | Parameter value | Performed operation Off | Performed operation On | Note |
|---|---|---|---|---|---|
| None | | nonE | — | — | Not used |
| Set manual mode | | A.Man | Automatic | Manual | |
| Keyboard lock | | Keb.I | Unlock | Locked | With the keyboard locked the commands from digital inputs and serial communication are still operating |
| PV measure hold | | H.PV | Normal operation | PV is hold | The value of PV is "frozen" at the time the digital input goes to the close state |
| Setpoint slopes inhibition | | SLo.I | Rate limiting is active | Normal operation | When the input is in the on state, the Setpoint is changed in steps |
| Standard Setpoint | 1st stored Setpoint | SP.1 | Local | 1st SP | If more than one digital input is selecting a Setpoint, the last to be activated is the one operating. |
| | 2nd stored Setpoint | SP.2 | Local | 2nd SP | |
| | Remote Setpoint | L-r. | Local | Remote | |
| Programmed Setpoint | Start/stop of a program | H.-r. | | Hold/Run | The status (RUN/HOLD) changes every time the digital input switches from Off to On. |

# 7 PROGRAMMED SETPOINT

## INTRODUCTION

The controller supplied with the Setpoint programmer option (mod. M5-3... 1) offers, in alternative to the adaptive tuning, the functionality to define, store, display and execute a program consisting in the Setpoint profile in time.

## MAIN CHARACTERISTICS

- 1 program, 16 segments/program
- start, stop, hold etc, commands from the keyboard
- time base in seconds, minutes or hours
- continuous or up to 1...9999 time cycling of the program
- 1 OP3 digital output with the state profile defined by the program
- setting of the maximum allowed deviation from the Setpoint

## 7.1 PROGRAM STRUCTURE

The program consists of a sequence of segments.

For each segment, it is specified:

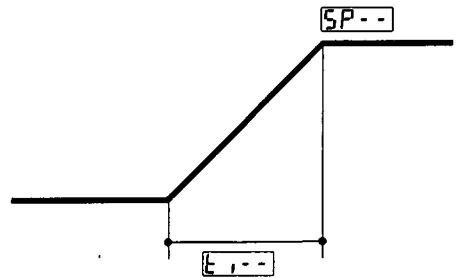
- the Setpoint to reach [S.P.]
- the duration of the segment [t. i.]

(always present)

- the state of the OP3 output

The program consists of:

- 1 initial segment named 0
- 1 end segment named F
- 1...14 normal segments




### Initial segment

Its main purpose is to define the value the process variable has to maintain before starting the program.

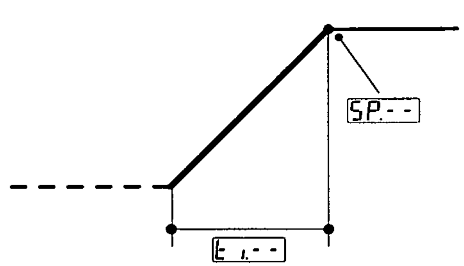
### End segment

Its main purpose is to define the value the process variable has to maintain at the end of the program and until further changes of Setpoint.

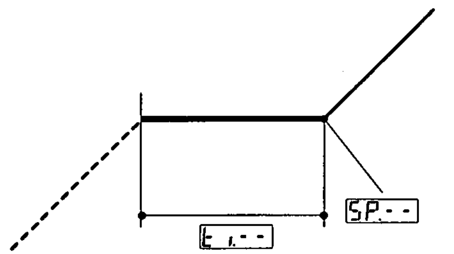
### Normal segments

These segments build up the profile program. There are 3 types of segments:

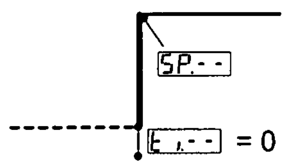
**Ramp**




**Dwell**

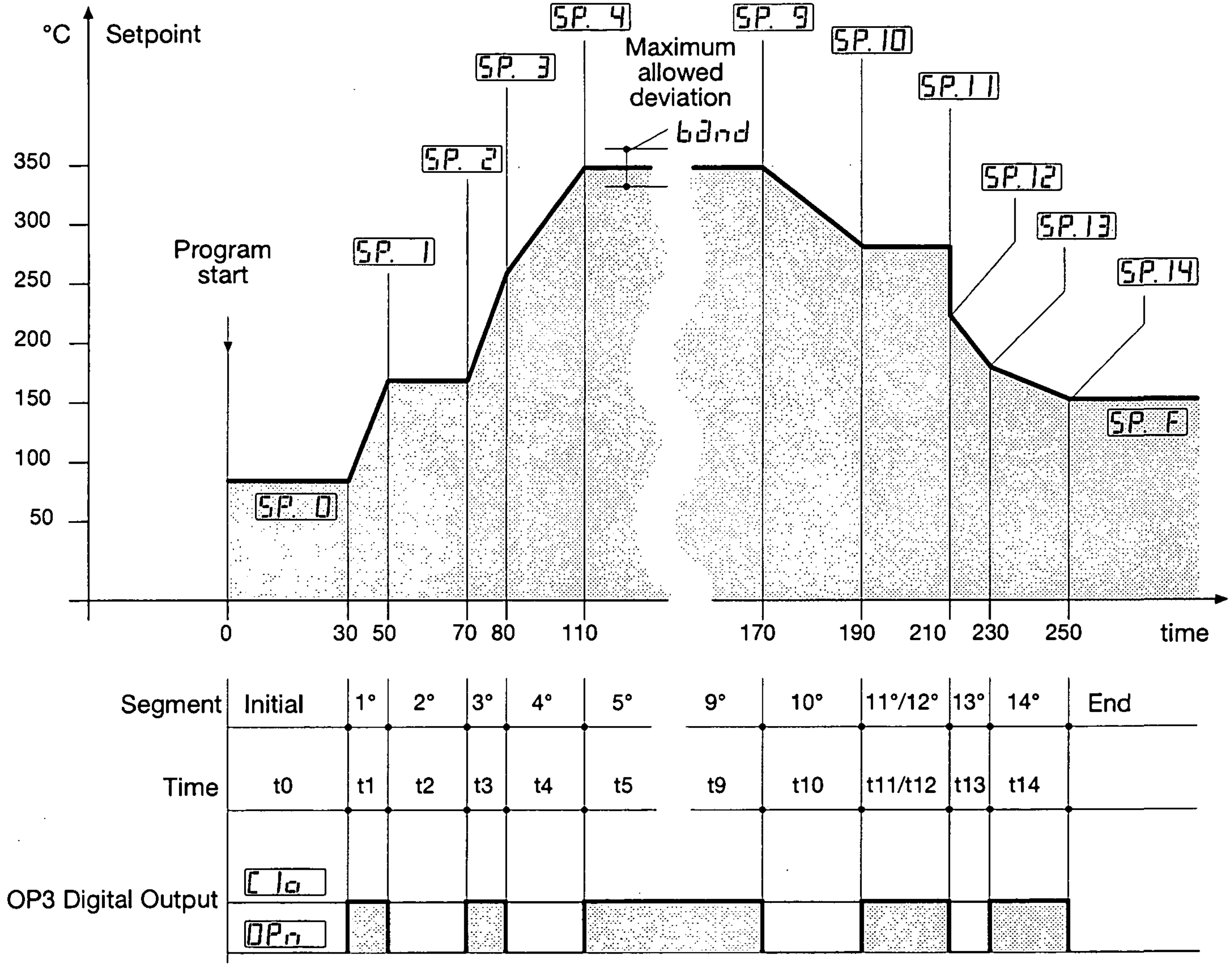



**Step**




S.P. = Target setpoint
t i. = Duration
---- = Previous segment
▬▬ = Current segment
—— = Next segment

## EXAMPLE OF SETPOINT PROFILE




The OP3 digital output state, during the segments, is defined in the program

CLo contact close (On)

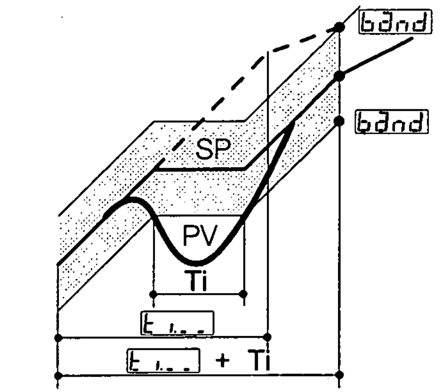
OPn contact open (Off)

## 7.2 SETPOINT PROGRAMMER OPERATION

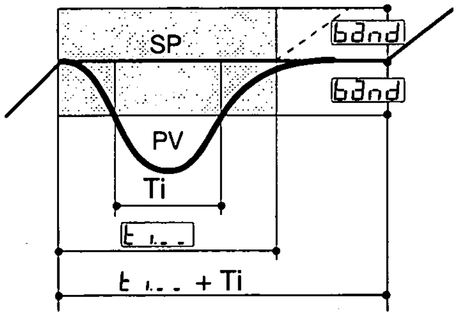
### 7.2.1 MAXIMUM ALLOWED DEVIATION (bAnd)

If the PV controlled input value exceeds the band, centred around the SP, the segment time is extended of the same time the PV input stays out of the band. The band width is defined in a parameter of the program segment. The actual segment period is calculated as t i... +Ti

**A. Ramp**




**B. Dwell**




### 7.2.2 RE-START OF A PROGRAM AFTER A POWER FAILURE

The parameter FAiL . specifies the behaviour of the programmer at power up (see pag.37). Selected between the following 3 choices:

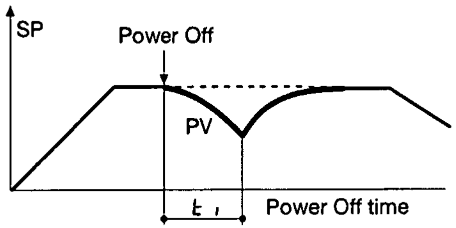
Cont **Continue**

rES **Reset**

rAMP **Ramp**

**If Cont is selected,**
the execution of the program starts from the point reached at the power failure time.

**All the parameters, like Setpoint and the remaining time are restored at the values they had at power off.**

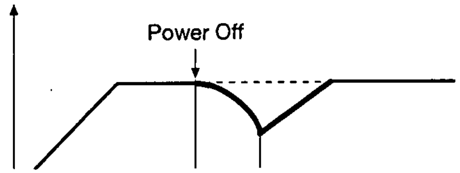



**If rES is selected,**
at power on the program ends and goes back to local mode.

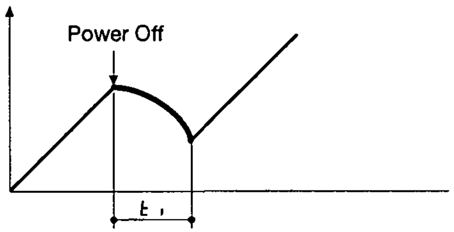
**If rAMP is selected,**
the execution of the program starts from the point reached at the power failure time.
**In this case, the programs continue with PV reaching SV with a ramp, whose slope corresponds to the one of the segment running at the power off.**

**The drawing below illustrates the situation.**

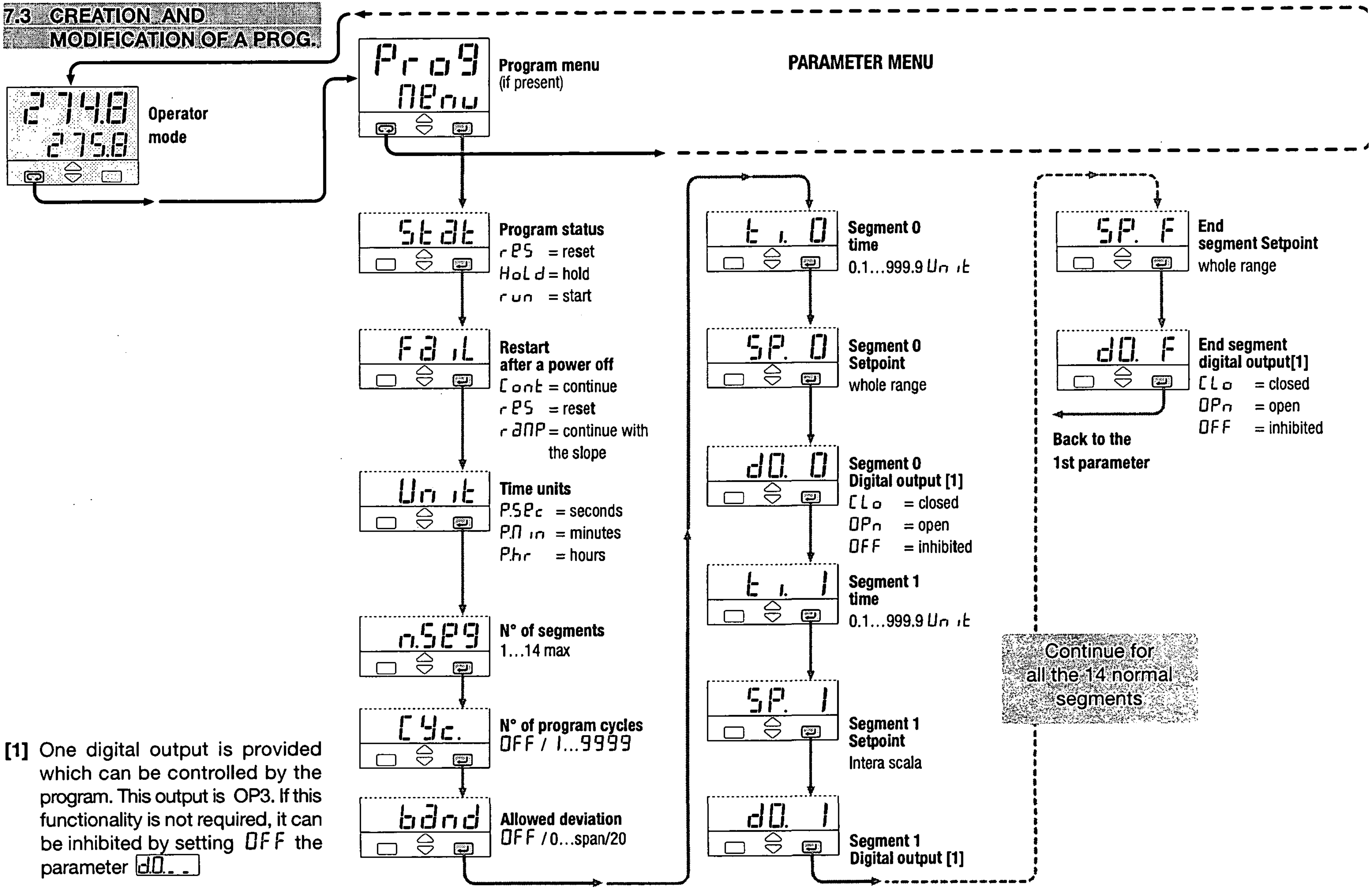
**Power off during a dwell**




**Power off during a ramp**



## 7.3 CREATION AND MODIFICATION OF A PROG.

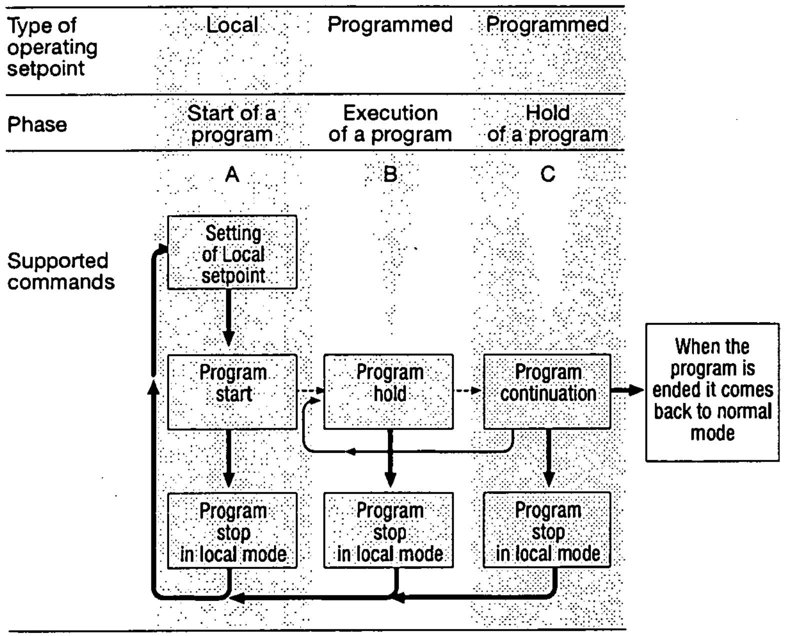



[1] One digital output is provided which can be controlled by the program. This output is OP3. If this functionality is not required, it can be inhibited by setting OFF the parameter dO. . .

## 7.4 START/STOP OF A PROGRAM

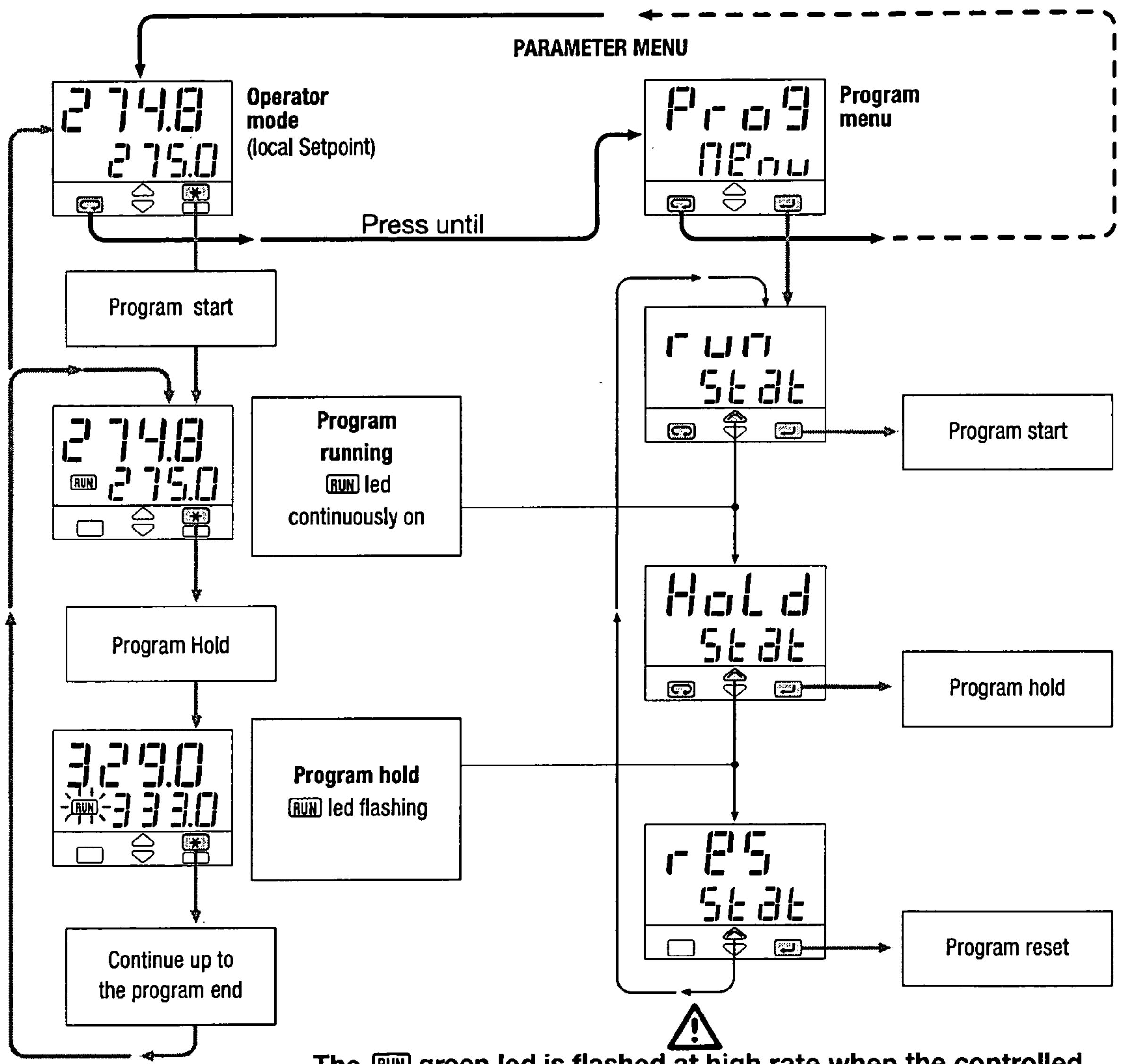
The various commands, supported by the controller, are different for each of the following operating phases:
A] when in Local Setpoint mode
B] during the execution of a program
C] when the program is in hold

Commands supported by the controllers




The different phase are displayed in a chained way, just for easing the understanding of the functionality.
Two different mode for starting and stopping a program are provided:
direct mode with the [*] key
through the parameter menu

## DIRECT MODE WITH / THROUGH THE PARAMETER MENU




The RUN green led is flashed at high rate when the controlled variable is out of the allowed deviation band
The current time of a segment is hold up to the time the variable re-enter in the band.

# 8 TECHNICAL SPECIFICATIONS

| Features at 25 °C env. temp. | Description | | | |
|---|---|---|---|---|
| **Total configurability** | The choices are: input type, operating mode, type of control, safety strategies, alarm strategies | | | |
| **Operating modes** | 1 loop with single/double output | | | |
| | 1 loop as the latter with the addition of the Setpoint programmer | | | |
| **Control mode** | Algorithm | PID with overshoot control or On-off | | |
| | | PID with velocity algorithm, for controlling motorised positioners | | |
| | Proportional band (P) | 0.1…999.9% | | PID control |
| | Integral time (I) | 1…9999 sec. | (user enabled/disabled) | |
| | Derivative time (D) | 0.1…999.9 sec. | | |
| | Error band | 0.1…10.0 digit | | |
| | Manual reset | 1…100% output | (user enabled/disabled) | Time proportioning control |
| | Cycle time | 0.2…100.0 sec. | | Discontinuous control |
| | Hysteresis | 0.1…5.0% | | ON-Off control |
| | Dead band | 0.0…5.0% | | Heat/Cool control |
| | Cool proportional band | 0.1…999.9% | | |
| | Cool Integral time | 1…9999 sec. | (user enabled/disabled) | |
| | Cool Derivative time | 0.1…999.9 sec. | | |
| | Cool cycle time | 0.2…100.0 sec. | | |
| | Motor travel time | 15…600 sec. | | Motorised positioner |
| | Motor minimum step | 0.1…5.0% | | |
| | Feedback potentiometer | 100Ω…10KΩ | | |
| **PV input** (see table 1 page 18 for the signal ranges) | Common characteristics | A/D converter with resolution of 160.000 points<br>Update measurement time: 50 ms<br>Sampling time (max update time of the output) : 0.1…10.0 sec. configurable<br>Input bias: - 60…+ 60 digit<br>Input filter with enable/disable 0.1…999.9 sec. | | |
| | Accuracy | 0.25% ± 1 digits for temperature sensors<br>0.1% ± 1 digits (for mV and mA) | | Between 100…240V~<br>the error is minimal |

| Features at 25°C env. temp. | Description | | | |
|---|---|---|---|---|
| PV input | Resistance thermometer (for ΔT: R1+ R2 must be <320Ω) | Pt100Ω a 0°C (IEC 751) °C/°F selectable | 2 or 3 wires or 2 Pt100 for ΔT | Max. wire res.: 20Ω (3 wires) Input drift 0.1°C/10°C Env. temperature <0.1°C/10Ω Wire Resistance |
| | Thermocouple | L,J,T,K,R,S (IEC 548) °C/°F selectable | Internal cold junction compensation | Max. wire res.: 150Ω Input drift <2μV/°C Env. temperature <0.5μV/10Ω Wire Resistance |
| | DC input (current) | 0/4…20mA Rj = 30Ω | Engineering units Configurable decimal point position with or without √ Initial scale.: - 999…9999 Full scale.: -999…9999 (minimum range of 100 digits) | Input drift <0.1% / 20°C Env. temperature |
| | DC input (voltage) | 0…50 mV Rj = 10MΩ | | |
| | | 1-5/0-5/0-10V Rj = 10KΩ | | |
| Auxiliary inputs (options) | Remote Setpoint Not isolated accuracy 0.1% | Current 0/4…20mA Rj = 30Ω | Bias in engineering units and ± range | |
| | | Voltage 1-5/ 0-5/ 0-10V Rj = 300KΩ | Ratio from -9.99…+99.99 | |
| | | | Local + Remote Setpoint | |
| | CT current transformer | max span 50 or 100 mA hdw selectable | Display from 10 to 200 A resolution of 1A with alarm threshold (Heater break alarm) | |
| | Potentiometer | 100Ω…10KΩ supply 300mV | Position feedback measurement | |
| Digital inputs | 2 logic | The closure of the external contact produces any of the following actions: | Auto/Man mode change, Local/Remote Setpoint mode change, Stored Setpoints activation, keyboard lock, measure hold and slopes inhibit. | |
| | | | Start, stop, hold of a program (only with Setpoint programmer) | |
| Control output (cont.) | Single or double channel, direct or reverse action | | | |
| | Minimum limit | 0…100.0% (OP1 heat) | | |
| | Maximum limit | 0…100.0% (OP1 heat), -100.0…0% (OP2 cool) | | |

| Features at 25 °C env. temp. | Description | | | | |
|---|---|---|---|---|---|
| Control output | Maximum slope | 0.01…99.99%/sec. up and down | | | |
| | Safety value | -100…100% . (user enabled/disabled) | | | |
| | Time proportioning | Relays | Double action, 2 poles NO 2A/250V~ resistive loads | | |
| | | Triac | Double action, 2 poles NO 1A/250V~ resistive loads | | |
| | | SSR drive | 0…22V–, 20mA max<br>(for static switches) | | |
| | Analogue | Current | 0/4…20mA max 750Ω/10V max | | Galvanic insulation 500V~/1min.<br>Resol.: 12 bit (0.025%)<br>Accur. 0.1%. Short circuit protection |
| | | Voltage | 0…1/5/10V<br>500Ω / 20mA max | | |
| | Motor positioner (3 states)<br>Raise - Stop - Lower | | Double action<br>2 poles NO, 2A/250V~ resistive load | | |
| Alarms | 2 poles NO, 2A/250V~ resistive load<br>Hysteresis 0.1…5.0% symmetrical | | | | |
| | Actions | Active high | Action type | Deviation threshold | ± range |
| | | Active low | | Band width | 0…range |
| | | | | Absolute threshold | Whole scale |
| | | Special functions | Heater Break detection | | |
| | | | Loop Break Alarm | | |
| | | | Activation inhibit (blocking) | | |
| | | | Acknowledge (latching) | | |
| | | | Related to the program (optional) (OP3) | | |
| OP4 analogue output (optional) | Galvanic insulated:<br>500 V~/1min.<br>Resolution: 12 bit (0.025%)<br>Accuracy: 0.1% . Short circuit protected | | Current<br>0/4…20mA 750Ω/10V max | | Retransmission of PV or SP |
| | | | Voltage<br>1-5/0-5/0-10V 500Ω/20mA max | | |
| Setpoint | Ramp up and down, with slope in digit/sec., digit/minute or digit/hour between 0.0…10.0% of the range<br>High and low limits | | Local plus 2 stored Setpoints | | |
| | | | Only Remote | | |
| | | | Local and Remote | | |
| | | | Local with trim | | |
| | | | Remote with trim | | |
| | | | Time programmable (optional) | | |

| Features at 25 °C env. temp. | Description | |
|---|---|---|
| **Programmable Setpoint** (optional) | 1 program, 16 segments (1 initial and 1 end)<br>From 1 to 9999 cycles or continuous cycling (OFF)<br>Time values in seconds, minutes and hours<br>Start, stop, hold, etc. activated from the keyboard, digital input and serial communications. | |
| **Tuning** | One shot Tune- step response method for calculating the PID terms parameters | |
| | Adaptive Tune self-learning, not intrusive, analysis of the process response to perturbations and continuously calculation of the PID parameters (not available with the Setpoint Programmer option) | |
| **Auto/Manual station** | Integrated in the controller, bumpless<br>Operated from keyboard, digital input and serial communication. | |
| **Serial com.** (optional) | RS485 isolated, Modbus-Jbus, 1200, 2400, 4800, 9600, 19200 bit/sec., 2 wires | |
| **Auxil. supply** | 18V– ± 20%, 30mA max for transmitters (2, 3, 4 wires) | |
| **Operational safety** | Measure input | Detection of out of range, short circuit or sensor break with automatic activation of the safety strategies and alerts on display |
| | Control output | Safety value: -100...+100%. (user enabled/disabled) |
| | Parameters | Parameters and configuration data are stored in a non volatile memory for an unlimited time.<br>They are organised in functionally homogeneous groups, like: visible and changeable, visible and not changeable, not visible. |
| | Access protection | Password to access the configuration data and the parameter protection menu |
| **General characteristics** | Supply | 100 - 240V~ (- 15% + 10%) 50/60Hz or 24V~ (- 25% + 12%) 50/60Hz and 24V– (- 15% + 25%)<br>power consumption 3W max |
| | Electric safety | Compliance to EN61010, installation class 2 (2500V) pollution class 2 |
| | Electromagnetic compatibility | Compliance to the CE standards for industrial system and equipment |
| | Protection EN650529 | IP20 termination unit, IP65 front panel |
| | Dimensions | 1/16 DIN - 48 x 48, depth 150 mm, weight 230 gr. apx. |

# WARRANTY

We warrant that the products will be free from defects in material and workmanship for 3 years from the date of delivery.
The warranty above shall not apply for any failure caused by the use of the product not in line with the instructions reported on this manual.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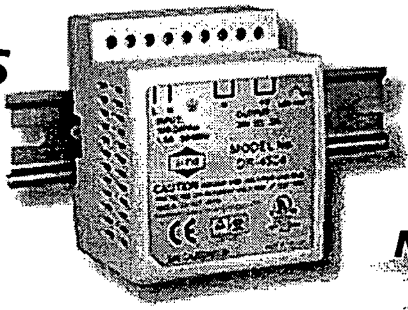
# DR-45 Series

# Low Cost, Industrial 45W, DIN Rail Mount AC/DC Power Supplies



New Industrial Supplies!!

## Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

### Input

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Input Voltage Range | | 85 | | 264 | VAC |
| | | 120 | | 370 | VDC |
| Input Frequency Range | | 47 | | 63 | Hz |
| Inrush Current | 230 VAC, Cold Start | | 56 | | A |
| | 115 VAC, Cold Start | | 28 | | |
| Leakage Current | 240 VAC | | | 1.0 | mA |

### Output

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Output Voltage Tolerance | Note 1 | | ±1.0 | | % |
| Voltage Adjustment Range | 5 VDC Output | 4.75 | | 5.5 | VDC |
| | 12 VDC Output | 10.8 | | 13.2 | |
| | 15 VDC Output | 13.5 | | 16.5 | |
| | 48 VDC Output | 21.6 | | 26.4 | |
| Line Regulation | | | ±1.0 | | % |
| Load Regulation | Iout = 10% to 100% | | ±1.0 | | % |
| Set Up Time | 230 VAC, Full Load | | 800 | | mSec |
| Rise Time | At Full Load | | 60 | | mSec |
| Hold Time | 230 VAC, Full Load | | 100 | | mSec |
| Ripple & Noise (Note 2) | 5 VDC Output | | | 100 | mV Pk-Pk |
| | 12 VDC Output | | | 200 | |
| | 15 VDC Output | | | 240 | |
| | 24 VDC Output | | | 480 | |
| Output Power Protection | Note 3 | 105 | | 150 | % |
| Over Voltage Protection (Note 4) | 5 VDC Output | 5.75 | | 6.75 | VDC |
| | 12 VDC Output | 13.8 | | 16.2 | |
| | 15 VDC Output | 17.25 | | 20.25 | |
| | 24 VDC Output | 27.6 | | 32.4 | |
| Over Temperature Protection | Note 5 | | 135 | | °C |
| Temperature Coefficient | 0°C to 50°C | | ±0.03 | | %/°C |
| Switching Frequency | Fixed | | 100 | | kHz |

### General

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Isolation Voltage | Input - Output | 3,000 | | | VAC |
| | Input - FG (Frame Ground) | 1,500 | | | |
| | Output - FG (Frame Ground) | 500 | | | |
| Isolation Resistance (Note 6) | 500 VDC | 100 | | | MΩ |

### Environmental

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| Operating Temperature Range | Ambient | -10 | +25 | +50 | °C |
| Storage Temperature Range | | -20 | | +85 | °C |
| Operating Humidity | RH, Non-condensing | 20 | | 90 | % |
| Storage Humidity | RH, Non-condensing | 10 | | 95 | % |
| Vibration | 10 ~ 500 Hz; 2G 10 min./1 Cycle; X, Y, Z axis each 1 hour | | | | |

### Physical

| | |
|---|---|
| Case Size | 3.66 x 3.05 x 2.64 Inches (93.0 x 78.0 x 67.0 mm) |
| Case Material | Plastic (UL94-V0) |
| Connection | Screw Terminal |
| Weight | 11 Oz (0.31 kg) |

### Reliability Specifications

| Parameter | Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|
| MTBF | MIL HDBK 217F, 25°C, Gnd Benign | 364.6 | | | kHours |
| Safety Standards | UL 508, UL 60950, EN 60950-1 | | | | |
| Safety Approvals | UL, cUL, TUV | | | | |
| EMI Compliance | Compliance to EN55011, EN55022 (CISPR22) Class B | | | | |
| Harmonic Current Compliance | Compliance to EN6100-3-2,-3 | | | | |
| EMS Immunity Compliance | EN6100-4-2,3,4,5,6,8,11; ENV50204;EN6100-6-2(EN50082-2) Heavy Ind. Level, criteria A | | | | |

## Key Features:

- 45W Output Power
- DIN Rail Mountable
- Universal AC Input
- UL 508 Approved
- Safety Approved
- 5, 12, 15 & 24 VDC Outputs
- Cond./Rad. EMI Class B
- >364 kH MTBF
- *LOW COST!*

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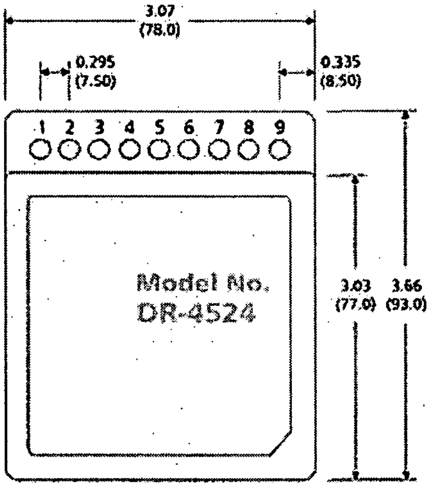
## Model Selection Guide

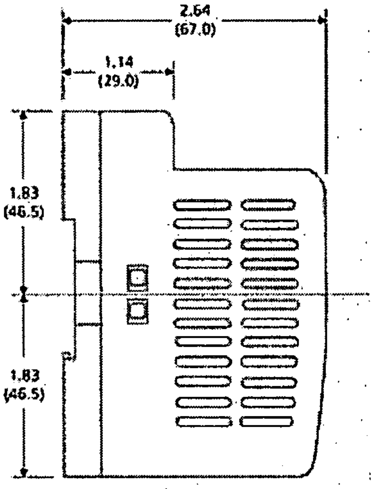
| Model Number | Rated Power (W) | Input Voltage (VAC) Range | Input Current (A) 115 VAC | Input Current (A) 230 VAC | Output Voltage (VDC) | Output Current (A) Max) | Output Current (A) Range | Efficiency (%, Typ) | Fuse Rating Slow-Blow (A) |
|---|---|---|---|---|---|---|---|---|---|
| DR-45-05 | 25 | 85 - 264 | 1.5 | 0.75 | 5 | 5.0 | 0 ~ 5.0 | 72 | 5.0 |
| DR-45-12 | 42 | 85 - 264 | 1.5 | 0.75 | 12 | 3.5 | 0 ~ 3.5 | 77 | 5.0 |
| DR-45-15 | 42 | 85 - 264 | 1.5 | 0.75 | 15 | 2.8 | 0 ~ 2.8 | 77 | 5.0 |
| DR-45-24 | 48 | 85 - 264 | 1.5 | 0.75 | 24 | 2.0 | 0 ~ 2.0 | 80 | 5.0 |

Notes:
1. Output voltage tolerance includes set-up tolerance, line regulation and load regulation.
2. Ripple & noise is measured using equipment with 20 Mhz of bandwidth. Connection to the unit under test is made with a 12 inch length of "twisted pair" wires terminated with a set of 1.0 $\mu F$ & 4.7 $\mu F$ capacitors connected in parallel.
3. Overload protection is foldback current limiting. The unit recovers automatically when the fault is removed.
4. Over voltage protection is a shut down type. The power to the unit must be manually reset to recover.
5. Over temperature protection shuts down the output. The unit recovers automatically when the temperature goes down. The thermal detector is mounted on the heat sink of the power semiconductor.
6. Isolation resistance is given for Input/Output; Input/FG and Output/FG.
7. To mount the unit to the DIN rail, tilt the unit rearwards from the top, fitting the mount over the top of the rail. Press back on the bottom front of the unit until it locks in place on the rail. To remove the unit from the rail, pull the removal clip at the bottom rear of the unit downward with a screw driver. With the clip down, lift up on the unit from the bottom front until it clears the rail. Before installation or removal all wiring should be disconnected and the main power to the system shut off.
8. When wiring the supply, all lines should be as thick and short as possible. AWG 14 wire is recommended for the DR-45 series.
9. The units should be mounted so they are vertically orientated. Air flow (if it is provided) would optimally flow from the bottom to the top of the unit.
10. It is recommended that a fuse be used on the input of a power supply for protection. See the table above for the correct rating.

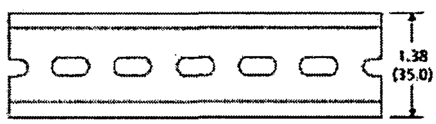
## Mechanical Dimensions




Front View




Side View




Compatible DIN Rail:
TS35/7.5
or
TS35/15

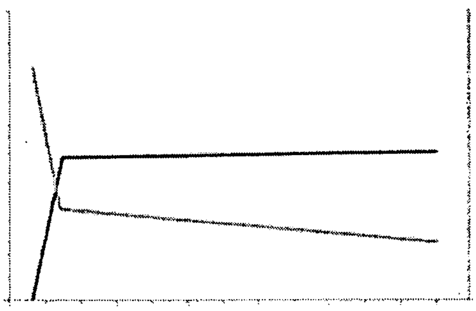
Mechanical Notes:
- All dimensions are typical in inches (mm)
- Tolerance x.xx = ±0.01 (±0.25)

## Terminal Connections

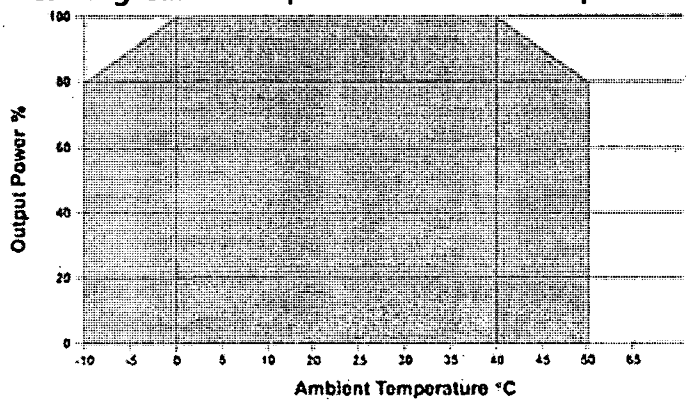
| Pin | Function |
|---|---|
| 1 | AC/Live (DC-) |
| 2 | AC/Neutral (DC+) |
| 3 | Frame Ground (FG) |
| 4,5 | DC Output (-V) |

| Pin | Function |
|---|---|
| 6,7 | DC Output (+V) |
| 8 | LED |
| 9 | +VAdj |

## Static Characteristics (24 Vout)



## Derating Curve - Output Power vs Ambient Temp.

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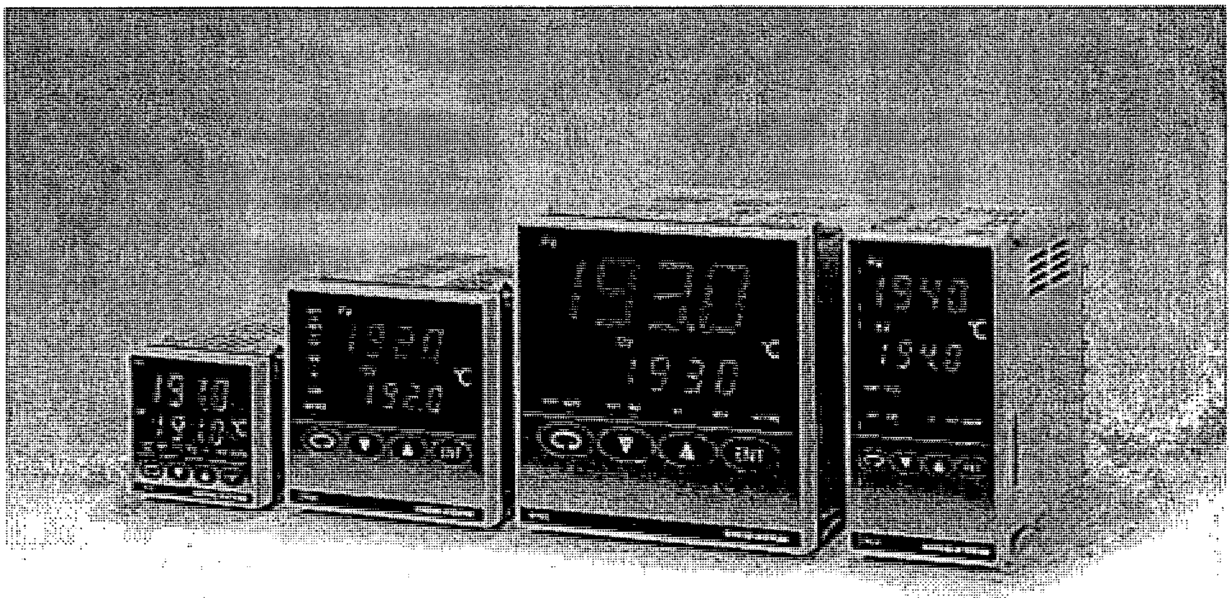
SHIMADEN

Series SR90

# SHIMADEN DIGITAL CONTROLLER



CE approved

## BASIC FEATURES

- ☐ ***Multi-input and multi-range performance***
- ☐ ***Large 20mm bright display (SR93)***
- ☐ ***Readable from a distance and in a low light area***
- ☐ ***2-output heating and cooling control available***
- ☐ ***RS232C or RS485 Interface available***
- ☐ ***Dust and splash proof front panel equivalent to IP66***
- ☐ ***A wide selection of additional functions (optional) is available to suit various needs.***

# SPECIFICATIONS

Series **SR90**

■ **Display**

- Digital display: Measured value (PV)/7 segments red LED 4 digits
  Target set value (SV)/7 segments green LED 4 digits
- Display accuracy: ±(0.3%FS + 1 digit)
  Excluding reference contact temperature compensation accuracy of thermocouple input.
  Accuracy of readings lower than −100°C of thermocouples K, T, U inputs is ±0.7%FS.
  Accuracy guarantee not applicable to 400°C (752°F) and below of B thermocouple.
- Display accuracy maintaining range: 23°C ± 5°C (18~28°C)
- Display resolution: Depends on measuring range (0.001, 0.01, 0.1 and 1)
- Measured value display range: −10%~110% of measuring range
- Display updating cycle: 0.25 seconds
- Action display/color: 7 type, LED lamp display
  Control output (OUT1, OUT2)/Green
  Event (EV1, EV2)/Orange
  Auto tuning/Green
  Manual control output (MAN)/Green
  Set value bias, communication (SB/COM)/Green

■ **Setting**

- Setting method: By operating 4 keys (◎, ▼, ▲ and ENT) on the front panel
- Target value setting range: Same as measuring range (within setting limiter)
- Setting limiter: Individual setting for higher and lower limits, any value is selectable within measuring range (Lower limit value<Higher limit value)

■ **Input**

- Type of input: Selectable from multiple (TC, Pt, mV), voltage (V) and current (mA)
- Thermocouple: B, R, S, K, E, J, T, N, PL II, Wre5-26 {U, L (DIN 43710)}
  Input impedance: 500kΩ minimum
  External resistance tolerance: 100Ω maximum
  Burnout function: Standard feature (up scale)
  Reference junction compensation accuracy:
  ± 1°C (within the accuracy maintaining range (23 ± 5°C))
  ± 2°C (between 5 and 45°C of ambient temperature)
- R.T.D.: Pt100/JPt100, 3-wire type
  Normal current: 0.25 mA
  Lead wire tolerance: 5Ω maximum/wire (3 lead wires should have the same resistance.)
- Voltage mV: −10~10, 0~10, 0~20, 0~50, 10~50, 0~100mv DC
  V: −1~1, 0~1, 0~2, 0~5, 1~5, 0~10V
  Input impedance: 500kΩ minimum
- Current mA: 0~20, 4~20mA DC
  Receiving impedance: 250Ω
- Input scaling function: Scaling possible for voltage (mV, V) or current (mA) input
  Scaling range: −1999~9999 counts
  Span: 10~5000 counts
  Position of decimal point: None, 1, 2 and 3 digits on the right of decimal point
- Sampling cycle: 0.25 seconds
- PV bias: −1999~2000 units
- PV filter: 0~100 seconds
- Isolation: Control input not insulated from system, set value bias, and CT input but insulated from others

■ **Control**

- Control mode
  With 1 output: Expert PID control with auto tuning function
  RA (reverse action characteristic): Heating action
  DA (direct action characteristic): Cooling action
  With 2 outputs: Expert PID control with auto tuning function + PID control
  PID (output 1) + PID (output 2)
  RA (reverse action characteristic): Heating action (OUT1) and cooling action (OUT2)
  DA (direct characteristic): 2-stage heating action
- Type of control/rating: Contact/1a 240V AC 2A (resistive load) 1.2A (inductive load)
  (Common to Output 1 and 2): SSR drive voltage/12V±1.5V DC (Maximum load current 30mA)
  Current/4~20mA DC (Maximum load resistance 600Ω)
  Voltage/0~10V DC (Maximum load current 2mA)
- Control output resolution: Control output 1: approx. 0.0125% (1/8000)
  Control output 2: approx. 0.5% (1/200)
- Control output 1
  Proportional band (P): OFF, 0.1~999.9% (ON-OFF action by OFF)
  Integral time (I): OFF, 1~6000 seconds (P or PD action by OFF)
  Derivative time (D): OFF, 1~3600 seconds (P or PI action by OFF)
  Set value function: OFF, 0.01~1.00
  ON-OFF hysteresis: 1~999 units (Effective when P=OFF)
  Manual reset: −50.0~50.0% (Effective when I=OFF)
  Higher/lower limit output limiter: Lower limit 0.0~99.9%, higher limit 0.1~100.0% (Lower limit value < Higher limit value)
  Proportional cycle: 1~120 seconds (for contact and SSR drive voltage output)
- Control output 2 (option)
  Proportional band (P): OFF, 0.1~999.9% (ON-OFF action by OFF)
  Integral time (I): OFF, 1~6000 seconds (P or PD action by OFF)
  Derivative time (D): OFF, 1~3600 seconds (P or PI action by OFF)
  Set value function: OFF, 0.01~1.00
  ON-OFF hysteresis: 1~999 units (Effective when P=OFF)
  Dead band: −1999~5000 units (Overlap with a negative value)
  Higher/lower limit output limiter: Lower limit 0.0~99.9%, higher limit 0.1~100.0% (Lower limit value < Higher limit value)
  Proportional cycle: 1~120 seconds (for contact and SSR drive voltage output)
- Manual control
  Output setting range: 0.0~100.0%
  Setting resolution: 0.1%
  Manual ↔ auto switching: Balanceless bumpless (within proportional range)
- Soft start: OFF, 1~100 seconds
- AT point: SV value in execution
- Control output characteristic: RA (reverse action characteristic)/DA (direct action characteristic) switching by front key or communication
  With 2 outputs: RA (heating/cooling)/DA (2 stage heating)
- Isolation: Contact output isolated from all.
  Analog output not insulated from SSR drive voltage, current and voltage but insulated from others. (In case another output is also SSR drive voltage, current or voltage, two outputs are not insulated from each other.)

■ **Event output (option)**

- Number of event points: 2 points of EV1 and EV2
- Types: Selectable from the following 9 types for EV1 and EV2:
  oFF No selection
  Hd Higher limit deviation
  Ld Lower limit deviation
  od Outside higher/lower limit deviations
  id Within higher/lower limit deviations
  HA Higher limit absolute value
  LA Lower limit absolute value
  So Scaleover
  Hb Heater break/loop alarm
- Event setting range: Absolute values (both higher limit and lower limit): Within measuring range
  Deviations (both higher limit and lower limit): −1999~2000 units
  Higher/lower limit deviations (within/outside): 0~2000 units

- Event action: ON-OFF action
- Hysteresis: 1~999 units
- Standby action: Selectable from the following 4 types
  EV1 and EV2:
  1 Without standby action.
  2 Standby when power is applied.
  3 Standby when power is applied and when SV value in execution is changed.
  4 Control mode without standby action (No alarm is output at the time of abnormal input).
- Output type/rating: Contact (1a × 2 points common)/240V AC 1A (resistive load)
- Output updating cycle: 0.25 seconds

### ■ Heater break/heater loop alarm (option)

Break/loop detection only for OUT1 (Selectable when output type is contact or SSR drive voltage)

- Current capacity: 30A, 50A to be designated when CT is ordered.
- Alarm action: Heater current is detected by external CT provided as an accessory.
  When heater break is detected while control output is ON=Alarm output ON
  When heater loop alarm is detected while control output is OFF=Alarm output ON
- Current setting range: OFF, 0.1~50.0A (Alarm action is stopped by setting OFF)
- Setting resolution: 0.1A
- Current display range: 0.0~55.0A
- Display accuracy: ±2.0A (Sine wave at 50Hz)
- Minimum time to identify action: 0.25 seconds (every 0.5 seconds) common to ON and OFF
- Alarm retention mode: Selectable from lock (to retain) and real (not to retain).
- Standby action: Selectable from without (OFF) and with (ON).
- Sampling cycle: 0.5 seconds
- Isolation: CT input not insulated from system and other inputs but insulated from the others.

### ■ Set value bias (option)

- Setting range: −1999~5000 units
- Action input: Non-voltage contact or open collector (level action) about 5V DC, 1mA maximum
- Minimum level retention time: 0.15 seconds
- Isolation: Action input not insulated from system and other inputs but insulated from others

### ■ Communication function (option)

- Type of communication: RS-232C, RS-485
- Communication system: RS-232C 3-line type half duplex system
  RS-485 2-line type half duplex system
  {RS-485 is of half-duplex multi-drop (bus) system}
- Synchronization system: Start-stop synchronization system
- Communication distance: RS-232C The longest: 15 m
  RS-485 The longest 500 m (depending on conditions)
- Communication speed: 1200, 2400, 4800, 9600, 19200 bps
- Data format: 7 bits, even parity, 1 stop bit or
  8 bits, non-parity, 1 stop bit
- Communication address: 1~255
- Communication memory mode: EEP/RAM/r_E
- Communication BCC: Add/Add two's cmp/XOR/None
- Communication delay time: 1~100 (× 0.512 msec)
- Communication code: ASCII code
- Communication protocol: Shimaden's standard protocol
- Number of connectable instruments:
  RS-232 1
  RS-485 up to 31
- Isolation: Communication signals insulated from system, each input and each output.

### ■ Analog output (option)

- Number of output points: 1 point
- Type of analog output: Selectable from measured value, target value (SV in execution), control output 1 and control output 2.
- Output signal/rating: 4~20mA DC/Maximum load resistance 300Ω
  0~10V DC/Maximum load current 2mA
  0~10mV DC/Output resistance 10Ω
- Output scaling: Measured value, target value: Within measuring range (inversed scaling possible)
  Control output 1 and 2 0.0~100.0% (inversed scaling possible)
- Output accuracy: ±0.3% FS (with respect to displayed value)
- Output resolution: Approx. 0.01% (1/10000)
- Output updating cycle: 0.25 seconds
- Isolation: Analog output insulated from system and inputs but not insulated from control output except contact output.

### ■ General specifications

- Data storage: Non-volatile memory (EEPROM)
- Environmental conditions for instrument operation:
  Temperature: −10~50°C
  Humidity: 90% RH or less (no dew condensation)
  Height: 2000m from the sea level or lower
  Category: II
  Degree of pollution: 2
- Storage temperature: −20~65°C
- Supply voltage: Either 100-240V AC±10% 50/60Hz or 24V AC/DC±10% to be designated.
- Power consumption: SR91: 100-240VAC 11VA maximum for AC; 6W for DC 24V; 7VA for AC 24V
  SR92, SR93 and SR94: 100-240VAC 15VA maximum for AC; 8W for DC 24V; 9VA for AC 24V
- Input/noise removal ratio: 50 dB or higher in normal mode (50/60 Hz)
  130 dB or higher in common mode (50/60 Hz)
- Applicable standards: Safety: IEC1010 and EN61010-1
  EMC: EN61326
- Insulation resistance: Between input/output terminals and power terminal 500V DC 20MΩ or above; Between input/output terminals and protective conductor terminal 500V DC 20MΩ or above
- Dielectric strength: Between input/output terminals and power terminal 2300V AC/minute; Between power terminal and protective conductor terminal 1500V AC/minute
- Protective structure: Only front panel has dust-proof and drip-proof structure equivalent to IP66.
- Material of case: PPO resin molding (equivalent to UL94V-1)
- External dimensions:
  SR91: H48 × W48 × D111 (Panel depth: 100) mm
  SR92: H72 × W72 × D111 (Panel depth: 100) mm
  SR93: H96 × W96 × D111 (Panel depth: 100) mm
  SR94: H96 × W48 × D111 (Panel depth: 100) mm
- Mounting: Push-in panel (one-touch mount)
- Panel thickness: 1.0~4.0 mm
- Panel cutout: SR91: H45 × W45 mm
  SR92: H68 × W68 mm
  SR93: H92 × W92 mm
  SR94: H92 × W45 mm
- Weight: SR91: Approximately 170 g
  SR92: Approximately 280 g
  SR93: Approximately 330 g
  SR94: Approximately 240 g

| ITEM | | CODE | SPECIFICATIONS | |
|---|---|---|---|---|
| SERIES | | SR91- | MPU-Based Auto-Tuning PID Digital Controller, DIN H48 × W48 × D110mm | |
| INPUT | Multi input | 8 | Thermocouple: B, R, S, K, E, J, T, N, PLII, Wre5-26 {U, L (DIN 43710)}<br>R.T.D.: Pt100Ω /JPt100Ω<br>Voltage: -10~10, 0~10, 0~20, 0~50, 10~50, 0~100mV DC | For voltage and current input: Scaling Possible<br>Range: -1999~9999<br>Span: 10~5000<br>Note: Inverse scaling is not possible |
| | | 4 | Current (mA): 0~20, 4~20mA DC<br>Receiving impedance: 250Ω | |
| | | 6 | Voltage (V): -1~1, 0~1, 0~2, 0~5, 1~5, 0~10V DC | |
| CONTROL OUTPUT (1) | | Y- | Contact: 1a, Contact capacity: 240V AC 2.5A/resistive load<br>Proportional cycle: 1~120 sec. | |
| | | I- | Current: 4~20mA DC<br>Load resistance: 600Ω max. | |
| | | P- | SSR drive voltage: 12V±1.5V DC/30mA max.<br>Proportional cycle: 1~120 sec. | |
| | | V- | Voltage: 0~10V DC<br>Load current: 2mA max. | |
| POWER SUPPLY | | 90- | 100~240V AC±10%, 50/60Hz | |
| | | 08- | 24V AC/DC±10%, 50/60Hz | |
| EVENT OUTPUT (OPTION) | | 0 | None | |
| | | 1 | Contact output (2a) Ev1, Ev2: 240V AC 1A/resistive load | |
| OPTION | | N | None | |
| | Control output (2) | Y | Contact: 1a, Contact capacity: 240V AC 2.5A/resistive load<br>Proportional cycle: 1~120 sec. | |
| | | I | Current: 4~20mA DC<br>Load resistance: 600Ω max. | |
| | | P | SSR drive voltage: 12±1.5V DC/30mA max.<br>Proportional cycle: 1~120 sec. | |
| | | V | Voltage: 0~10V DC<br>Load current: 2mA max. | |
| | Heater break alarm | 1 | Current setting range: 0.1~30.0A (with CT 30A) | Note: Avaialble only when control output (1) is Y or P and when event output is selected. |
| | | 2 | Current setting range: 0.1~50.0A (with CT 50A) | |
| | Analog output | 3 | Voltage: 0~10mV DC, Output resistance: 10Ω | |
| | | 4 | Current: 4~20mA DC, Load resistance: 300Ω max. | |
| | | 6 | Voltage: 0~10V DC, Load current: 2mA max. | |
| | Communication | 5 | RS-485 | |
| | Set value bias | 8 | 1 point (setting range: -1999~5000), Non-voltage contact or Open collector input<br>Open collector input rating: approx. 5V/1mA max. | |
| REMARKS | | 0 | Without | |
| | | 9 | With (Please consult before ordering.) | |

Note:

When you purchase a two-output type controller and use it in a one output capacity, larger overshooting or undershooting may happen as a result of integral operation. Therefore, we recommend you to choose a one-output type.

The cause of the above-mentioned problem is that the positional relationship between the proportional band (PB) and the set value (SV) of a one-output type controller differs from that of a two-output type.

| ITEM | CODE | | | | | | | | SPECIFICATIONS | |
|---|---|---|---|---|---|---|---|---|---|---|
| SERIES | SR92- | | | | | | | | MPU-Based Auto-Tuning PID Digital Controller, DIN H72 × W72 × D110mm | |
| INPUT | | 8 | | | | | | Multi input | Thermocouple: B, R, S, K, E, J, T, N, PLII, Wre5-26 {U, L (DIN 43710)}<br>R.T.D.: Pt100Ω /JPt100Ω<br>Voltage (mV): -10~10, 0~10, 0~20, 0~50, 10~50, 0~100mV DC | For voltage and current input: Scaling Possible<br>Range: -1999~9999<br>Span: 10~5000<br>Note: Inverse scaling is not possible. |
| | | 4 | | | | | | | Current (mA): 0~20, 4~20mA DC<br>Receiving impedance: 250Ω | |
| | | 6 | | | | | | | Voltage (V): -1~1, 0~1, 0~2, 0~5, 1~5, 0~10V DC Input resistance: 500kΩ min. | |
| CONTROL OUTPUT (1) | | | Y- | | | | | | Contact: 1a, Contact capacity: 240V AC 2A/resistive load<br>Proportional cycle: 1~120 sec. | |
| | | | I- | | | | | | Current: 4~20mA DC<br>Load resistance: 600Ω max. | |
| | | | P- | | | | | | SSR drive voltage: 12V±1.5V DC/30mA max.<br>Proportional cycle: 1~120 sec. | |
| | | | V- | | | | | | Voltage: 0~10V DC<br>Load current: 2mA max. | |
| CONTROL OUTPUT (2) (OPTION) | | | | N- | | | | | None | |
| | | | | Y- | | | | | Contact: 1a, Contact capacity: 240V AC 2A/resistive load<br>Proportional cycle: 1~120 sec. | |
| | | | | I- | | | | | Current: 4~20mA DC<br>Load resistance: 600Ω max. (RA when shipped) | |
| | | | | P- | | | | | SSR drive voltage: 12V±1.5V DC/30mA max.<br>Proportional cycle: 1~120 sec. | |
| | | | | V- | | | | | Voltage: 0~10V DC<br>Load current: 2mA max. | |
| POWER SUPPLY | | | | | 90- | | | | 100V~240V AC±10%, 50/60Hz | |
| | | | | | 08- | | | | 24V AC/DC±10%, 50/60Hz | |
| EVENT OUTPUT/ HEATER BREAK ALARM (OPTION) | | | | | | 0 | | | None | |
| | | | | | | 1 | | | Event output (2a) Ev1, Ev2<br>Contact capacity: 240V AC 1A/resistive load | |
| | | | | | | 2 | | | Event output (Ev1) + Heater break alarm (with CT30A) | Note: Available only when control output (1) is Y or P is selected. |
| | | | | | | 3 | | | Event output (Ev1) + Heater break alarm (with CT50A) | |
| ANALOG OUTPUT (OPTION) | | | | | | | 0 | | None | |
| | | | | | | | 3 | | Voltage: 0~10mV DC, Output resistance: 10Ω | |
| | | | | | | | 4 | | Current: 4~20mA DC, Load resistance: 300Ω max. | |
| | | | | | | | 6 | | Voltage: 0~10V DC, Load current: 2mA max. | |
| COMMUNICATION OR SV BIAS (OPTION) | | | | | | | | 0 | None | |
| | | | | | | | | 5 | RS-485 | |
| | | | | | | | | 7 | RS-232C | |
| | | | | | | | | 8 | 1 point (setting range: -1999~5000), Non-voltage contact or Open collector input<br>Open collector input rating: approx. 5V/1mA max. | |
| REMARKS | | | | | | | | 0 | Without | |
| | | | | | | | | 9 | With (Please consult before ordering.) | |

Note:

When you purchase a two-output type controller and use it in a one output capacity, larger overshooting or undershooting may happen as a result of integral operation. Therefore, we recommend you to choose a one-output type.

The cause of the above-mentioned problem is that the positional relationship between the proportional band (PB) and the set value (SV) of a one-output type controller differs from that of a two-output type.

| ITEM | | CODE | SPECIFICATIONS | |
|---|---|---|---|---|
| SERIES | | SR93- | MPU-Based Auto-Tuning PID Digital Controller, DIN H96 × W96 × D110mm | |
| | | SR94- | MPU-Based Auto-Tuning PID Digital Controller, DIN H96 × W48 × D110mm | |
| INPUT | Multi input | 8 | Thermocouple: B, R, S, K, E, J, T, N, PLII, Wre5-26 {U, L (DIN 43710)}<br>R.T.D.: Pt100Ω /JPt100Ω<br>Voltage: -10~10, 0~10, 0~20, 0~50, 10~50, 0~100mV DC | For voltage and current input: Scaling Possible<br>Range: -1999~9999<br>Span: 10~5000<br>Note: Inverse scaling is not possible |
| | | 4 | Current (mA): 0~20, 4~20mA DC<br>Receiving impedance: 250Ω | |
| | | 6 | Voltage (V): -1~1, 0~1, 0~2, 0~5, 0~10V DC<br>Load resistance: 600Ω max. | |
| CONTROL OUTPUT (1) | | Y- | Contact: 1a, Contact capacity: 240V AC 2A/resistive load<br>Proportional cycle: 1~120 sec. | |
| | | I- | Current: 4~20mA DC<br>Load resistance: 600Ω max. | |
| | | P- | SSR drive voltage: 12V±1.5V DC/30mA max.<br>Proportional cycle: 1~120 sec. | |
| | | V- | Voltage: 0~10V DC<br>Load current: 2mA max. | |
| CONTROL OUTPUT (2) (OPTION) | | N- | None | |
| | | Y- | Contact: 1a, Contact capacity: 240V AC 2A/resistive load<br>Proportional cycle: 1~120 sec. | |
| | | I- | Current: 4~20mA DC<br>Load resistance: 600Ω max. | |
| | | P- | SSR drive voltage: 12V±1.5V DC/30mA max.<br>Proportional cycle: 1~120 sec. | |
| | | V- | Voltage: 0~10V DC<br>Load current: 2mA max. | |
| POWER SUPPLY | | 90- | 100~240V AC±10%, 50/60Hz | |
| | | 08- | 24V AC/DC±10%, 50/60Hz | |
| EVENT OUTPUT/ HEATER BREAK ALARM (OPTION) | | 0 | None | |
| | | 1 | Event output (2a) Ev1, Ev2<br>Contact capacity: 240V AC 1A/resistive load | |
| | | 2 | Event output (Ev1) + Heater break alarm (with CT30A) | Note: Available only when control output (1) is Y or P is selected. |
| | | 3 | Event output (Ev1) + Heater break alarm (with CT50A) | |
| OPTION | | 00 | None | |
| | Analog output | 30 | Voltage: 0~10mV DC, Output resistance: 10Ω | |
| | | 40 | Current: 4~20mA DC, Load resistance: 300Ω max. | |
| | | 60 | Voltage: 0~10V DC, Load current: 2mA max. | |
| | Set value bias (S V bias) | 08 | 1 point (setting range: -1999~5000), Non-voltage contact or Open collector input<br>Open collector input rating: approx. 5V/1mA max. | |
| | Analog output + Set value bias (S V bias) | 38 | Voltage: 0~10mV DC, Output resistance: 10Ω<br>SV bias 1 point | |
| | | 48 | Current: 4~20mA DC, Load resistance: 300Ω max.<br>SV bias 1 point | |
| | | 68 | Voltage: 0~10V DC, Load current: 2mA max.<br>SV bias 1 point | |
| | Communication | 05 | RS-485 | |
| | | 07 | RS-232C | |
| REMARKS | | 0 | Without | |
| | | 9 | With (Please consult before ordering.) | |

Note:

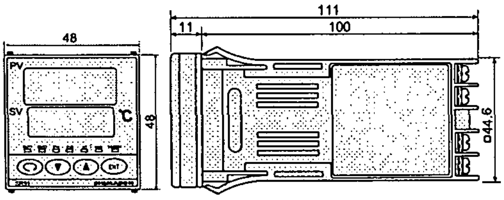
When you purchase a two-output type controller and use it in a one output capacity, larger overshooting or undershooting may happen as a result of integral operation. Therefore, we recommend you to choose a one-output type.

The cause of the above-mentioned problem is that the positional relationship between the proportional band (PB) and the set value (SV) of a one-output type controller differs from that of a two-output type.

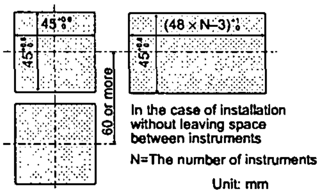
## SR91

**Series SR90**

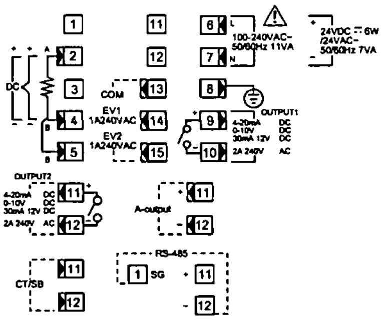
### External Dimensions



### Panel Cutout

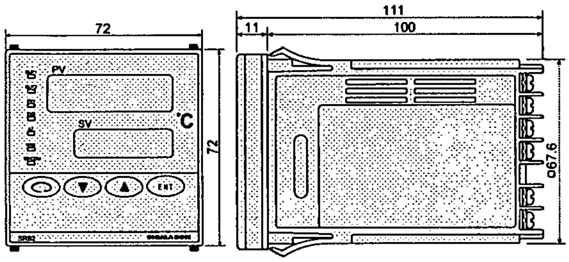



### Terminal Arrangement

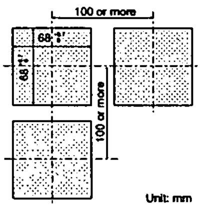


## SR92

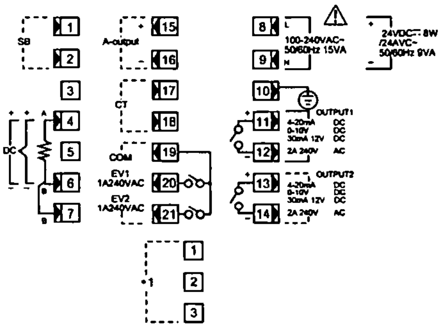
### External Dimensions



### Panel Cutout




### Terminal Arrangement

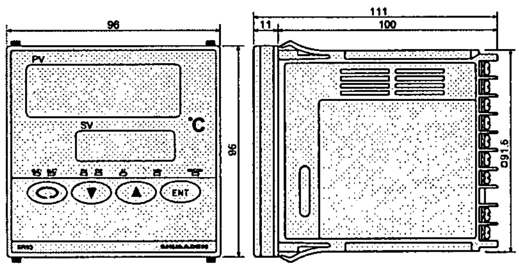


| *1 SPECIFICATION | TERMINAL 1 | 2 | 3 |
|---|---|---|---|
| RS-232C | SG | SD | RD |
| RS-485 | SG | + | - |

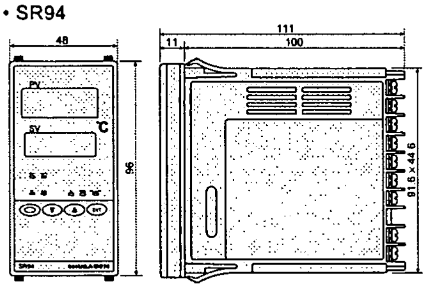
## SR93 AND SR94

### External Dimensions

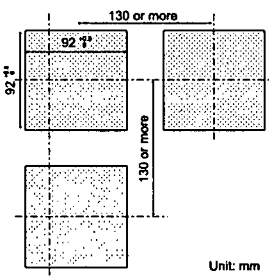
• SR93

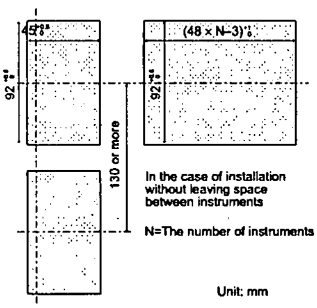


• SR94

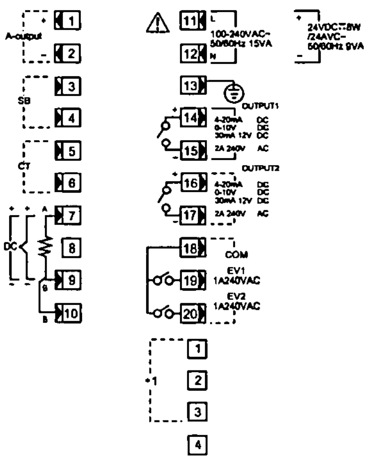


### Panel Cutout




### Terminal Arrangement (Common)



| *1 SPECIFICATION | TERMINAL 1 | 2 | 3 |
|---|---|---|---|
| RS-232C | SG | SD | RD |
| RS-485 | SG | + | - |

# MEASURING RANGE CODES

**Series SR90**

| Input Type | | | Code | Measuring range (°C) | Measuring range (°F) |
|---|---|---|---|---|---|
| Multi-input | Thermo-couple | B *1 | 01 | 0 ~ 1800 | 0 ~ 3300 |
| | | R | 02 | 0 ~ 1700 | 0 ~ 3100 |
| | | S | 03 | 0 ~ 1700 | 0 ~ 3100 |
| | | K | 04 *2 | -199.9 ~ 400.0 | -300 ~ 750 |
| | | K | 05 | 0.0 ~ 800.0 | 0 ~ 1500 |
| | | K | 06 | 0 ~ 1200 | 0 ~ 2200 |
| | | E | 07 | 0 ~ 700 | 0 ~ 1300 |
| | | J | 08 | 0 ~ 600 | 0 ~ 1100 |
| | | T | 09 *2 | -199.9 ~ 200.0 | -300 ~ 400 |
| | | N | 10 | 0 ~ 1300 | 0 ~ 2300 |
| | | PLII *3 | 11 | 0 ~ 1300 | 0 ~ 2300 |
| | | WRe5-26 *4 | 12 | 0 ~ 2300 | 0 ~ 4200 |
| | | U *5 | 13 *2 | -199.9 ~ 200.0 | -300 ~ 400 |
| | | L *5 | 14 | 0 ~ 600 | 0 ~ 1100 |
| | R.T.D. | Pt100 | 31 | -200 ~ 600 | -300 ~ 1100 |
| | | | 32 | -100.0 ~ 100.0 | -150.0 ~ 200.0 |
| | | | 33 | -50.0 ~ 50.0 | -50.0 ~ 120.0 |
| | | | 34 | 0.0 ~ 200.0 | 0.0 ~ 400.0 |
| | | Jpt100 | 35 | -200 ~ 500 | -300 ~ 1000 |
| | | | 36 | -100.0 ~ 100.0 | -150.0 ~ 200.0 |
| | | | 37 | -50.0 ~ 50.0 | -50.0 ~ 120.0 |
| | | | 38 | 0.0 ~ 200.0 | 0.0 ~ 400.0 |
| | Voltage (mV) | -10 ~ 10 | 71 | Scaling possible<br>Refer to the information on the right. | |
| | | 0 ~ 10 | 72 | | |
| | | 0 ~ 20 | 73 | | |
| | | 0 ~ 50 | 74 | | |
| | | 10 ~ 50 | 75 | | |
| | | 0 ~ 100 | 76 | | |
| Voltage (V) | | -1 ~ 1 | 81 | | |
| | | 0 ~ 1 | 82 | | |
| | | 0 ~ 2 | 83 | | |
| | | 0 ~ 5 | 84 | | |
| | | 1 ~ 5 | 85 | | |
| | | 0 ~ 10 | 86 | | |
| Current (mA) | | 0 ~ 20 | 91 | | |
| | | 4 ~ 20 | 92 | | |

Owing to scaling function, any measuring range can be set within the following range.

Scaling range: -1999 to 9999 counts
Span: 10 to 5000 counts on condition of lower side < higher side

*1 Thermocouple:
B: Accuracy guarantee not applicable to 400°C (752°F) and below.

*2 Thermocouple
K, T, U: Accuracy of those whose readings are below -100°C is ±0.7% FS

*3 Thermocouple
PLII: Platinel

*4 Thermocouple
Wre5-26: A product of Hoskins

*5 Thermocouple
U, L: DIN 43710

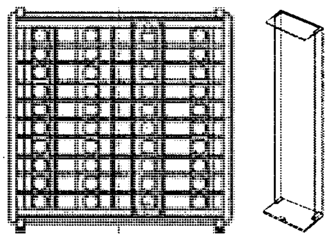
NOTE:
Unless otherwise specified, the measuring range will be set as listed below during the shipment from the factory.

| Input | Specification/Rating | Measuring range |
|---|---|---|
| Multi-input | K thermocouple | 0.0 ~ 800.0°C |
| Voltage (V) | 0 ~ 10V DC | 0.0 ~ 100.0 |
| Current (mA) | 4 ~ 20mA DC | 0.0 ~ 100.0 |

# TERMINAL COVER (AVAILABLE SEPARATELY)

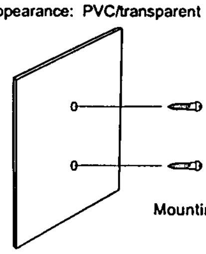
| Model | | Mounting |
|---|---|---|
| SR91 | QCR001 | One-touch mount |
| SR92 | QCR002 | One-touch mount |
| SR93 | QCR003 | One-touch mount |

Material/Appearance: PVC/transparent
Thickness: 1 mm



| Model | | Mounting |
|---|---|---|
| SR94 | QCR004 (Individual mounting) | Plus screw, B tight, M2.3 x 6 - 2 pcs. |
| | QCR005 (Tight-lock coupling) | Plus screw, B tight, M2.3 x 6 - 4 pcs. |

Material/Appearance: PVC/transparent Thickness: 1 mm



Mounting: 2+B tight pan-head screws M2.3 x 6mm

**⚠ Warning**

- The SR90 series is designed for the control of temperature, humidity and other physical values of general industrial equipment. (It is not to be used for any purpose which regulates the prevention of serious effects on human life or safety.)

**⚠ Caution**

- If the possibility of loss or damage to your system or property as a result of failure of any part of the process exists, proper safety measures must be made before the instrument is put into use so as to prevent the occurrence of trouble.

ISO 9001

(The contents of this brochure are subject to change without notice.)

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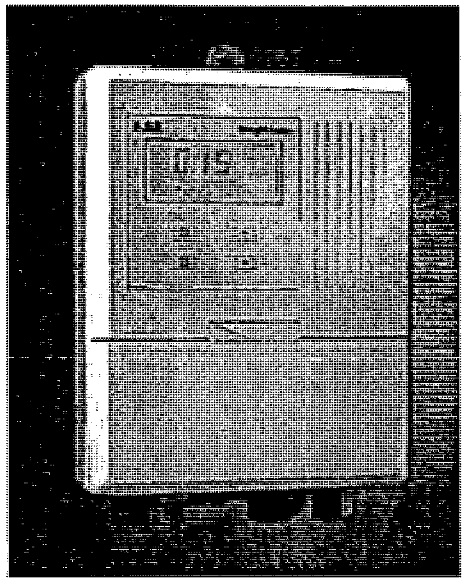
02DSR90500ILC

## Quick Reference Guide



# MagMaster™ Electromagnetic Flowmeters

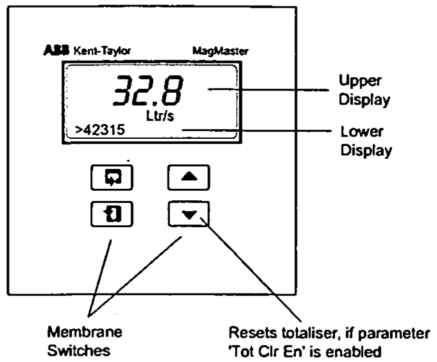
## Keypad Version

IM/MM–QRG Issue 2 07.04

ABB

ABB Limited
Oldends Lane, Stonehouse, Gloucestershire, GL10 3TA, UK
Tel: +44 (0)1453 826661, Fax: +44 (0)1453 829671

## CONTROLS AND DISPLAY




Controls and Display

Upper display gives continual update of flow rate in selected units.

By pressing the key, the lower display steps through the following sequence:

| | |
|---|---|
| > | Forward flow total value. |
| < | Reverse flow total value |
| • | Net flow total value |
| **Alm** | Active alarms – Any alarms are displayed sequentially if more than one alarm is present. 'Alm Clr' is displayed when no alarms are present. |
| **Vel** | Flow Velocity |
| % | % of Flow Range. |

Pressing the ▾ key resets the flow total displayed on the upper display, if parameter 'Tot Clr En' is enabled.

Pressing the key accesses the **Login** Parameter where it is necessary to enter a security code before any other parameters can be accessed – see **SECURITY ACCESS.**

## MENU LAYOUT

## ...MENU LAYOUT

Press [⮐] moves →

Press [⏎] moves ↓

Return to 'Flow Rng' Page

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Flow Rng | Anlg Fsd | Pls Fact | Tot Unit | Alm No1 Idle | Alm No2 Idle | Alm Trip Hi | Inpt | Mtsnsr Trip | Snsr No | Test Mode | Disp Res | Login Key 1 |
| Flow Unit | Anlg Zero | Pls Cutoff | Tot Mult | Alm No1 En | Alm No2 En | Alm Trip Lo | Inpt Idle | Mtsnsr mv | Snsr Tag | Test Flow | Disp Mode | Login Key 2 |
| Flow Mult | Anlg No2 | Pls Max | Tot ClrEn | Alm No1 Fault | Alm No2 Fault | Alm Trip Hyst | | | Snsr Size | Test % | | |
| Flow Time | Anlg mA | Pls Hz | | Alm No1 Fwd | Alm No2 Fwd | Alm Trip Disp | | | Snsr Vel | Test Hz | | |
| Flow Rspns | Anlg Dir Fwd | Pls Idle | | Alm No1 Rev | Alm No2 Rev | | | | Snsr Fact 1 | Test mA | | |
| Flow % | Anlg Dir Rev | Pls Size | | Alm No1 Cutoff | Alm No2 Cutoff | | | | Snsr Fact 2 | Test Vel | | |
| Flow Probe Ins | | | | Alm No1 Mtsnsr | Alm No2 Mtsnsr | | | | Snsr Fact 3 | Test Alm | | |
| Flow Probe Prf | | | | Alm No1 Hi | Alm No2 Hi | | | | Snsr Fact 4 | Test Txv | | |
| Flow Cutoff | | | | Alm No1 Lo | Alm No2 Lo | | | | | | | |
| | | | | Alm No1 Anlg | Alm No2 Anlg | | | | | | | |
| | | | | Alm No1 Pls | Alm No2 Pls | | | | | | | |

Key

Security Level 1

Security Level 2

## CONTROLS AND DISPLAY

### A – Advancing to Next Page

| Page 1 | Advance to next page | Page 2 |
|---|---|---|
| Parameter 1 | [⮐] | Parameter 1 |
| Parameter 2 | or | Parameter 2 |
| Parameter 3 | [⮐] | |
| Parameter 4 | | |
| Parameter 5 | | |
| Parameter 6 | | |

### B – Moving Between Parameters

Parameter 1

[⏎] Advance to next parameter

Parameter 2
Parameter 3
Parameter 4

[⏎]

### C – Adjusting and Storing a Parameter Value

Parameter Value or unit — [▲] [▼] Adjust

[⮐] Advance to next digit

[⏎] New value is automatically stored

### D – Selecting and Storing a Parameter Choice

Parameter X / Y / Z — [▲] [▼] Select

[⏎] New value is automatically stored

[⮐] Depressing this switch for 5 seconds and then releasing it will exit the menu system and return to normal operating mode.

## SECURITY ACCESS

Two security code levels, 1 and 2, are available, and are each accessed with a five digit number.

**User Code** Level 1 default number is 10760.

**Engineer Code** Level 2 default number is 56360.

Parameters accessible by the two levels are shown above.

At the flashing cursor on the first digit of the Login code number, press either ▴ or ▾ membrane switches to reach the required digit.

To set this digit and pass to the next digit, depress the switch. Continue until all digits have been set, and depress the ⏎ switch to enter the complete code.

If an incorrect value is entered, access to subsequent programming pages is prevented and the display reverts to the **Operating Page**.

## PARAMETER CHANGES

When a parameter is selected, which holds one or more variable units e.g. 'Flow Unit' parameter which can be Liters, Cubic meters, Gallons etc., proceed as follows to change the units: ('Flow Rng' selected).

Flow Rng
5.00000

Flow Unit
m^3/Hr

'Flow Unit' selected

Press ▲ or ▼ switch to change the units.

> **Note.** The existing units will flash at the first depression of the ▲ or ▼ switch, and further switch depressions will change the type of units displayed.

Depressing the switch will now enter the newly selected units.
This type of action is similar for all variable units.
Where numerical values are to be changed, initial depression of the ▲ or ▼ switches cause the first of the digits to be highlighted by a flashing cursor. Change the value with the ▲ and ▼ switches, the particular digit with the switch, and enter the final selection with the switch.

## PROGRAMMING

The correct security level **MUST** be selected – see **SECURITY ACCESS**.

Select the parameter to read the value, or to change it as necessary. All 'live' data displayed is updated each second.

Use the key to move between pages.

Use the key to move between parameters.

The ▲ and ▼ keys change displayed values and units.

The key will accept the chosen value or unit.

## FLOW MEASUREMENT

| PARAMETER | DESCRIPTION |
|---|---|
| **Flow Range** | Enter main full scale (100%) flow range (Upper Range Value) in selected flow units. # |
| **Flow Unit** | Select Units as required.<br>**Ltr** (Liters)<br>**m^3** (Cubic Meters)<br>**IGal** (Imp Gals)<br>**UGal** (U.S. Gals)<br>**ft^3** (Cubic Feet) |
| **Flow Mult** | Select multiplier as required.<br>**m** (0.001)<br>**c** (0.01)<br>**x1** (1)<br>**h** (100)<br>**k** (1000)<br>**M** (1000000) |
| **Flow Time** | Select time units as required.<br>**s** (Second)<br>**Min** (Minute)<br>**Hr** (Hour)<br>**Dy** (Day)<br>**Wk** (Week) |
| **Flow Resp** | Nominal Time Constant for output. Enter Display Setting from table below for time constant required. |

| Display Setting | Seconds |
|---|---|
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 8 |
| 6 | 15 |
| 7 | 30 |
| 8 | 60 |
| 9 | 120 |

| PARAMETER | DESCRIPTION |
|---|---|
| **Flow %** | Present flow as % of range. |
| **Flow Probe Ins** | Probe Insertion Factor. |
| **Flow Probe Prf** | Probe Profile Factor |
| **Flow Cutoff** | Flow velocity in mm/sec. below which flow set to 0. |

## ANALOG OUTPUT

| PARAMETER | DESCRIPTION |
|---|---|
| **Anlg Fsd** | Enter output current in mA for 100% flow (0 ≤ FSD ≤ 21) |
| **Anlg Zero** | Enter output current in mA for 0% flow (0 ≤ ZERO ≤ 21) |
| **Anlg No2** | Full scale flow range for 2nd analog range, as % of main flow range. |
| **Anlg mA** | Present output current (mA) |
| **Anlg Dir Fwd** | Output responds to forward flow if set to '1'. § |
| **Anlg Dir Rev** | Output responds to reverse flow if set to '1'. § |

## OUTPUT PULSE

| PARAMETER | DESCRIPTION |
|---|---|
| **Pls Fact** | Enter required output pulses per flow volume unit.# |
| **Pls Cutoff** | Flow rate (%) below which pulse output and totaliser cease to operate. |
| **Pls Max** | Maximum output frequency in Hz. |
| **Pls Hz** | Display of present output frequency in Hz (live value). |
| **Pls Idle** | Idle state for Pulse Output with no output pulse (e.g. at zero flow).<br>0 = Low (output transistor ON)<br>1 = High (output transistor OFF) |
| **Pls Size** | Enter output pulse width in msecs. (Value will be rounded up to nearest 10ms). Set to '0' for square wave output. |

## TOTALIZER

| PARAMETER | DESCRIPTION |
|---|---|
| **Tot Unit** | Select totaliser measurement units. |
| **Tot Mult** | Select multiplier units required. |
| **Tot ClrEn** | Enter '1' to enable totaliser reset function to be used from front panel. |

## ALARMS

| PARAMETER | DESCRIPTION |
|---|---|
| **Alarm No1 Idle** | Idle state for alarm output.<br>With no alarm active:<br>0 = Low (O/P transistor ON)<br>1 = High (O/P transistor OFF) |
| **Alm No1 En** | 0 = Alarm output disabled (set to idle state).<br>1 = Alarm output enabled. |
| **Alm No1 Fault** | Alarm occurs for System fault. |
| **Alm No1 Fwd** | Alarm occurs for forward flow. |
| **Alm No1 Rev** | Alarm occurs for reverse flow. |
| **Alm No1 Cutoff** | Alarm occurs for Pulse Output Cutoff. |
| **Alm No1 Mtsnsr** | Alarm occurs for empty sensor. |
| **Alm No1 Hi** | Alarm occurs for Flow ≥ 'Alm Trip Hi'. |
| **Alm No1 Lo** | Alarm occurs for Flow ≤ 'Alm Trip Lo'. |
| **Alm No1 Anlg** | Alarm occurs for Analogue Output over range. |
| **Alm No1 Pls** | Alarm occurs for Pulse Output over range. |

## ALARMS (CONTD.)

| PARAMETER | DESCRIPTION |
|---|---|
| **Alarm No2 Idle** | Identical to, but independent of Alarm No1 above. |
| **Alarm No2 Pls** | Alarm occurs for Pulse Output over range. |

| PARAMETER | DESCRIPTION |
|---|---|
| **Alarm trip Hi** | High flow alarm trip point as % of range. |
| **Alarm Trip Lo** | Low flow alarm trip point as % of range. |
| **Alm Trip Hyst** | Enter hysteresis for alarms as % of range. |
| **Alm Trip Disp** | Set to '1' if Hi/Lo Alarms are to be displayed. |

## INPUT CONTACT

| PARAMETER | DESCRIPTION |
|---|---|
| **Inpt** | Set up external logic input function:<br>**'Zero'** sets flowrate output to zero.<br>**'Hld'** holds flowmeter output value.<br>**'Clr'** resets all totalizers.<br>**'Anlg'** selects Anlg No2 Range. |
| **Inpt Idle** | Enter inactive state of input contact:<br>'1' for Hi normal<br>'0' for Lo normal. |

## EMPTY PIPE DETECTION

| PARAMETER | DESCRIPTION |
|---|---|
| **Mtsnsr Trip** | Set empty pipe detector trip threshold. |
| **Mtsnsr mV** | Measured value related to fluid conductivity. |

## SENSOR CALIBRATION

| PARAMETER | DESCRIPTION |
|---|---|
| **Snsr No** | Serial No. (Up to 13 characters) |
| **Snsr Tag** | Tag No. (If required). |
| **Snsr Size** | Sensor calibrated bore (mm). |
| **Snsr Vel** | Display of present velocity. |
| **Snsr Fact 1** | |
| **Snsr Fact 2** | Sensor calibration data – |
| **Snsr Fact 3** | should agree with sensor data label |
| **Snsr Fact 4** | |

## TEST MODE

| PARAMETER | DESCRIPTION |
|---|---|
| **Test Mode** | Set to '1' to enable. |
| **Test Flow** | Displays present flowrate. If in **'Test Mode'**, any value may be entered manually. ‡ |
| **Test %** | Flowrate as a percentage |
| **Test Hz** | Output Frequency |
| **Test mA** | Output Current |
| **Test Vel** | Flow Velocity in sensor |
| **Test Alm** | Shows present active alarms sequentially. ('Clr' indicates no alarms are active). Ø |
| **Test Txv** | Live flow velocity (uncorrected for sensor calibration). |

## DISPLAY RESOLUTION

| PARAMETER | DESCRIPTION |
|---|---|
| **Disp Res** | Enter number of decimal places required on flow display (0 to 5). |
| **Disp Mode** | Serial Communication display mode (Read Only) – attempts to edit this parameter result in display of 'Keypad Version No.' with eventual return to normal operation. |

## SECURITY PASSWORD

> **Caution.** Access is **NOT** possible without the correct password. 'Lost' passwords can ONLY be reset by the Service Engineer.

| | |
|---|---|
| **Login Key 1** | Set Level 1 security password. |
| **Login Key 2** | Set Level 2 security password. |

**#** The maximum which can be entered must not exceed 21000. The value entered may be displayed with a small error in the decimal digits e.g. 1.900 may be displayed as 1.899. This is a display characteristic and the value 1.900 will be used by the MagMaster.

**§** Select both parameters for bidirectional operation (e.g. when dual current output is fitted). If both are zero, then Iout is always 0%.

**‡** On performing a Rapid Reset/Escape to return to 'Operation' level, 'Test Mode' is automatically cancelled.

**Ø** If the sensor is empty or disconnected, the alarms 'MtSnsr' and 'Coil' will be displayed as appropriate.

# *7.0 SWITCHBOARD WORKS TEST RESULTS*

Form No. F1017/3

J. & P. RICHARDSON INDUSTRIES PTY LTD
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

## SWITCHBOARD & SHEETMETAL INSPECTION REPORT

| Customer Name: HALLCO | | | | | Job No: B95768 |
|---|---|---|---|---|---|
| Item: PORT GATE ESTATE SEWAGE PUMP PANEL | | | | | Drawing No: E07-B95768 A0 => A5 |
| **TASK** | **PRODUCT DETAIL** | **INSPECTED BY** | **DATE** | **PASS / FAIL** | **CORRECTIVE ACTION REQUEST OR COMMENTS** |
| Design | Documents | DW | 7-3-07 | P | |
| Drafting | Documents | DW | 7-3-07 | P. | |
| Sheetmetal (Refer F1018 for details) | Switchboard | | | | |
| | Doors | | | | |
| | Cell/Panels | [illegible] | 12-3-07 | P | |
| Painting | | | | | |
| Process | Powder / Wet | | | | |
| Min DFT (40 STD) | | | | | |
| Cure Test | | | | | |
| Colour Exterior | MIST GREEN | Howard | | | |
| Colour Internal | WHITE | | 14/03/07 | PASS | |
| Colour Panels | WHITE | | | | |
| Cubicle Erection | Vedhant Chance | | | | |
| Electrical Fitout (In accordance with drawings) | | R Kompankons | | | |
| Inspection & Test (Refer to F1019) | | E Ensor | 4/4/07 | Pass | |
| Packing | | | | | DIETER |

*Comments:*

PAINT PLINTH MIST GREEN
all Kepp an Dor Howard 14/03/07

*NOTE: - Manufacture is not to proceed to the next process until the item has passed inspection*

Affix Status Here: -

| | |
|---|---|
| Yellow | Awaiting Inspection |
| Green | Inspection & Test Passed |
| Red | Inspection & Test Failed, Awaiting Rectification |

Form No. F1018/2

J. & P. RICHARDSON INDUSTRIES PTY. LTD.
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

## SWITCHBOARD / SHEETMETAL INSPECTION CHECKLIST

CLIENT: HALLCO

JOB NO: 595768

PRODUCT DESCRIPTION: PORT GATE ESTATE SEWAGE PUMP STATION

DRAWING & SCHEDULE NUMBERS: E07 595768 A0 — A8

| CONSTRUCTION | QUALITY: GOOD | QUALITY: POOR | COMPLIANCE WITH DRAWINGS: YES | COMPLIANCE WITH DRAWINGS: NO | REMARKS OR ACTION |
|---|---|---|---|---|---|
| 1. Folds | | | ✓ | | |
| 2. Welds | | | ✓ | | |
| 3. Edges / File | | | ✓ | | |
| 4. Gauge | | | ✓ | | |
| 5. Material | | | ✓ | | |
| 6. Ventilation Openings / Filter Bracket | | | ✓ | | |
| 7. Equipment Mounting Arrangement | | | ✓ | | |
| 8. Doors Stiffened | | | ✓ | | |
| 9. Escutcheons and Lexan Covers | | | ✓ | | |
| 10. Cable Saddles | | | ✓ | | |
| 11. Grinding | | | ✓ | | |
| 12. Door Stays Fitted | | | ✓ | | |
| 13. Earth Studs | | | ✓ | | |
| 14. Rubber Retainer | | | N/A | | |
| 15. Drawing Holder | | | ✓ | | |
| 16. Hat Sections | | | N/A | | |
| 17. Locking Bars Fitted | | | ✓ | | |
| 18. External Crevice Welded and Ground | | | ✓ | | |
| 19. Legend Cards | | | ✓ | | |
| 20. General Conditions Satisfactory | | | ✓ | | |
| 21. Cabinet Clean | | | ✓ | | |
| 22. Job Name and Number Marked | | | ✓ | | |

INSPECTED BY: [signature]

DATE: 12-3-07

| AFFIX STATUS HERE | | |
|---|---|---|
| | Yellow | Awaiting Inspection |
| | Green | Inspected/Tested Passed |
| | Red | Inspected/Tested Awaiting Rectification |

Form No. F1019/8
Page 1 of 6

**J. & P. RICHARDSON INDUSTRIES PTY LTD**
114 Campbell Avenue, WACOL QLD 4076
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E-mail: jpr@jpr.com.au

# SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT

| | | | |
|---|---|---|---|
| Customer Name: | Hallco | | |
| Project: | Port of Brisbane - Port Gate Estate | | |
| JPR Job No: | M 95768 | Item: | Sewerage Pump Station |
| Constructed by: | R Kompenhans | Tested by: | E Ensor — Date: 4/4/07 |

**Item check list: — To comply with Drawings, Documents & Specification**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Main Functional Unit/s | Qty | ✓ | Size | ✓ | Fuses/O/L | | |
| Fuse Fittings | Qty | ✓ | Size | ✓ | Fuse Size | ✓ | |
| Circuit Breakers | Qty | ✓ | Size | ✓ | O/L | | |
| Neutral | Reqd | ✓ | Size | ✓ | ID | | |
| Earthing | Checked | ✓ | Size | ✓ | | | |
| C.T.s | Qty | ✓ | Rating | ✓ | | | |
| Meters | Qty | | Rating | | | | |
| Contactors | Qty | | Rating | | Voltage | | |
| Overloads | Qty | | Rating | | Function | | |
| Relays | Qty | ✓ | Rating | ✓ | Voltage | ✓ | |
| Timers | Qty | ✓ | Rating | ✓ | Voltage | ✓ | |
| Control Switches | Qty | ✓ | Rating | ✓ | Function | ✓ | |
| Push Buttons | Qty | ✓ | Rating | | Function | | |
| Pilot Lights | Qty | | Rating | | Voltage | | |
| Transformers | Qty | ✓ | Rating | ✓ | Voltage | ✓ | |
| ~~ATT/VFD~~/Soft Starter | Qty | ✓ | Rating | ✓ | Function | ✓ | |
| DC Supply | Qty | | Rating | | Voltage | | |
| Terminals | Qty | ✓ | Size | ✓ | ID | ✓ | |
| Engraving | Qty | ✓ | Size | ✓ | ID | ✓ | |
| Cabling | Type | ✓ | Size | ✓ | ID | ✓ | |
| Busbars | Type | | Size | | ID | | |
| Escutcheons / Shrouds | Type | ✓ | Material | ✓ | IP rating | ✓ | |
| S.A. Metering CTs | Qty | | Rating | | | | |
| S.A Metering Links | Type | | | | | | |
| S.A. Meters | Type | ✓ | Size | | | | |
| JPR Label | Fitted | ✓ | Stamped | ✓ | Safety Stkr | ✓ | |
| Legend Card | Qty | ✓ | Correct | ✓ | | | |
| PLC/Telemetry | Qty | ✓ | Size | ✓ | | | |
| Power Monitor Relay | Qty | | Rating | | Function | | |

**General Check List:**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| IP Sealing | Rating | ✓ | | | | | | |
| Door Latches/Hinges | Qty | ✓ | Type | ✓ | Operation | ✓ | | |
| Ventilation | Required | ✓ | Type | ✓ | Operation | | | |
| Circuit Schedule | Required | | Fitted | | Checked | | | |
| Terminal Tightness | Power | ✓ | Control | ✓ | Result | ✓ | | |
| Busbar System | Clearances | | Joints | | ID | | | |
| Earth Continuity | Body to E | ✓ | Doors to E | ✓ | Panels to E | ✓ | | |
| Cubicle Cleaned | | ✓ | | | | | | |
| Paint Finish Intact | | ✓ | | | | | | |
| Polarity Check | R - R | ✓ | W - W | ✓ | B - B | ✓ | | |
| Function | Power | ✓ | Control | ✓ | PLC/Telem | ✓ | | |
| Continuity Check | R - R | ✓ | W - W | ✓ | B - B | ✓ | N - N | ✓ |

**Comments:**

J. & P. RICHARDSON INDUSTRIES PTY LTD
114 Campbell Avenue, WACOL QLD 4076
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Form No. F1019/8
Page 6 of 6

## SWITCHBOARD CONTINUITY & INSULATION TEST REPORT

| | | | |
|---|---|---|---|
| Customer Name: | Hallco | | |
| Project: | Port of Brisbane - Port Gate Estate | | |
| JPR Job No: | M 95768 | Switchboard: | Sewerage Pump Station |
| Constructed by: | R Kompenhans | Tested by: E Ensor | Date: 23/3/07 |

### CONTINUITY TEST

| From | To | Red | White | Blue | Neutral |
|---|---|---|---|---|---|
| | | | | | |
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***Sketch:***

### INSULATION TESTS TO SECTION 8 OF AS3439.1

| *Designation* | 1000 V Test (MΩ) | 2.5 kV Test ( 1min ) | 1000 V Test (MΩ) |
|---|---|---|---|
| Red to Earth | 400 | | |
| White to Earth | 400 | | |
| Blue to Earth | 400 | | |
| Neutral to Earth | | | |
| Red to White | 400 | | |
| Red to Blue | 400 | | |
| White to Blue | 400 | | |

***Comments:***

**J. & P. RICHARDSON INDUSTRIES PTY LTD**
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E-mail: jpr@jpr.com.au

Form No. F1019/8


# SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
## PRIMARY & SECONDARY INJECTION TESTS

**Customer Name:** Hallco

**JPR Job No:** M 95768 | **Item:** Sewerage Pump Stn. | **Drive:**

**Constructed by:** R Hompenhuns | **Tested by:** E Ensor | **Date:** 26/3/07

| Item | CT Ratio | Primary Turns | Primary Amps | Secondary Amps | Percentage (%) | Comment |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1T1 | 50/5A | 1 | 50 | 51·9 | | |
| 1T2 | 50/5A | 1 | 50 | 52·3 | | |
| 1T3 | 50/5A | 1 | 50 | 51·1 | | |
| | | | | | | |
| 2T1 | 50/5A | 1 | 50 | 52·3 | | |
| 2T2 | 50/5A | 1 | 50 | 52·7 | | |
| 2T3 | 50/5A | 1 | 50 | 51·9 | | |

***Comments:***

Form No. F1019/8
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J. & P. RICHARDSON INDUSTRIES PTY LTD
114 Campbell Avenue, WACOL QLD 4076
Ph: (07) 3271 2911 - Fax: (07) 3271 3623
E-mail: jpr@jpr.com.au

## SWITCHBOARD ELECTRICAL INSPECTION & TEST REPORT
## EARTH LEAKAGE TEST

| | | | |
|---|---|---|---|
| Customer Name: | Hallco | | |
| JPR Job No: | M 95768 | Item: | Sewerage Pump Station |
| Constructed by: | R Kompenhans | Tested by: | G Ensor — Date: 26/3/07 |
| Test Unit | Megger RCDT330 | ✓ | Other |

| Circuit Breaker | Phase | Rated Current (mA) | | Trip Current (mA) | | Trip Time (mS) | Comments |
|---|---|---|---|---|---|---|---|
| Q5 | | 30 | | 23 | | 28.7 | |
| Q6 | | 30 | | 23 | | 28.2 | |

*Comments:-*

FILE: EMC0381/BL 03/01/03 PAGE 1 OF :

# JOB SAFETY ANALYSIS

## LIVE LOW VOLTAGE WORK

## TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 23/3/07

| AUTHORISATIONS | PERSONAL PROTECTIVE EQUIPMENT |
|---|---|
| • Authorisation from person in charge ☑ YES<br>(Signature) | • Long cotton clothing ☑ YES<br>• Insulating work gloves in test ☑ YES<br>• Insulating mats / covers in test ☑ YES<br>• Switchboard rescue kit in test ☑ YES |

| TASK | | |
|---|---|---|
| LIVE LOW VOLTAGE WORK | • Isolation points identified and accessible | ☑ YES |
| | • Work area clear of obstructions | ☑ YES |
| | • Unauthorised access prevented to work area | ☑ YES |
| | • P.P.E. is fit for purpose | ☑ YES |
| | • Test equipment is fit for purpose | ☑ YES |
| | • Written authority to proceed has been obtained from a person in charge | ☑ YES |
| TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES | • JPR authorisation to conduct live work is current | ☑ YES |
| | • Approved dedicated power supply only used for testing. | ☑ YES |
| | • Approved dedicated power supply in current test | ☑ YES |
| OPTION | (A) RCD protected outputs used at power supply | ☑ YES |
| | > RCD protection checked daily prior to use | ☑ YES |
| | > Safety Observer ~~is~~ / is not required | ☑ YES |
| OPTION | (B) Non RCD protected outputs used at power supply | ☐ YES |
| | > Supervisor consulted prior to use | ☐ YES |
| | > Safety Observer is in attendance | ☐ YES |

I understand and am fully aware of the requirements of this job safety analysis.

| Signatures: | 1. E.U Gmor | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|

FILE: EMC0381/BL 03/01/03 PAGE 1 OF

# JOB SAFETY ANALYSIS

## LIVE LOW VOLTAGE WORK

## TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

**APPROVED BY:** Eric McCulloch (WHSO)

**LOCATION:** WACOL WORKSHOP **DATE:** 26/3/07

| AUTHORISATIONS | PERSONAL PROTECTIVE EQUIPMENT |
|---|---|
| • Authorisation from person in charge ☑ YES<br>(Signature) | • Long cotton clothing ☑ YES<br>• Insulating work gloves in test ☑ YES<br>• Insulating mats / covers in test ☑ YES<br>• Switchboard rescue kit in test ☑ YES |

| TASK | | |
|---|---|---|
| LIVE LOW VOLTAGE WORK | • Isolation points identified and accessible | ☑ YES |
| | • Work area clear of obstructions | ☑ YES |
| | • Unauthorised access prevented to work area | ☑ YES |
| | • P.P.E. is fit for purpose | ☑ YES |
| | • Test equipment is fit for purpose | ☑ YES |
| | • Written authority to proceed has been obtained from a person in charge | ☑ YES |
| TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES | • JPR authorisation to conduct live work is current | ☑ YES |
| | • Approved dedicated power supply only used for testing. | ☑ YES |
| | • Approved dedicated power supply in current test | ☑ YES |
| OPTION | (A) RCD protected outputs used at power supply | ☑ YES |
| | > RCD protection checked daily prior to use | ☑ YES |
| | > Safety Observer ~~is~~ / is not required | ☑ YES |
| OPTION | (B) Non RCD protected outputs used at power supply | ☐ YES |
| | > Supervisor consulted prior to use | ☐ YES |
| | > Safety Observer is in attendance | ☐ YES |

I understand and am fully aware of the requirements of this job safety analysis.

| Signatures: | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|

FILE: EMC0381/BL 03/01/03 PAGE 1 OF 1

# JOB SAFETY ANALYSIS

## LIVE LOW VOLTAGE WORK

## TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES

APPROVED BY: Eric McCulloch (WHSO)

LOCATION: WACOL WORKSHOP DATE: 3.1.4.1.07

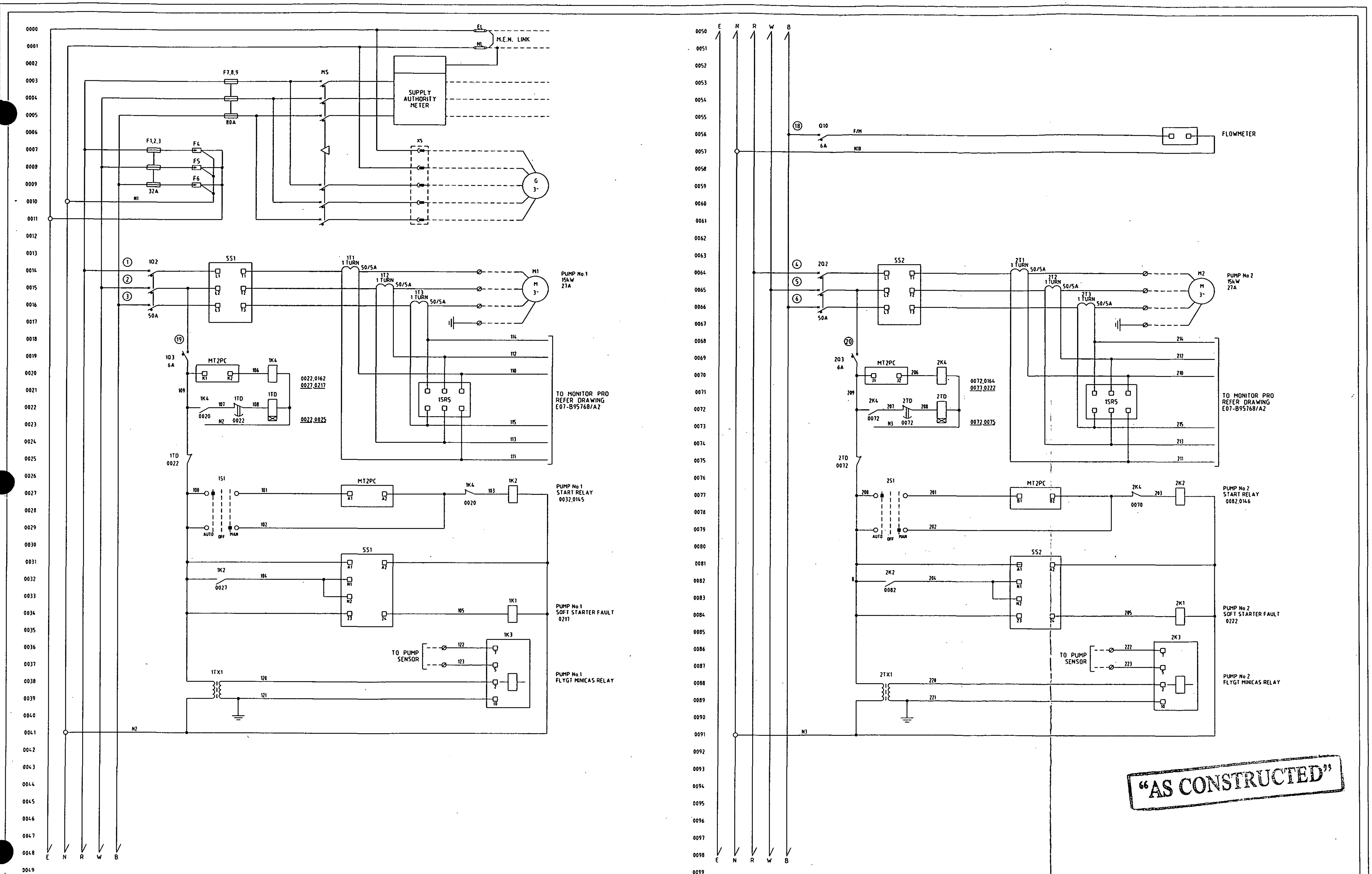
| AUTHORISATIONS | | PERSONAL PROTECTIVE EQUIPMENT | |
|---|---|---|---|
| • Authorisation from person in charge<br>(Signature) | ☑ YES | • Long cotton clothing<br>• Insulating work gloves in test<br>• Insulating mats / covers in test<br>• Switchboard rescue kit in test | ☑ YES<br>☑ YES<br>☑ YES<br>☑ YES |

| TASK | | |
|---|---|---|
| LIVE LOW VOLTAGE WORK | • Isolation points identified and accessible | ☑ YES |
| | • Work area clear of obstructions | ☑ YES |
| | • Unauthorised access prevented to work area | ☑ YES |
| | • P.P.E. is fit for purpose | ☑ YES |
| | • Test equipment is fit for purpose | ☑ YES |
| | • Written authority to proceed has been obtained from a person in charge | ☑ YES |
| TESTING SWITCHBOARDS AND CONTROL PANELS WITHIN OUR MANUFACTURING PREMISES | • JPR authorisation to conduct live work is current | ☑ YES |
| | • Approved dedicated power supply only used for testing. | ☑ YES |
| | • Approved dedicated power supply in current test | ☑ YES |
| OPTION | (A) RCD protected outputs used at power supply | ☑ YES |
| | > RCD protection checked daily prior to use | ☑ YES |
| | > Safety Observer ~~is~~ / is not required | ☑ YES |
| OPTION | (B) Non RCD protected outputs used at power supply | ☐ YES |
| | > Supervisor consulted prior to use | ☐ YES |
| | > Safety Observer is in attendance | ☐ YES |

I understand and am fully aware of the requirements of this job safety analysis.

| Signatures: | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|

## *8.0 "AS CONSTRUCTED" DRAWINGS*






FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

| LETTER | DESCRIPTION | DATE | AM'D BY | CHK'D |
|---|---|---|---|---|
| B | AS CONSTRUCTED | 19-4-07 | L.P. | |
| A | AMENDED FOR APPROVAL | 6-3-07 | L.P. | D.W. 6-3-07 |

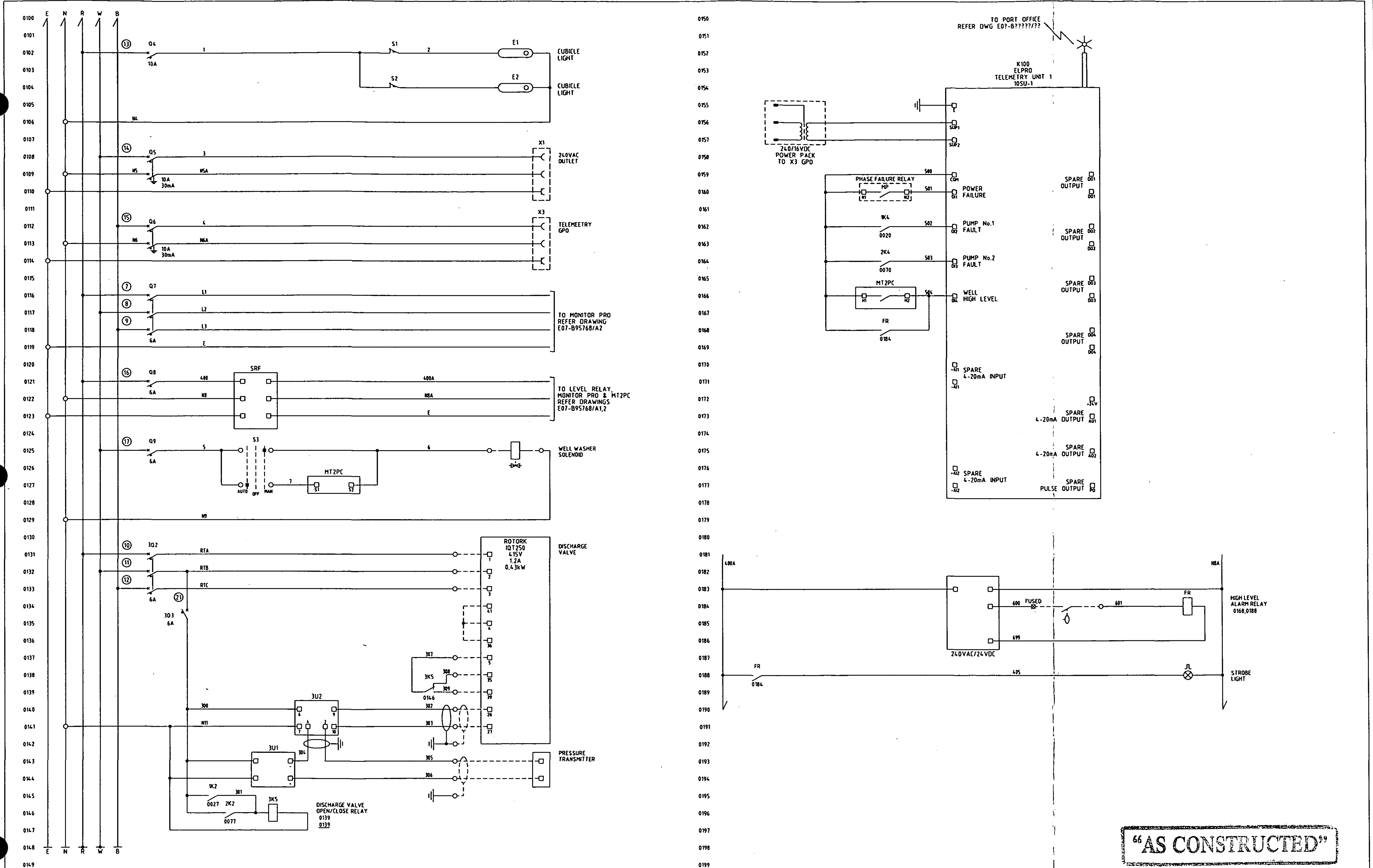
| | |
|---|---|
| SCALE | N.T.S. |
| DESIGNED | D.W. |
| TRACED | L.P. |
| CHECKED | D.W. 25-1-07 |
| DATE | 25-1-07 |
| APPROVED | |
| CLIENT NAME | HALLCO |
| JOB No. | B95768 |

J. & P. RICHARDSON INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWERAGE PUMP STATION
SCHEMATIC WIRING DIAGRAM

DRAWING No
E07-B95768/A0

AMENDMENT
B

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FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

LAST AMENDMENT DATE:

| LETTER | DESCRIPTION | DATE | AM'D BY | CHK'D |
|---|---|---|---|---|
| C | ADDED HIGH LEVEL ALARM RELAY | 26-9-07 | L.P. | |
| B | AS CONSTRUCTED | 19-4-07 | L.P. | D.W. 19-4-07 |
| A | AMENDED FOR APPROVAL | 6-3-07 | L.P. | D.W. 6-3-07 |

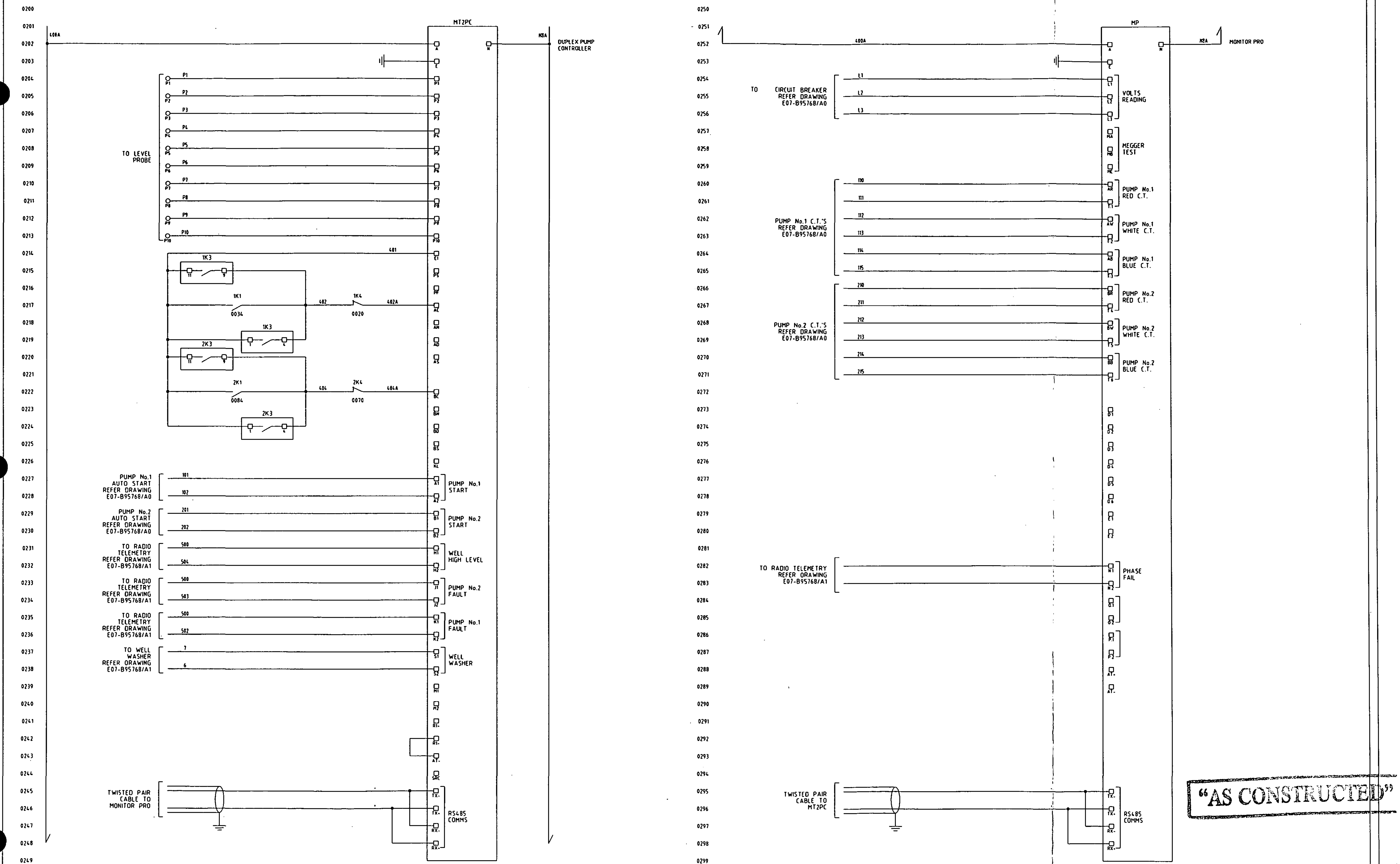
| | |
|---|---|
| SCALE | N.T.S. |
| DESIGNED | D.W. |
| TRACED | L.P. |
| CHECKED | D.W. 25-1-07 |
| DATE | 25-1-07 |
| APPROVED | |
| CLIENT NAME | HALLCO |
| JOB No. | B95768 |

J. & P. RICHARDSON INDUSTRIES PTY LTD – 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWERAGE PUMP STATION
SCHEMATIC WIRING DIAGRAM

DRAWING No
E07-B95768/A1

AMENDMENT
C






FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
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LAST AMENDMENT DATE:

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| CLIENT NAME | HALLCO |
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TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWERAGE PUMP STATION
SCHEMATIC WIRING DIAGRAM

DRAWING No
E07-B95768/A2

AMENDMENT
B

| ITEM | QTY | MAKE & NUMBER | DESCRIPTION | LABEL |
|---|---|---|---|---|
| EL | 2 | DORE ELECTRICS 165E12 | EARTH LINK | EARTH |
| E1,2 | 2 | BIKINI BBD13SW | CUBICLE LIGHTS | |
| F1-3 | 3 | NHP NV32FW | SURGE DIVERTER FUSE HOLDER | F1, F2, F3 |
| | 3 | NHP NNS 32 | FUSE LINKS | |
| F4-6 | 3 | NOVARIS SD1-80 | SURGE DIVERTER | F4, F5, F6 |
| 1,2K1,1,2K2 | 4 | FINDER 55.34.0054 240VAC c/w 94.04 BASE | RELAY | 1K1, 2K1, 1K2, 2K2 |
| 3K5 | 1 | FINDER 55.34.0054 240VAC c/w 94.04 BASE | RELAY | 3K5 |
| MP | 1 | MULTITRODE MT2PC 2 | MONITOR PRO | |
| MT2PC | 1 | MULTITRODE MONITORPRO 2 | DUPLEX PUMP CONTROLLER | |
| NL | 1 | DORE ELECTRICS 165N12 c/w E/NFEET MOUNTING FEET | NEUTRAL LINK | NEUTRAL |
| MS | 1 | SOCOMEC SCO 125 3P | MAIN SWITCH CHANGEOVER | MAIN SWITCH |
| F7-9 | 3 | NHP NOS80 + NC100FW | FUSE LINKS | F7, F8, F9 |
| 1Q2, 2Q2 | 2 | TERASAKI DTCB6350C | PUMP CIRCUIT BREAKER | 1Q2, 2Q2 |
| 3Q2 | 1 | TERASAKI DTCB6306C | DISCHARGE VALVE CIRCUIT BREAKER | 3Q2 |
| 1Q3, 2Q3 | 2 | TERASAKI DTCB6106C | PUMP CONTROL CIRCUIT BREAKER | 1Q3, 2Q3 |
| 3Q3, Q10 | 2 | TERASAKI DTCB6106C | DISCHARGE VALVE CONTROL, FLOWMETER CIRCUIT BREAKER | 3Q3 ,Q10 |
| Q4 | 1 | TERASAKI DTCB6110C | CUBICLE LIGHT CIRCUIT BREAKER | Q4 |
| Q5 | 1 | TERASAKI DSRCBH-10-30A | 240VAC OUTLET EARTH LEAKAGE CIRCUIT BREAKER | Q5 |
| Q6 | 1 | TERASAKI DSRCBH-10-30A | TELEMETRY OUTLET EARTH LEAKAGE CIRCUIT BREAKER | Q6 |
| Q7 | 1 | TERASAKI DTCB6306C | MONITOR PRO 3 PHASE SUPPLY CIRCUIT BREAKER | Q7 |
| Q8 | 1 | TERASAKI DTCB6106C | MONITOR PRO & MT2PC CONTROL CIRCUIT BREAKER | Q8 |
| Q9 | 1 | TERASAKI DTCB6106C | WELL WASHER SUPPLY CIRCUIT BREAKER | Q9 |
| 1SR5, 2SR5 | 2 | MULTITRODE SR5 | CURRENT SHUNTS | 1SR5, 2SR5 |
| S1,2 | 2 | DORE SM202 | DOOR SWITCH | |
| 1S1, 2S1 | 2 | ELECTRA B2N U3-20C | M-O-A SELECTOR SWITCH | PUMP 1, 2 |
| S3 | 1 | ELECTRA B2N U3-20C | M-O-A SELECTOR SWITCH | WELL WASHER |
| 1,2TX1 | 2 | ATCO 75 | CONTROL TRANSFORMER | 1TX1, 2TX1 |
| SS1, SS2 | 2 | DANFOSS MCD202 | SOLID STATE STARTER | SS1, SS2 |
| 1T1-3, 2T1-3 | 6 | IME TAI BB 50/5 | CURRENT TRANSFORMER | 1T1-3, 2T1-3 |
| 3U1 | 1 | ONETEMP DR-4524 | 24VDC POWER SUPPLY | 3U1 |
| 3U2 | 1 | ONETEMP SHIMADEN SR91-41-90-1N0 | PID CONTROLLER | DISCHARGE PRESSURE PID |
| X1,3 | 2 | CLIPSAL 2025 | 10A 240V DOUBLE POWER OUTLET / TELEMETRY OUTLET | |
| X5 | 1 | 51DA058 c/w 3168017 | GENERATOR INLET SOCKET | |
| SRF | 1 | PSF110 | SURGE REDUCTION FILTER | SRF |
| K100 | 1 | ELPRO 105U-1 | TELEMETRY UNIT | |
| | 31 | DOOR ELECTRIC ATB4 | 4mm TERMINAL | |
| | 7 | DOOR ELECTRIC EC4 + 10 END CLAMPS | 4mm TERMINAL END PLATE | |
| | 3 | DOOR ELECTRIC EC4 | 4mm EARTH TERMINAL | |
| | 1 | MOUNTING BLOCK | | |
| | 1 | ABB MAGMASTER | FLOWMETER | |
| | 6 | DOOR ELECTRIC 6mm TERMINALS | | |
| | 2 | DOOR ELECTRIC 6mm EARTH TERMINALS | | |
| | 2 | DOOR ELECTRIC 6mm ENDPLATES | | |
| | 1 | RF INDUSTRIES YB16-70 ARIEL | | |

"AS CONSTRUCTED"



FILE NAME:

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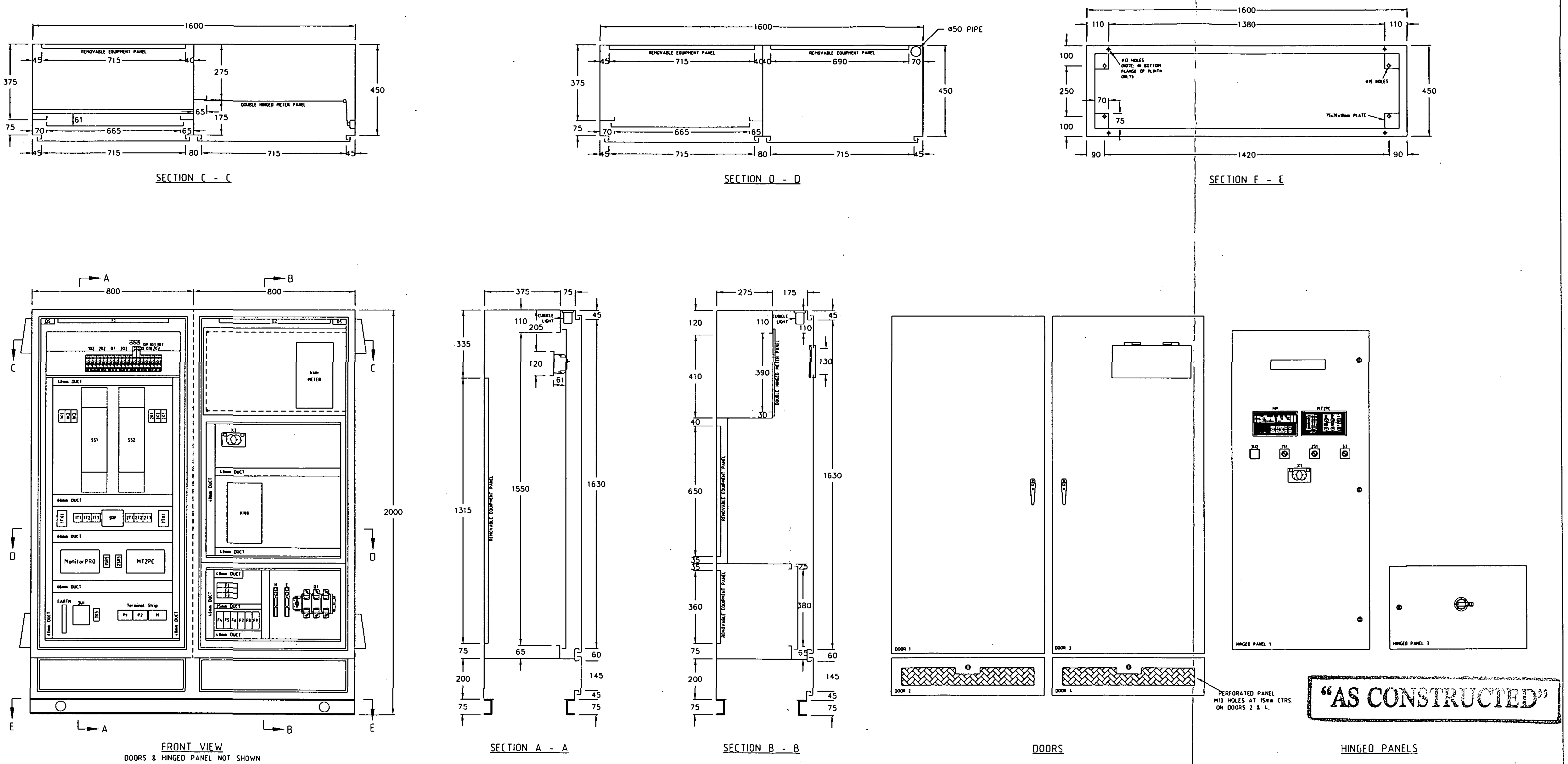
| DESIGNED | D.W. |
| TRACED | L.P. |
| CHECKED | D.W. 25-1-07 |
| DATE | 25-1-07 |
| APPROVED | |
| CLIENT NAME | HALLCO |
| JOB No. | B95768 |

J. & P. RICHARDSON
INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
PH(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWERAGE PUMP STATION
EQUIPMENT SCHEDULE

DRAWING No
E07-B95768/A3

AMENDMENT
B

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| CHECKED | D.W. 25-1-07 |
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| APPROVED | |
| CLIENT NAME | HALLCO |
| JOB No. | B95768 |

J. & P. RICHARDSON INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076 ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325 Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWERAGE PUMP STATION
GENERAL ARRANGEMENT

DRAWING No
E07-B95768/A4

AMENDMENT
B

| | |
|---|---|
| **PROJECT:** | **Hallco** |
| **JOB NO:** | **B95768** |
| **ITEM:** | **MCC Construction Notes** |
| **DOCUMENT NO:** | **Drawing No.E07-B95768/A5** |
| **DESIGN DETAILS: -** | |
| Place of installation | Outdoor |
| Type of installation | Stationary |
| S.C.A. Design | Custom |
| S.C.A. Detail | Front Access, Front Connect, Bottom Entry / Exit |
| Current Rating | 80A |
| Frequency | 50 Hz |
| Rated Voltage (operational) | 415 VAC 3 Phase and Neutral |
| Control Voltage | 240VAC / 24VAC |
| Insulation Rating | 0.6 / 1 kV |
| Short Circuit withstand Current | 6kA for 1 second |
| Type Tested in accordance with | N/A |
| Segregation Classification | Form 1 to AS3439.1 |
| Degree of Protection | IP56 to AS1939 |
| Internal Degree of Protection | IP20 |
| Design Ambient Temperature | 40°C |
| Design Temperature Rise | 50°C above Ambient |
| Earthing System | Men |
| Men Link | Required |
| **CONSTRUCTION DETAILS: -** | |
| Cubicle Material | 3mm thick Marine Grade Aluminium |
| Equipment Panels | 3mm thick Marine Grade Aluminium |
| Fixings | All Fixings shall be 316 Grade Stainless Steel |
| Welding | Fully Welded on Facia |
| Sealing Against Sewer Gas | Switchboard to be Sealed to Limit Ingress of Sewer Well Gases |
| Stiffening | To prevent warping and form a rigid enclosure |
| Plinth - Material Type | Aluminum Channel |
| Plinth - Material Dimensions | 75 x 40 x 6 mm |
| Plinth - Finish | Painted |
| Lifting | Via 50mm holes in Plinth |
| Door Sealing | Dore Electrics ES60-51 |
| Hinges Doors / Hinged Panels | Chrome Plated lift off type |
| Door Locks | Padlockable 'L' Handle |
| Escutcheon Locks | 1/4 turn with Slotted Insert |
| Cable & Bus Zones Fixings | 1/4 turn with Slotted Insert |
| Three Point Locking | Required |
| Door Earthing | Fit Earthing Stud to all Doors / Hinged Panels fitted with Electrical Equipment, Earth Doors with 6mmsq. Tinned Copper Braid |
| Door Opening | 100° min |
| Door Stays | Drop Stays |
| Equipment Shrouding | IP20 for Controlgear, Fully Shroud Line Side of Main Switch |
| Drawing Holder | Fit to Rear of Door 1 |
| Legend Card Holder | Fit to Rear of Door 1 |
| Meter Panel | Double Hinged / 6mm Laminated Phoenelic Resin |
| Ventilation | Louvres with Mesh Gauze and removable Filter Material, refer drawing for detail |
| Cowls | Cowls Louvres with Mesh Gauze and removable Filter Material, refer drawing for detail |
| Door Switch Brackets | Fit Door Switch Brackets to Cubicle Body, refer drawing for detail |

| | |
|---|---|
| **PAINTING: -** | |
| Paint Type | Polyester Powdercoat to 40 Micron Minimum thickness |
| Preparation | Grind Smooth all Welds, Descale and Degrease |
| Exterior / Doors Colour | Dulux Mist Green 36648 |
| Interior Colour | White |
| Equipment Panel Colour | White |
| Escutcheon Colour | White |
| Plinth Colour | Dulux Mist Green 36648 |
| **CABLE DETAILS: -** | |
| Power | V75 0.6 / 1 kV Multi-Stranded, Min. Size 2.5mm (7/0.67) |
| Control | V75 0.6 / 1 kV Tinned Flexible, Min., Size 1.5mm (30/0.25) |
| Protection / Metering | V90 0.6 / 1 kV Tinned Flexible, Min. Size 2.5mm (50/0.25) |
| ***Colours:*** | |
| Power Wiring to 16mm | Red, White, Blue |
| Power Wiring above 16mm | Red With Phase Identification at Cable Ends |
| Phase Neutral | Black |
| Earth | Green Yellow |
| Control Active 240VAC | White |
| Control Neutral 240VAC | Black |
| Control Active ELV | Brown |
| Control Neutral ELV | Grey |
| Thermistors & No Volt Contacts | Orange |
| Telemetry | Violet |
| ***Terminations:*** | |
| Control Cable Identification | Brady Marking System (Clear Plastic Sleeves with Insertable Tabs) |
| Cable Ends | Metal Ferrules / Crimp Lugs as Necessary |
| Mains Incoming | Copper Tags / Terminals |
| Outgoing | Direct Onto Equipment / Terminals |
| Control | Terminals |
| **LABELS: -** | |
| Material | Traffolyte |
| Fixings External | 316 Grade Stainless Steel Metal Threads and Adhesive |
| Fixings Internal | 316 Grade Stainless Steel Metal Threads and Adhesive |
| Mounting | Labels to be secured to Equipment Panels |
| General Labels | WBW / 4mm Letters |
| Warning Labels | WRW / 6mm Letters |
| Danger Labels | RWR / 6mm Letters |
| Drive Labels | WBW / 6mm Letters |
| Main Switch Labels | RWR / 8mm Letters |
| S.C.A. Main Label | WBW / 20mm Letters |

"AS CONSTRUCTED"



FILE NAME:

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| DATE | 25-1-07 |
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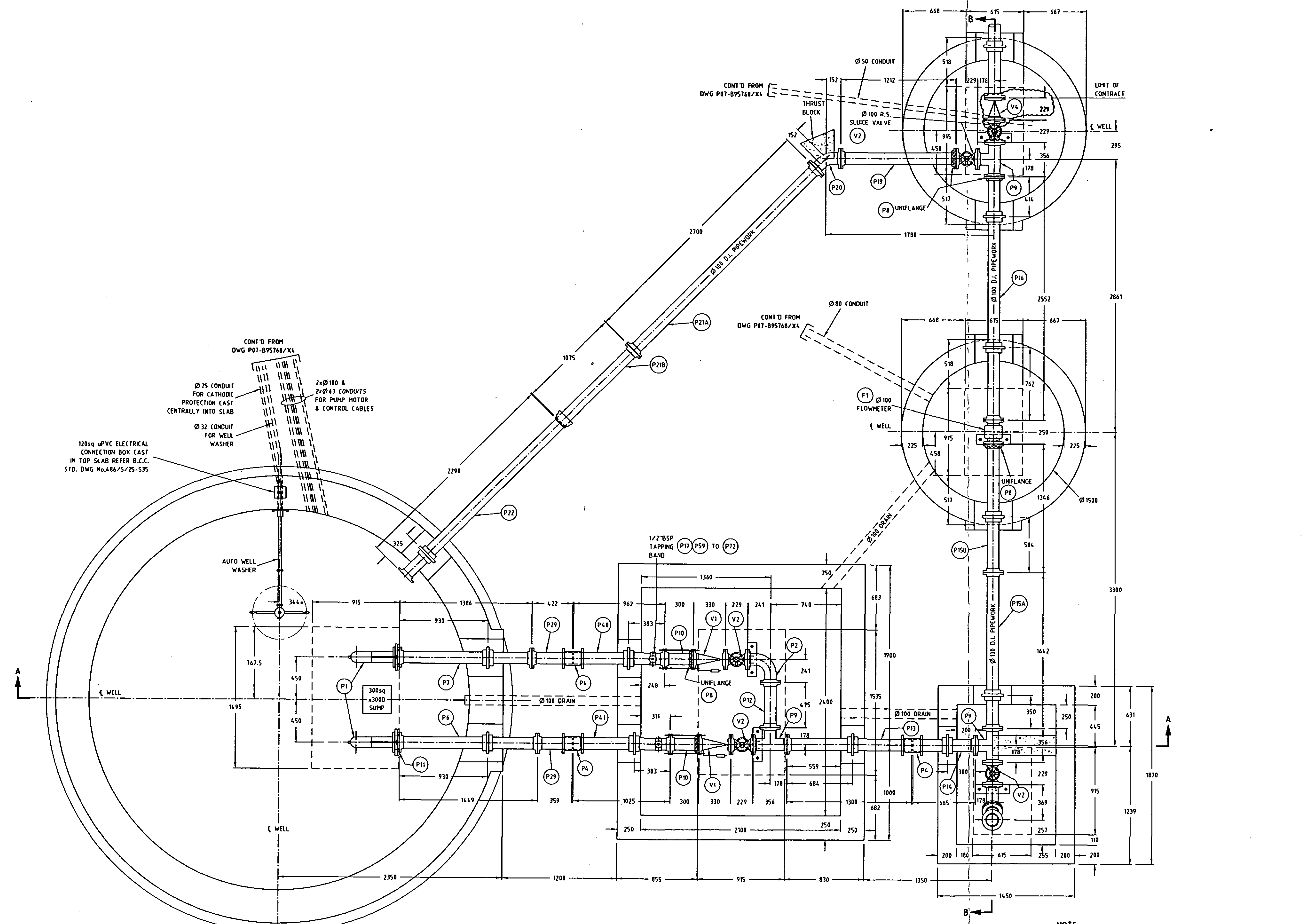
| CLIENT NAME | HALLCO |
| JOB No. | B95768 |

J. & P. RICHARDSON INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWERAGE PUMP STATION
CONSTRUCTION NOTES

DRAWING No
E07-B95768/A5

AMENDMENT
B

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**PLAN**

TOP SLAB NOT SHOWN

**NOTE:**

1. PUMPS FLYGT MODEL NS3153.181 SH 15kW 4PL
2. • CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS



FILE NAME:

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|---|---|---|---|---|
| D | AMEND AS CONSTRUCTED | 18-4-08 | P.H. | |
| C | PUMP WELL & VALVE PIT MANHOLE OPENING SIZES AMENDED | 14-3-07 | P.H. | P.H. 14-3-07 |
| B | VALVE BOX MOVED TO 1200mm FROM WET WELL | 26-2-07 | P.H. | P.H. 26-2-07 |
| A | MODIFICATIONS AS PER MWH REVISED DRAWINGS RECEIVED 31-1-07 & PORT OF BRISBANE REQUIREMENTS | 5-2-07 | P.H. | P.H. 5-2-07 |

| | |
|---|---|
| SCALE | 1:20 AT A1 |
| DESIGNED | P.H. |
| TRACED | P.H. |
| CHECKED | P.H. 22-1-07 |
| DATE | 22-1-07 |
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| CLIENT NAME | HALLCO ENGINEERING Pty Ltd |
| JOB No. | B95768 |

J. & P. RICHARDSON

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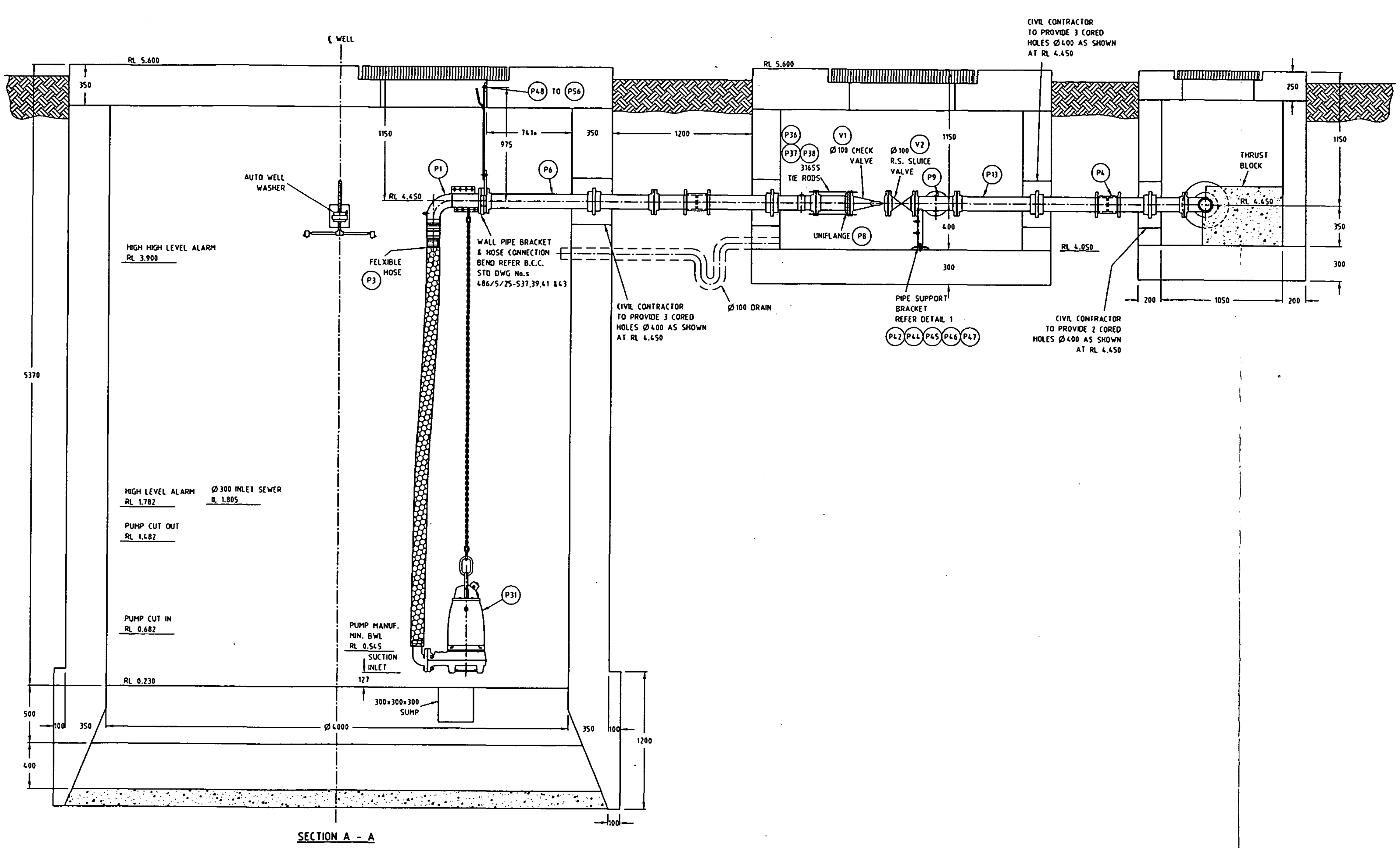
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE

PORT OF BRISBANE
PORT GATE ESTATE
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No P07-B95768/X0

AMENDMENT D




SECTION A - A

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NOTE:

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2. • CIVIL CONTRACTOR TO MAINTAIN THESE DIMENSIONS



FILE NAME:

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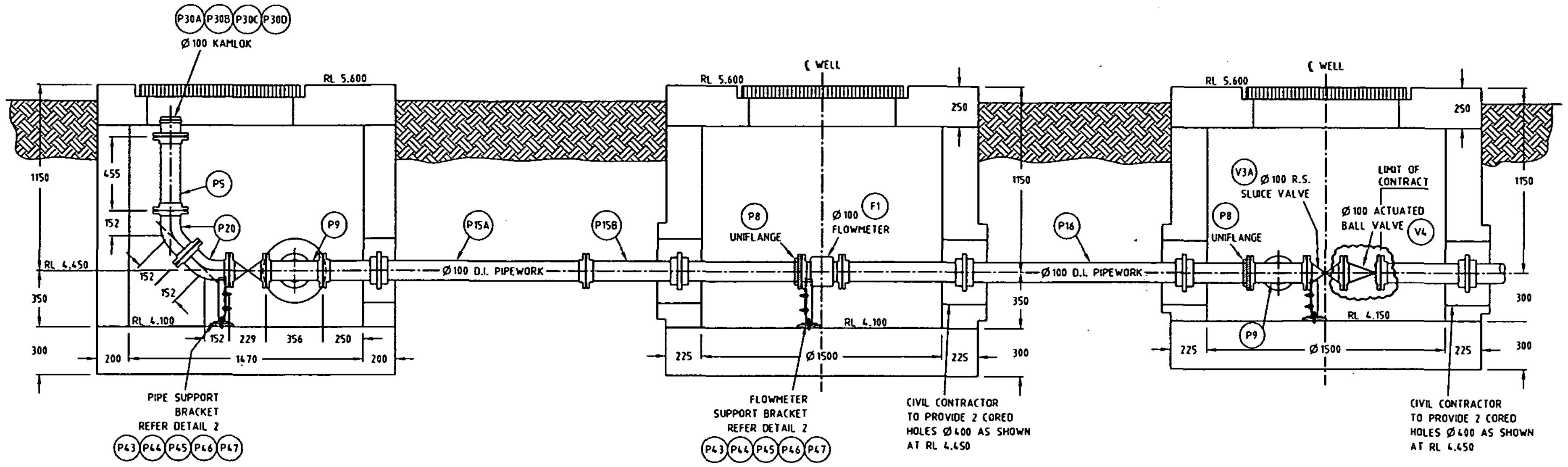
TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWER PUMP STATION
PIPEWORK LAYOUT

DRAWING No
P07-B95768/X1

AMENDMENT
D




SECTION B - B

## JOB NOTES

### WORK BY PUMP CONTRACTOR

1. Supply & Installation of all equipment detailed on drawing numbers P07-B95768/X0-4
2. Supply & Installation of control cubicle & associated wiring for pump station.
3. Pipework D.I. 100dia. Class K12 & fittings AS2280 Externally & Internally Nylon coated with fusion bonded epoxy.
4. All bolts, nuts, & washers in wet well grade 316SS.
5. All flanges to be AS2129 Table "C".
6. Supply & Installation of underground consumers mains cabling for a route length of 10m.

### WORK BY OTHERS

1. Construction of Pump Well, pits, generator slab, & plinth for Switchboard
2. Supply & Installation of manhole covers & frames, twist lock insert boxes, & steelwork other than that itemised on drawing numbers P07-B95768/X0-3
3. Supply & Installation of cast in conduits detailed on drawings.
4. Supply & Installation of property / property pole including rag bolts.
5. Supply & Installation of mains conduit to point of supply.
6. Supply & Installation of inlet pipework & valves.
7. Supply & Installation of air release pipework.
8. Provision of water for site testing.
9. Supply & Installation of rising main connection fitting.
10. Installation of rising main connection fitting if rising main is either:
    a. Not installed at time of pipework installation or
    b. The rising main is incorrectly located.
11. Excavation & backfilling where required.
12. Provision of cored holes for pipework & making good same after pipework installation.
13. Benching of pump well as requried by Consulting Engineer / Council.
14. Construction of concrete thrust blocks.
15. Supply & Installation of 20mm water service.

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NOTE:
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| CLIENT NAME | HALLCO ENGINEERING Pty Ltd |
| JOB No. | B95768 |

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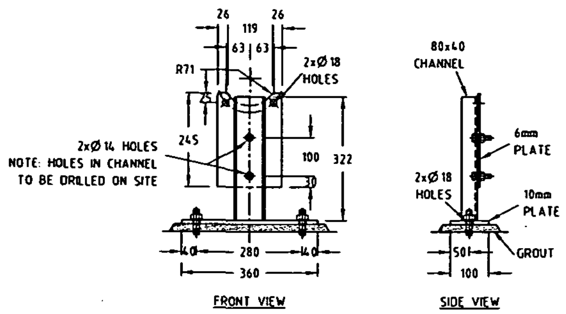
TITLE: PORT OF BRISBANE PORT GATE ESTATE SEWER PUMP STATION PIPEWORK LAYOUT & JOB NOTES

DRAWING No: P07-B95768/X2

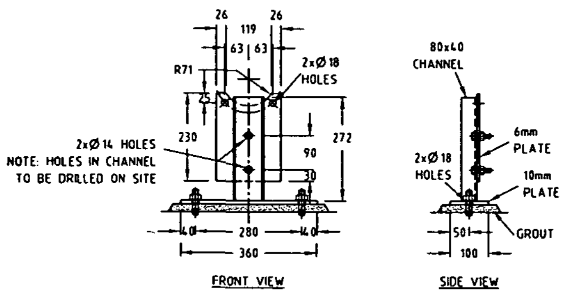
AMENDMENT: B




DETAIL 1
PIPE SUPPORT BRACKET

SCALE: 1:10 AT A1
MATERIAL: ALUMINIUM
No. REQUIRED: 2

P42 P44 P45 P46 P47




DETAIL 2
PIPE & FLOWMETER SUPPORT BRACKET

SCALE: 1:10 AT A1
MATERIAL: ALUMINIUM
No. REQUIRED: 2

P43 P44 P45 P46 P47

PIPEWORK & FITTINGS

| Item | Qty | Make & Number | Req. No. |
|---|---|---|---|
| P1 | 2 | BCC WALL PIPE BRACKET & HOSE CONNECTION BEND ASSEMBLIES | P8018 |
| P2 | 1 | 100dia. DF 90deg. BEND | P8015 |
| P3 | 20m ROLL | 100mm I.D. ALFA GOMMA T254 FLEXIBLE HOSE | P8017 |
| P4 | 3 | 100dia. ELONGATED GIBAULT JOINT | P8015 |
| P5 | 1 | 100dia. DF PIPE 455Lg | P8015 |
| P6 | 1 | 100dia. DF PIPE 1449Lg c/w WEEP FL 930 FROM FL | P8015 |
| P7 | 1 | 100dia. DF PIPE 1386Lg c/w WEEP FL 930 FROM FL | P8015 |
| P8 | 5 | 100dia. UNIFLANGE c/w SS STUDS | P8015 |
| P9 | 3 | 100dia. ALL FL TEE | P8015 |
| P10 | 2 | 100dia. FL/SP PIPE 300Lg | P8015 |
| P11 | 35 | 100dia. B.N.W.G. SETS 316SS TABLE "C" | P8015 |
| P12 | 1 | 100dia. DF PIPE 475Lg | P8015 |
| P13 | 1 | 100dia. FL/SP PIPE 2700Lg c/w WEEP FL 684 FROM FL CUT ON SITE TO SUIT | P8015 |
| P14 | 1 | 100dia. FL/SP PIPE 665Lg c/w WEEP FL 300 FROM FL | P8015 |
| P15A | 1 | 100dia. DF PIPE 1642Lg c/w WEEP FL 350 FROM FL | P8015 |
| P15B | 1 | 100dia. FL/SP PIPE 1346Lg c/w WEEP FL 584 FROM FL | P8015 |
| P16 | 1 | 100dia. FL/SP PIPE 2552Lg c/w WEEP FL 762 FROM FL & WEEP FL 414 FROM SP | P8015 |
| P17 | 2 | 100dia. 1/2"BSP TAPPING BAND | P8015 |
| P18 | | BY OTHERS | |
| P19 | 1 | 100dia. FL/SP PIPE 1375Lg C.O.S. | P8015 |
| P20 | 3 | 100dia. DF 45deg. BEND | P8016 |
| P21A | 1 | 100dia. DF PIPE 2700Lg | P8016 |
| P21B | 1 | 100dia. FL/SP PIPE 1410Lg C.O.S. | P8016 |
| P22 | 1 | 100dia. FL/SOC PIPE 2290Lg c/w WEEP FL 325 FROM FL | P8016 |
| P23 | | BY OTHERS | |
| P24 | | BY OTHERS | |
| P25 | | BY OTHERS | |
| P26 | | BY OTHERS | |
| P27 | | BY OTHERS | |
| P28 | | BY OTHERS | |
| P29 | 2 | 100dia. DF HYDRANT RISERS 600Lg C.O.S. TO SUIT | ---- |
| P30A | 1 | 4" TABLE "D" GALV. FLANGE SCREWED 4"BSP | P7450 |
| P30B | 1 | 100mm ALUMINIUM KAMLOK TYPE "F" | P7450 |
| P30C | 1 | 100mm ALUMINIUM DUST CAP | P7450 |
| P30D | 4 | M16x65-316SS SET SCREWS | V2122 |
| P31 | 2 | PUMPS FLYGT MODEL NS3153.181 SH 15kW 4PL | P8003 |
| P32 | -- | SPARE | ---- |
| P33 | -- | SPARE | ---- |
| P34 | -- | SPARE | ---- |
| P35 | -- | SPARE | ---- |
| P36 | 4m | M16-316SS BROOKER ROD | V2122 |
| P37 | 16 | M16-316SS NUTS | V2122 |
| P38 | 16 | 16mm-316SS FLAT WASHERS | V2122 |
| P39 | -- | SPARE | ---- |

PIPEWORK & FITTINGS

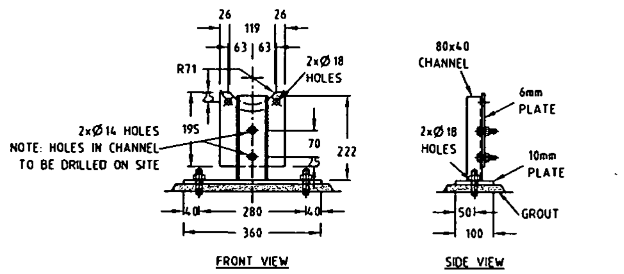
| Item | Qty | Make & Number | Req. No. |
|---|---|---|---|
| P40 | 1 | 100dia. FL/SP PIPE 962Lg c/w WEEP FL 383 FROM FL | STOCK |
| P41 | 1 | 100dia. FL/SP PIPE 1025Lg c/w WEEP FL 383 FROM FL | STOCK |
| P42 | 2 | PIPE SUPPORT BRACKET TO DETAIL 1 ON DWG P07-B95768/X3 | V2122 |
| P42A | 1 | PIPE SUPPORT BRACKET TO DETAIL 3 ON DWG P07-B95768/X3 | V2122 |
| P43 | 2 | FLOWMETER & PIPE SUPPORT BRACKET TO DETAIL 2 ON DWG P07-B95768/X3 | V2122 |
| P44 | 10 | M16x100 HSARM HILTI ANCHORS | V2122 |
| P45 | 10 | M12x40-316SS SET SCREWS | V2122 |
| P46 | 10 | M12-316SS NUTS | V2122 |
| P47 | 10 | 12mm-316SS FLAT WASHERS | V2123 |
| P48 | 4 | 12mm x 100-316SS SLEEVE ANCHORS | V2123 |
| P49 | 4 | 12mm GALV. SQUARE WASHERS | V2123 |
| P50 | 4 | M10-316SS HOOKS | V2123 |
| P51 | 4 | M10-316SS NUTS | V2123 |
| P52 | 4 | M10-HKDR HILTI ANCHORS | V2123 |
| P53 | 2 | PC6 NYLON CABLE STOCKINGS | V2123 |
| P54 | 2 | 8mm HOT DIP GALV. LIFTING CHAINS 5625Lg c/w RINGS AT 1125crs. S.W.L. 640kg | P8002 |
| P55 | 2 | 19 x 16 BOW SHACKLES S.W.L. 3250kg | P8002 |
| P56 | 2 | 11 x 10 BOW SHACKLES S.W.L. 1000kg | P8002 |
| P57 | -- | SPARE | ---- |
| P58 | -- | SPARE | ---- |
| P59 | 2 | PRESSURE GAUGE BRACKETS PC1617 | V2123 |
| P60 | 4 | M10x60 HSARM HILTI ANCHORS | V2123 |
| P61 | 4 | 1/2"x3/8" BSP REDUCING NIPPLES BRASS | V2123 |
| P62 | 2 | 3/8" BSP TEES BRASS | V2123 |
| P63 | 2 | 1/2" BSP BALL VALVES | V2124 |
| P64 | 2 | 3/8" BSP BALL VALVES | V2124 |
| P65 | 2 | 3/8" BSP NIPPLES BRASS | V2124 |
| P66 | 2 | 1/2" BSP BUNGS BRASS | V2124 |
| P67 | 4 | 1/2" BSP MALE TO 1/2" OD NYLON COMPRESSION UNIONS BRASS | V2124 |
| P68 | 6m | 1/2" OD NYLON 11 TUBING | V2124 |
| P69 | 12 | 1/2"-316SS SADDLES | V2124 |
| P70 | 24 | 25x8-316SS PK SCREWS | V2124 |
| P71 | 24 | WALL PLUGS GREEN | V2124 |
| P72 | 1 ROLL | THREAD TAPE | V2124 |

VALVES

| Item | Qty | Make & Number | Req. No. |
|---|---|---|---|
| V1 | 2 | 100dia. DF CHECK VALVE c/w C/WEIGHT | P8016 |
| V2 | 5 | 100dia. DF R.S. SLUICE VALVE c/w H/WHEEL | P8016 |
| V3 | -- | SPARE | ---- |
| V4 | 1 | 100dia. DF ACTUATED BALL VALVE | **** |

FLOWMETER

| Item | Qty | Make & Number | Req. No. |
|---|---|---|---|
| F1 | 1 | 100dia. DF MAGMASTER FLOWMETER | P8001 |




DETAIL 3
VALVE SUPPORT BRACKET

SCALE: 1:10 AT A1
MATERIAL: ALUMINIUM
No. REQUIRED: 1

P42A P44 P45 P46 P47

THIS DRAWING INDICATES THE WORKS BEING CARRIED OUT BY J & P RICHARDSON Ind. ONLY. IT DOES NOT NECESSARILY DEPICT ALL SERVICES, REQUIREMENTS,etc THAT MAY BE NEEDED BY COUNCIL OR THE DEVELOPER.



FILE NAME:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE
FOR YOUR SAFETY

LAST AMENDMENT DATE:

| LETTER | DESCRIPTION | DATE | AM'D BY | CHK'D |
|---|---|---|---|---|
| C | AMEND AS CONSTRUCTED | 18-4-08 | P.H. | P.H. |
| B | ITEM No.'s P4, P11, & P13 AMENDED, ITEM No. P29 ADDED | 26-2-07 | P.H. | P.H. 26-2-07 |
| A | MODIFICATIONS AS PER MWH REVISED DRAWINGS RECEIVED 31-1-07 & PORT OF BRISBANE REQUIREMENTS | 5-2-07 | P.H. | P.H. 5-2-07 |

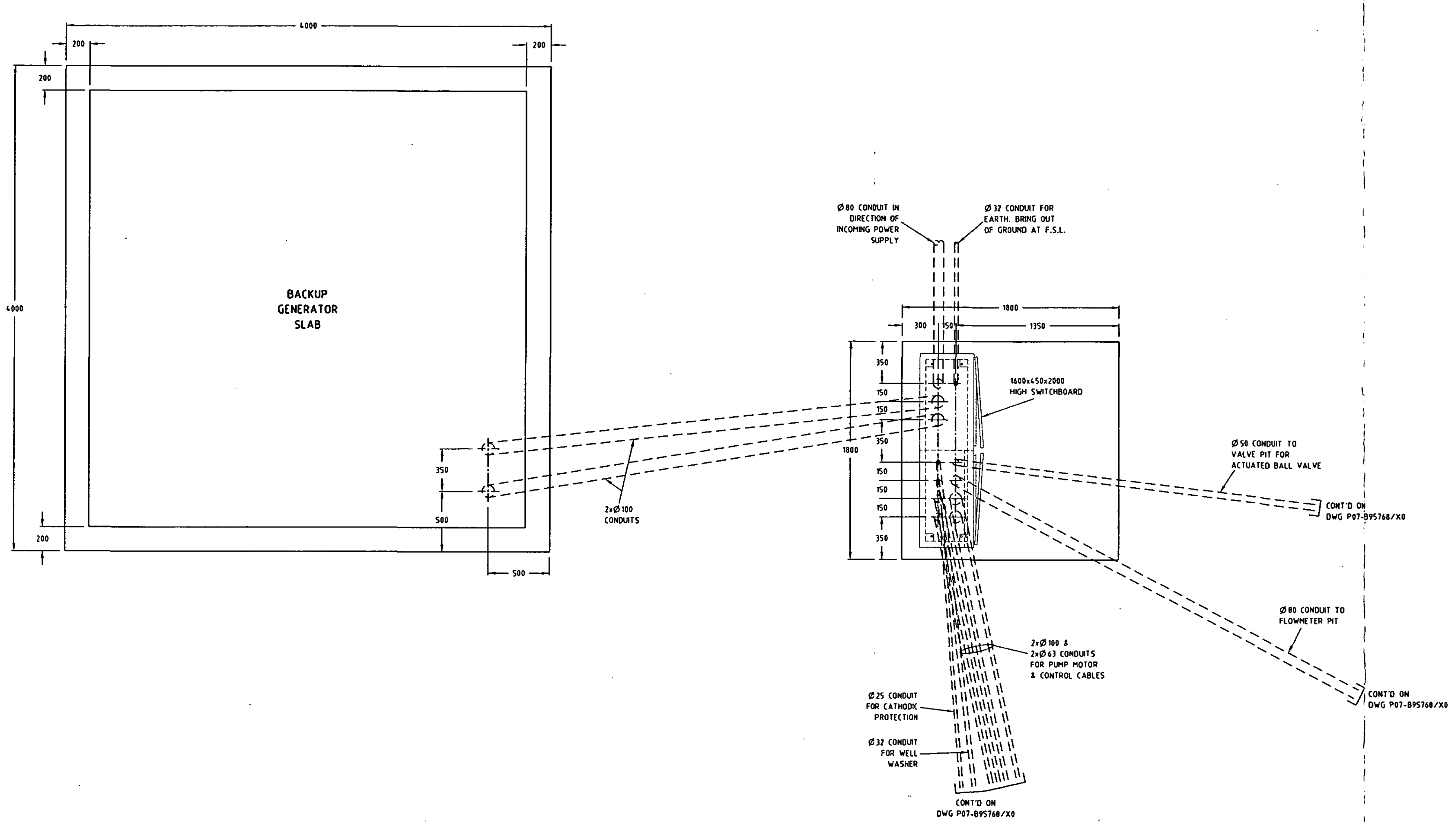
| | |
|---|---|
| SCALE | 1:10 AT A1 |
| DESIGNED | P.H. |
| TRACED | P.H. |
| CHECKED | P.H. 22-1-07 |
| DATE | 22-1-07 |
| APPROVED | |
| CLIENT NAME | HALLCO ENGINEERING Pty Ltd |
| JOB No. | B95768 |

J. & P. RICHARDSON
INDUSTRIES PTY LTD - 114 CAMPBELL AVE WACOL 4076
ELECTRICAL CONTRACTORS & ENGINEERS ABN 23 001 952 325
Ph(07)3271 2911 Fax(07)3271 3623 Email JPR@JPR.COM.AU

TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWER PUMP STATION
SUPPORT BRACKETS
& MATERIAL LIST

DRAWING No
P07-B95768/X3

AMENDMENT
C




NOTE:
1. ALL CONDUITS TO BE Min. 600mm BELOW F.S.L. & BE FITTED WITH DRAW ROPES.
2. BENDS TO BE LONG RADIUS.
3. CONDUITS TO FINISH 50mm ABOVE SWITCHBOARD SLAB

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FILE NAME:
LAST AMENDMENT DATE:

HAVE YOU ASSESSED THE RISK ASSOCIATED WITH THIS WORK?
REPORT PROMPTLY ANY CONDITION LIABLE TO CAUSE AN ACCIDENT REMEMBER
YOU ARE RESPONSIBLE FOR YOUR SAFETY

| LETTER | DESCRIPTION | DATE | AM'D BY | CHK'D |
|---|---|---|---|---|
| B | AMEND AS CONSTRUCTED | 18-4-08 | P.H. | PJIS 4-08 |
| A | MODIFICATIONS AS PER MWH REVISED DRAWINGS RECEIVED 31-1-07 & PORT OF BRISBANE REQUIREMENTS | 5-2-07 | P.H. | P.H. 5-2-07 |

| | |
|---|---|
| SCALE | 1:20 AT A1 |
| DESIGNED | P.H. |
| TRACED | P.H. |
| CHECKED | P.H. 22-1-07 |
| DATE | 22-1-07 |
| APPROVED | |
| CLIENT NAME | HALLCO ENGINEERING Pty Ltd |
| JOB No. | B95768 |

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TITLE
PORT OF BRISBANE
PORT GATE ESTATE
SEWER PUMP STATION
CONDUIT DETAILS

DRAWING No
P07-B95768/X4

AMENDMENT
B