



Client :

BRISBANE WATER

Document Title : **CASWELL ST. SEWAGE PUMPING STATION
OPERATION and MAINTENANCE DATA MANUAL**



Issue : ***Book 1 of 1***

Date of Issue : ***August 2000***

Author : ***Peter Hague***



Brisbane City Council



Project Acceptance Certificate

Brisbane Water Business Asset Services
Project Management Section



PROJECT ACCEPTANCE CERTIFICATE

Project: *Caswell St. Sewage Pumping Station Upgrade.*

Date: *21nd August 2000*

The project is complete as per the Project Delivery Document, has been commissioned and is now in operation.

Certified By:

Andrew Schoemaker Project Manager

The Operation and Maintenance Manuals have been accepted by:

Engineering Services

The Project is accepted with the attached defects.

24/8/00

A. Schoemaker Project Manager

Client's Representative

Attachments: Defects List

Caswell St. Sewage Pumping Station Upgrade



Client :

BRISBANE WATER

Document Title : ***Caswell St. Sewage Pumping Station Upgrade***

Item 1 Nil.

Regards

Peter Hague

Table of Contents *Caswell St. Sewage Pumping Station Upgrade O & M manuals*

1 Book 1

Maintenance copy

1.1 Maintenance Data Manual

Contains equipment details, supplier, programming and/or setup data.

1.2 Functional Spec

Functional requirement Specification

1.3 Misc.

Miscellaneous information on construction, installation and operation.

1.4 Actuator

Rotork actuator manual

1.5 Schematics.

Contains all of the final as commissioned drawings for the project.

SET POINTS FOR CASWELL ST.

The operation levels are to be amended post October 2000 on completion of the Wembley Park main.
The set points will be as follows:

Wet Well Level Metres	Indicator %	Metres AHD	Function
			Maximum rising main flow rate = 900l/sec. Maximum speed/pump, 2 pumps running = 50 Hz = 900l/sec.
			Minimum speed = 26Hz = 100l/sec through rising main.
		2.050 m 2.778 m	Probable slab level on wet well room. Surveyed level @ gutter on corner.
		2.050 m	Probe Suspension Level
		11.000 m	Probe length
10.000	100.0%	1.050 m	Probe upper range 20mA
0.000	00.00%	-8.950 m	Probe lower range 4 mA
		1.506 m	Surcharge @ Wembley Park O/F 17
		0.725 m	Surcharge @ Stones Corner
9.650	96.5%	0.700 m	Wet Well "A" ARI 2 year TWL
9.600	96.0%	0.650 m	Start lag pump At the same speed as the lead pump.
9.550	95.5%	0.600 m	The PID output will have reached 100% ie the lead pump is running at 50Hz.
9.250	92.5%	0.300 m	Start lead pump at minimum speed. PID control is enabled after a delay of 45 sec. This enables the flow to stabilise and acts as an anti-integral wind-up function. Once activated this remains in activation until the pump stops.
8.650	86.5%	-0.300 m	Set Point
8.600	86.0%	-0.350 m	Stop lag pump
8.550	85.5%	-0.400 m	Stop lead pump (BWL)
6.265	62.7%	-2.685 m	Inflow level from Wembley Park Sewer Overflow Manhole (Station Outlet)
6.247	62.5%	-2.703 m	Inflow level from Woolloongabba Sewer Overflow Manhole (Station Outlet)
6.200	62.0%	-2.750 m	Pump under capacity open valve
5.900	59.0%	-3.050 m	Warning high level alarm wet well "B"
5.800	58.0%	-3.150 m	Close valve
0.000	0.0%	-8.950 m	Length of probe

Functional Spec.



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Project Management

Operation Manual & FUNCTIONAL SPECIFICATION

Caswell Street Sewage Pumping Station

Author	Peter Tranter
Date Created	8 March, 2000
Last Saved by	Peter Tranter
Date Saved	6 June, 2000
Definitive	Version 2.4
Location of Document	G:\CNPMS\Officer Directory\CMBW\CaswellSt\FunCaswl.doc

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REVISION AND AMENDMENT RECORD SHEET

Revision Number	Date	Amendment Details	Responsible Officer
<i>Original 1.00</i>	<i>1993</i>	<i>Original produced by Mark Flood of Patterson Flood Engineers.</i>	<i>Mark Flood</i>
V2.0	8 March 2000	Original document scanned and modified into word document.	Peter Tranter
V2.1	8 March 2000	Addition of auto valve to allow compartmentilization of wet well during wet weather events. <i>Note new additions are in blue. Contains extracts and modifications of the design brief prepared by R.Kamalathan.</i>	Peter Tranter
V2.2	31 March 2000	Addition of comments from Kamal and Tim Waggett	Peter Tranter
V2.3	13 April 2000	Alter Max and min flow rates	Peter Tranter
Version 2.4	5 June 2000	Pre-Commissioning mods. Including operating levels.	

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1 OVERVIEW

The Caswell Street Pump Station Upgrade included replacement of the old pumps with Three 210 kW Flygt pumps, new electric's and MCC, and the installation of a Remote Terminal Unit (RTU) to send information and alarms via telemetry to the Telemetry Control Room.

A Programmable Logic Controller performs the automatic pump operation at Caswell Street with selector switches on the MCC to allow for manual pump operation if required.

A new rising main from Caswell Street to the Kingsbury Street interconnection was also installed together with a new valve pit located at the Caswell Street Pump Station which allows sewage to be directed to either the old rising main or the new rising main.

2 DESCRIPTION OF OPERATION

2.1 DESIGN CRITERIA

Pumps Installed	3
Maximum Flow	1000 I/s
Minimum Flow	340 I/s
Maximum Number of Pumps Operating	2

2.2 PROCESS DESCRIPTION

The Caswell Street Pump Station consists of a wet well to provide surge capacity for the sewage inflow and a dry well housing three sewage pumps and a dry well sump pump.

The three variable speed sewage pumps discharge into a common header in the dry well, which connects to the rising mains via a valve pit.

The three new pumps installed at Caswell Street are all variable speed, and have start and stop ramping to prevent water hammer.

Under normal inflow conditions to the pump station, one pump will operate intermittently. Each pump has a minimum flow limit to ensure that a minimum scour velocity is maintained in the rising main.

Under high inflow conditions to the pump station, a second pump will start, and the two pumps will then operate until the Wet Well Level (WWL) is reduced.

During normal operation under automatic control the pump speed is adjusted based on the wet well level. As the wet well level rises the pump speed will increase (and call up a second pump if necessary), and as the level falls the pump speed will decrease. When the inflow to the pump station is less than the pump minimum flow limit, the wet well level will decrease to the Bottom Water Level (BWL) and stop the pump.

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2.3 CONTROL PHILOSOPHY

2.3.1 System Control

Control of the system is from the Pump Station Motor Control Centre (MCC) mounted on the ground floor. The MCC doors contain drive stop/start control pushbuttons and indicating lights, mode selector switches and speed setting potentiometers for the pumps. A GE-FANUC PLC mounted within the MCC performs drive start/stop functions, mode determination, drive sequencing and control loop functions.

The general function of the control system is to control the sewage pumping rate to match the inflow rate where practicable based on wet well level, in order to keep the wet well level within an acceptable operating range.

The control system is effective only when the control mode selector switches for the sewage pumps (PPI, PP2, PP3) mounted on the respective MCC door are in AUTO mode. When they are in manual mode, the speeds of the pumps can be controlled directly using the potentiometers provided, but they will not maintain preset flowrates and starting/stopping will not be dependent on wet well level.

2.3.2 Pump Duty Rotation

The pumps are assigned specific temporary duties by the PLC. These duties are termed the "Lead" pump, the "Lag" pump and the "stand-by" pump.

The Lead pump is the operating pump and the Lag pump is started to assist the Lead pump if the Lead pump is operating at its maximum flow and the wet well level continues to rise. The Stand-by pump is used to assume the duty of either Lead or Lag pump in the advent of a failure.

The duty allocation of the pumps will rotate whenever any of the following occurs:

The Lead pump stops due to pumping down of the wet well

The Lead pump has run continually for 24 hours

The Switchboard Alarm Accept and Spare (rotate) pushbuttons have been pressed simultaneously

The PLC has recovered from a power loss

The Duty Rotation of the three pumps has the following sequence:

Duty	Lag	Stand-by
PP1	PP2	PP3
PP2	PP3	PP1
PP3	PP1	PP2

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2.3.3 Pump Operation

Refer to Operating Philosophy heading : 3

2.3.4 Stand-by Pump

The stand-by pump will start if either the lead or lag pump fails to start when required or the lead or lag pump fails when operating. The stand-by pump performs the duty of the pump that has failed.

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2.3.5 Control Loops

The PLC based control system consists of a Level (Demand Flow) Controller a Total Flow Controller and three Individual Flow Controllers (one for each pump).

2.3.5.1 Level (Demand Flow) Controller

This Controller uses proportional control only, to output a required "demand" flow based on the wet well level. As the wet well level rises the controller will output a higher demand flow, and as the wet well level falls, the demand flow will decrease proportionally. The Level (Demand Flow) Controller output is cascaded as the set point to the Total Flow Controller.

2.3.5.2 Total Flow Controller

The Total Flow Controller compares the actual totalised flow of the pumps, to the set point (which is the cascaded Level (Demand Flow) Controller output). The Total Flow Controller is cascaded as the set point to the three pump flow controllers.

2.3.5.3 Individual Pump Flow Controllers

Each pump has an Individual Flow Controller, which compares, the flow being delivered by the pump, to the cascaded setpoint from the Total Flow Controller. The output from each Individual Flow Controller is input to the variable speed drive of each pump to vary the pump speed, and hence flow.

2.4 COMPARTMENTALISATION (AUTO VALVE OPERATION)

2.4.1 Background

The objective of the Caswell St. Pump Station compartmentalisation is to lower the wet weather surcharge level at the outlet of the Wembley Park Sewer and help to reduce the frequency and severity of sewer overflows in Wembley Park.

This project forms a part of Stage 2 works of the Augmentation of Norman Creek Sewers (Wembley Park) Works to Abate the Impact of Wet Weather Overflows.

Camp Hill and Coorparoo suburbs including Wembley Park experience some of the most sensitive overflows within the Norman Creek sewer catchment. In addition to the high inflow infiltration rates in the sewer system due to the age and condition of sewers, and backup due to the under capacity of the S1 main sewer, the poor wet weather performance of Branch Sewer No 3 is compounded by additional limitations created by high peak sewer levels at Caswell St pump station.

A contract was let in 1993 to ADS Environmental Services to gauge and model the sewers in the Norman Creek catchment. The wet weather surcharge levels recorded by the gauges around Caswell St pump station showed that the catchment wet weather flows were much greater than the capacity of the pumps and the pump station wet well surcharged even in small rain events. The levels in the sewer system in the pump station vicinity were controlled by the overflow thresholds of existing overflows upstream of the pump station. Subsequent sewer modelling by GH & D confirmed these findings.

The outlet of the Wembley Park sewer at Caswell Street is drowned by 3.5 metres above the obvert of the pipe during significant rain resulting in severe back up in the sewer and aggravating overflows in Wembley Park.

Dynamic modelling of the catchment No 3 system has indicated that lowering the levels at the outlet of the Wembley Park sewer to the obvert of the pipe by pumping at 400 l/s will significantly reduce overflows in

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Wembley Park at Overflow No 17 for rain fall up to a frequency of one year Annual Recurrence Interval (ARI) event.

Caswell St Pump Station was upgraded in 1993 to a maximum capacity of 1000 l/s with two pumps operating. Three identical submersible type pumps with a maximum capacity of 500 l/s at 28m head each were installed with variable speed drives and a capability to operate a single pump at 335 l/s during dry weather. A 900 mm MSCL rising main was also constructed to replace the old 600 mm diameter main.

The feasibility report on Augmentation of Norman Creek Sewers (Wembley Park) has identified the Compartmentalisation of the Caswell Street pump station and utilising one pump (up to approximately 50 % of the station capacity) for Wembley Park catchment as forming a part of Stage 2 of the Overflow Abatement Works.

2.4.1.1 *Function of The Facility*

The proposed modifications to the Wembley Park sewer near Caswell Street pump station and the Compartmentalisation of the Pump station will enable isolation of the Wembley Park sewer from the Norman Creek Main sewer during wet weather events and will enable one of the operating pumps to be utilised for transferring flows from the Wembley Park catchment into the Norman Creek Interceptor Sewer, when the pump station is not affected by power failure.

2.4.1.2 *Project scope*

Caswell St Pump station compartmentalisation Project comprises the design and construction of the following components and any other minor works required for completion of the project.

- Construction of a 70m section of sewer at Stanley St / Caswell St junction from Wembley Park sewer to diversion manhole K D.
- Installation of a non return valve (tideflex valve) on the Wembley Park sewer in a new manhole.
- Modifications to the wet well at Caswell St. pump station including installation of a electrically actuated knifegate valve.
- Installation of additional level detection equipment at the pump station
- Reprogramming of the Pump Control equipment.

2.4.1.3 *Description of the Facilities*

The existing sewer system and the configuration showing the entry of the main sewers into the pump station are shown on Figure 1. As part of the 1993 upgrading of Caswell St pump station, three new submersible type Flygt Pumps with a capacity of 500 l/s at 28 m head were installed in the dry well with variable speed drives. At maximum load two pumps are to operate with the third pump as a standby.

The works will involve the following: Caswell St. pump station will be compartmentalised by dividing the wet well into two sections an upstream well and downstream well. Existing Pump No 1 and 2 will draw from upstream wet well and pump No 3 will draw from downstream wet well.

Wet weather flows from the upstream sewers will enter the Caswell st upstream wet well from the upstream diversion manhole via the upstream 900 dia inlet pipe as is presently installed.

Wet weather flows from Wembley Park sewer will enter the downstream well via the new connecting sewer to the new downstream diversion manhole and through the 600 dia inlet pipe.

To compartmentalise the wet well, the existing opening on the central partition wall near the bottom of wet well will need to be closed and the wall raised up to the soffit of the floor above wet well at elevation +2.05m AHD to prevent spills from upstream wet well.

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Though the wet well is to be compartmentalised, an interconnection will be provided between the two wells with a valve control. A knife gate valve is to be installed to provide interconnection between the two wet wells. The valve is to be incorporated with the closure arrangement at the existing lower opening of the partition wall. The knife gate valve is to be electrically activated and will incorporate an actuator, extension spindles/ brackets and pedestal at floor level + 2.05m AHD.

Additional level detection equipment for the downstream well and knife gate valve is provided.

Reprogramming of PLCs, RTU at the pump station and data base at the Newstead Control.

2.4.1.4 Works in Caswell St pump station wet well

The central partition wall in the wet well is to be raised to the soffit of the existing slab level at +2.05m AHD and the opening on the wall near the bottom of the well is to be closed.

2.4.1.5 Knife gate Valve

The proposed knife gate valve shall be installed at the opening for interconnection of the wet wells and shall incorporate extension spindles up to the floor at elevation + 2.05 m AHD, pedestal at floor level and an electrical actuator with manual override. The valve shall be controlled by levels in wet wells as described under the operating philosophy.

3 OPERATING PHILOSOPHY**3.1 KNIFE GATE POSITION**

The two wells will remain connected via the knife gate valve with the valve in the open position normally. The pump station will operate as one station for dry weather pumping and for wet weather events of small magnitudes. This is where inflows are less than the capacity of the pumps and no surcharge would occur in the wet wells. The valve will not be allowed to close unless pump 3 is available and if closed and pump 3 fails the valve shall open immediately.

3.2 WET WELLS "A" AND "B"

The wet wells are designated Wet Well "A" and Wet Well "B".

Wet Well "A" receives the sewage from the Woolloongabba Sewer and incorporates 2 pumps, pumps No. 1 & 2. Wet Well "B" receives sewage from the Wembley Park Sewer, but only in the event of wet weather where the level in the sewer allows the sewage to flow through the new diversion manhole into Wet Well "B". Wet Well "B" incorporates 1 pump only, pump No.3.

3.3 PUMP STATION CONTROL**3.3.1 Knife Gate Valve**

Under normal conditions the pump station operates as a 3 pump VFD control Sewage Pumping Station. The dividing knife gate valve is fully open.

When the level in the wet well rises to Start Duty Pump level the Duty Pump Pumps 1, 2 or 3 will start.

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3.3.2 Auto Mode

The pumps shall be controlled such that when the pump station is in auto mode the pump station output flow rate shall not exceed Maximum Rising Main Flow Rate. This is achieved by limiting the maximum operating frequency of the pumps to 50Hz (actual value to be determined at commissioning) when two pumps are operational in other than Total Flow Control and limited by the Total Flow Controller under normal operating conditions. When "Maximum Rising Main Flow Rate" is achieved an urgent alarm shall be generated at the Newstead SCADA system.

Control of the pump station will be based on the current state of the wet well level with the pumps operating on a lead/lag configuration. Under normal conditions, with the wet well rising and the wet well level and flow signals valid, the site will pump in a combination of level and flow control affected by a Proportional/Integral/Derivative (P.I.D) Controller that will reside in the PLC.

In the event of a failure of a wet well level probe, all associated pumps will immediately stop.

While the isolating valve is opened the station shall be controlled by the Wet Well "A" probe.

The delivery shall be down the 900 mm main only the 600mm main is to be isolated.

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3.3.2.1 Set Points

The operation levels are to be amended post October 2000 on completion of the Wembley Park main.
The set points will be as follows:

Wet Well Level Metres	Indicator %	Metres AHD	Function
			Maximum Rising Main Flow Rate = 900 l/sec. Maximum Speed/Pump, 2 pumps running = 46Hz = 900l/s
			Minimum Speed = 26 Hz = 100l/sec through rising main.
		2.050 m 2.778 m	Probable Slab Level on wet well room. Surveyed level @ gutter on corner.
		2.050 m	Probe suspension level
		11.000 m	Probe Length
10.000	100%	1.050 m	Probe upper range 20mA
0.000	0.00%	-8.950 m	Probe lower range 4 mA
		1.506 m	Surcharge @ Wembley park O/F 17
		0.725 m	Surcharge @ Stones Corner
9.650	96.5%	0.700 m	Wet Well "A" ARI 2 year TWL
9.600	96.0	0.650 m	Start lag pump. At the same speed as the lead pump..
9.550	95.5	0.600 m	The PID output will have reached 100 % ie the lead pump is running at 50Hz.
9.250	92.5	0.300 m	Start lead pump at minimum speed. PID control is enabled after a delay of 45 sec. This enables the flow to stabilise and acts as an anti -integral wind-up function. Once activated this remains in activation until the pump stops
8.650	86.5	-0.300 m	Set Point.
8.600	86.0	-0.350 m	Stop Lag Pump

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8.550	85.5	-0.400 m	Stop lead pump (BWL)
6.265	62.7	-2.685 m	Inflow level from Wembley Park Sewer Overflow Manhole (Station Outlet)
6.247	62.5	-2.703 m	Inflow level from Woolloongabba Sewer Overflow Manhole (Station Outlet)
6.200	62%	-2.750 m	Pump Under Capacity Open Valve
5.900	59%	-3.050 m	Warning High Level Alarm Wet Well "B"
5.800	58%	-3.150 m	Close Valve
0.000	0.0%	-8.950 m	Length of Probe

The lead pump will be requested to start at "minimum speed" (this speed will be a set constant and will be used in all Auto PLC controlled conditions as the pump minimum speed.) when the wet well level exceeds the "start lead pump level".

The pump will continue to run at "minimum speed" until a delay period expires to allow for stabilisation. The set point shall be the PID control level.

A wet well level PID control loop shall cascade to a flow PID control loop where the output of the level loop controller shall be the set-point for the flow loop controller.

Pump speed shall be capable of varying from minimum speed to a maximum speed.

The modulating PID control will continue until the "stop lead pump level" is reached.

Should the level rise to the "Start lag pump" set point the lag pump shall start. The flow controller shall then control both pumps at the same speed determined by the calculated PID speed.

Both pumps will continue to run until the wet well level drops to the "Stop Lag Pump" level. Set point for a time period (initially set to 30 seconds). At this point the lag pump will stop. The lead pump will continue to run as described above.

3.4 WET WEATHER EVENT

Should the level in the wet well continue to rise to the "Close Valve" level the isolating valve will close.

On fully closing the station shall operate as 2 separate stations. Station "A" and Station "B".

Each will be controlled from its associated wet well probe.

Only 1 pump is to be allowed to operate per station while the valve is fully closed. If pumps 1 & 2 are operating at valve closure the lag pump is to be shut down. Should Station "A" duty pump fail the lag pump shall become the duty pump. Should both pumps fail the valve is to remain closed unless the level reaches "Pump Under Capacity Open Valve". Pump 3 shall be the duty pump for Station "B".

Two separate PID controls each as per above in Auto Mode are to perform calculations and control for each station. Should the levels in the 2 wells differ dramatically and subsequent differing NPSH's, it is envisaged that:

- In "Flow Control" the individual flow meters are used to control the pumps, therefore the speed of the pump will compensate for any hydraulic changes in the system.

If 1 or more flow meters fail and the operation reverts to level control the minimum speed shall be determined by the maximum calculated output speed of both PID controllers, if > than Minimum Speed above. The integral value of

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the PID and the error shall wind up the output to control the level. The common rising main calculated "Maximum Rising Main Flow Rate" shall remain as the maximum flow restriction.

Site tests will determine the "Maximum Speed" for each pump while 2 pumps are running. This shall be used should the station be required to run in level control.

Wet weather control shall continue and the isolating valve remain closed until the level in Wet Well "B" \leq "Stop Lead Pump" of Wet Well "B".

If the level in Wet Well "B" rises to "Pump Under Capacity Open Valve" the assumption is that the pump in Station "B" is under capacity and requires the assistance of the pump in Wet Well "A". Once activated the station shall revert to normal dry weather control and latch until the level is lowered to $<$ "Stop Lag Pump".

3.5 SURCHARGE IMMINENT CONDITION

3.5.1 Surge imminent electrode (Not Installed)

(Allowance in PLC to be made for future works)

On activation of the surcharge imminent electrode

the lead pump will start, a surcharge imminent alarm shall immediately be sent to the operator (future). This function while active shall override the wet well control.

The lead pump will operate at 100% speed until the surcharge imminent electrode goes inactive and has been inactive for a time period (initially set to 3 minutes).

3.5.2 PLC Calculated Surge Imminent Alarm (Future)

Should the wet well level exceed a PLC calculated Surge Imminent parameter an alarm shall be raised immediately to the operator

3.6 AUTO MODE FLOW METER FAILURE

In the event of a failure of a flowmeter, an alarm (future) shall be generated at the operators SCADA system. An additional level only PID loop controller shall become the speed control output for the VFD's bypassing the flow loop.

Control shall remain as above.

3.7 TIDEFLEX VALVE

The proposed tideflex valve shall be located in a new manhole on the Wembley Park sewer at a suitable location downstream of manhole 2/1022. The stiffness of the valve shall be such as to allow the dry weather flows with minimum head loss. The valve shall be capable of resisting a back pressure of 10m.

4 PLANT OPERATION AND CONTROLS

4.1 CONTROL MODES: AUTOMATIC /MANUAL /EMERGENCY MANUAL

There are three modes of operation for each sewage pump drive:

- Automatic
- Manual

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- Emergency Manual

4.1.1 Automatic

In automatic mode the PLC will close or open the contactor as required by the wet well level, provided the auto/manual switch is in "automatic".

Speed control is via the PLC.

In both automatic and manual mode, the PLC provides protection features to stop the drive when required, eg. Low flow for pumps.

4.1.2 Manual

In normal manual mode the emergency mode selector is in the "normal" position and the Auto/manual switch in the "manual" mode. In this mode the PLC receives a start pulse

When the start pushbutton is pressed and will close the contactor provided:

- All control devices will permit a pump start
- Auto/manual switch for the drive is in the manual position

Speed control is via the manual MCC panel-mounted potentiometer.

4.1.3 Emergency Manual

The emergency manual mode is for use by electricians only under extreme circumstances. When running in emergency manual mode, the PLC is not operational and there is no equipment protection other than thermal overload for the motor. In this mode the emergency mode selector must be in the "emergency" position and the auto/manual switch in the "manual" position. The PLC output is bypassed when "emergency" is selected. The drive will run when the START pushbutton is pressed, which activates a self latching circuit for the drive contactor. The emergency mode selector switch is mounted within the MCC module to restrict access.

Speed control is via the manual MCC panel-mounted potentiometer.

4.2 START UP**4.2.1 Automatic**

When the mode selector switch is set to Auto, the lead pump will automatically start when the wet well level reaches "Start Lead Pump".

If the level continues to rise to "Start Lag Pump" this will then initiate an automatic start of the lag pump.

4.2.2 Manual

When a pump mode selector switch is set to Man., pressing the START pushbutton can manually start the pump.

NOTE:

When a pump is set to MAN and started, it is possible to pump the wet well level down to a level where the pump will aerate and lose its prime. If the potentiometer speed control is not set to a high enough value, it is possible for a low flow trip to occur due to the pump not delivering sufficient flow. If such a situation arises, reset the alarm and start the pump again at a higher speed control setting.

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4.2.2.1 Manual Start:

Set START MODE. SELECTOR to MAN
Set potentiometer SPEED CONTROL to 70%
Press MANUAL START

Once started in Manual, the pump speed can be adjusted via the potentiometer SPEED CONTROL.

4.2.2.2 Emergency Manual

The Emergency Manual mode is only to be used by electricians and is only intended for short-term operation of a pump.

Emergency Manual Start:

- Set START MODE SELECTOR to MAN
- Open MCC door and set EMERGENCY SELECTOR to EMERGENCY
- Set potentiometer SPEED CONTROL to 70%
- Press MANUAL START

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4.3 ALARMS/INTERLOCKS

4.3.1 Sewage Pump Control Panels

Each sewage pump has the following alarm lamps located on the respective MCC control panel.

Bearing Over-temperature - Activated from a thermistor on the bottom bearing of the motor/pump

Interlocks: Trips out operating pump

Motor Over-temperature - Activated from a RTD within the pump motor.

Interlocks: Trips out operating pump

Water In Motor Oil - Activated from a sensor within the oil reservoir

Interlocks: Trips out operating pump.

The above alarms are supplied as part of the Flygt pump protection system.

Pump Protection Trip - If any of the above three alarms is activated, the Pump Protection Trip alarm will become activated.

VF Drive. Fault - This is a group fault which is a general alarm and is initiated from the Fuji VSD. Fault codes are displayed on the VSD keypad, and reference should be made to the Fuji VSD manual for details of specific faults.

Interlocks: Trips out operating pump.

Reflux Failed to open - Activated if a pump is started and the reflux valve swing

Arm fails to move away from the proximity switch or if the swing arm returns to the rest position at the proximity switch when the pump is operating

Interlocks: Trips out operating pump.

Reflux Failed to Close - Activated if the reflux valve swing arm fails to return to its rest position at the proximity switch when a pump has been stopped. Interlocks> Trips out operating pump.

NOTE:

Each sewage pump control panel has a READY TO RUN IN AUTO lamp, which will not be lit if requirements are not met, and the mode selector switch is not set to Auto.

4.3.2 LC Control Panel

The PLC control panel on the MCC contains four alarms.

- Wet Well Level HI HI - Activated when the wet well level reaches Warning High Level Alarm Wet Well "B". Interlocks: none.
- Sump HI HI Level - Activated from a multitrode level sensor located in the dry well sumps
Interlocks: Trips out operating pump(s) and inhibits starts of other pumps.
- Power Failure Bus 1 - Activated by a power failure on Bus 1
- Power Failure Bus 2 - Activated by a power failure on Bus 2

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4.3.3 Sump Pump Control Panel

The dry well sump pump controls are on the back panel of the MCC and includes on alarm lamp:

- Motor Overload Fault - Activated in the advent of a thermal overload
Interlocks: Trips dry well sump pump.

4.4 SHUTDOWN

4.4.1 Automatic

When the mode selector switch is set to Auto, the lag pump will automatically shut down when the wet well decreases to "Stop Lag Pump" and the lead pump will shut down when the wet well level reaches "Stop Lead Pump".

4.4.2 Manual

To stop a pump operating in Manual, the SPEED CONTROL should be slowly turned back to zero prior to pressing the STOP push button. This procedure will ramp down the pump speed to avoid water hammer and sudden closure of the reflux valve.

4.4.2.1 Manual Stop:

- Turn SPEED CONTROL slowly to 0%.
- Press STOP.

4.4.2.2 Emergency Manual

The stop procedure for Emergency Manual is the same as for Manual:
Emergency Manual Stop:

- Turn SPEED CONTROL slowly to 0%.

4.5 DRY WELL SUMP PUMP

The dry well sump pump operates from high and low level signals from a multitrode electrode located in the dry well sump.

An Auto/Man selector switch is located on the MCC panel.

4.5.1 Automatic Mode

When set to Auto, the dry well sump pump will automatically start when a HI level is detected by a multitrode electrode located in the dry well. When a low level is detected, the sump pump will automatically stop.

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4.5.2 Manual Mode

When set to Man. the Pump will continue to start and stop based on high and low levels Detected by the multitrode.

If the MANUAL START push button is pressed when in Manual mode, the sump pump Will start and continue to run until:

The EMERGENCY STOP push button is pressed

Or

The Auto/Man. switch is set to Auto and the dry well sump is at the low level.

The Sump Pump electrics are all hard wired. The PLC's only function with respect to the Sump Pump is to check for a Dry Well Sump alarm from the multitrode electrode, which the PLC then outputs to the RTU.

4.6 ELECTRICAL ISOLATION

4.6.1 Sewage Pumps

Electrical isolation and tag out of sewage pumps is via the isolator switch located on the top left hand corner of each pumps MCC control panel.

The isolators should not be turned ON or OFF more than 5 times per hour.

4.6.2 Sump Pump

The sump pump isolation switch is located on the Distribution Board, behind an outer Compartment panel.

4.7 ELECTRICAL INSTALLATION

4.7.1 Switchboard Layout and Power Circuits

Drawing 57QK010 shows the Electrical Single Line Diagram for the Caswell Street MCC, and Power Electric Switchboard Pty Ltd drawings show the MCC layout. Electrical schematic and single line diagrams are contained in Appendix I. the MCC is located on the ground level floor above the wet well, inside the station building. Power is supplied to this MCC from the site 11kV switchboard and three 11kV transformers outside the building.

The incoming supply to the MCC consists of three separate circuits - one from each transformer. Each incoming circuit has a Terasaki XSSOONE circuit breaker, which provides overcurrent, and overload protection. The MCC busbar is split into two buses (1 and 2) which are joined by a 2500 A bus-tie switch. Two sewage pumps (PPI and PP2) and two transformers are on Bus 1. The bus tie switch is operated under normal operation and all incomers are normally energised. The transformers and pump sizes are closely matched such that one transformer cannot run two pumps.

Note: If one of the two transformers feeding Bus I fails then it is recommended to close the bus tie switch until the incomer is re-energised.

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The small power distribution board is fed from the two buses by two mechanically-interlocked switches such that both switches cannot simultaneously be on. Under normal operation it would be fed from Bus 1 as the two incoming supply configuration has greater availability than Bus 2. This distribution board supplies power to the PLC and the station instruments.

If Bus 1 power is lost the distribution board supply switch should be switched to Bus 2 to allow operation of sewage pump PP3 in auto or manual modes.

The MCC contains four motor starters for the three sewage pumps and one sump pump, as well as supplies for the control transformers and the building services distribution.

The MCC also has an instrument tier containing a Programmable Logic Controller (PLC) and door mounted indicating lights and push buttons for non-drive plant control.

All sewage pump motor starters contain a Terasaki X5400 moulded case circuit for overcurrent protection, a Sprecher & Schuh CA1 contactor for motor control, a Fuji VSD unit, and a Flygt CAS relay for motor and pump protection. The Fuji VSD includes earth-fault protection. Each motor has a field mounted control isolator.

4.7.2 Switchboard Control Circuits

The control voltage used is 110VAC supplied from one of two 415V/110V control transformers mounted within the switchboard and fed off the small power distribution board. Each transformer is fully wired for service, but one is kept as a spare with links and fuses removed. The control transformers should not be paralleled.

The PLC mounted in the instrument tier is used for equipment control, and a typical sewage pump motor control circuit (for PPI) is shown on drawings 57QK011 and 57QK012.

The circuit is designed so that the PLC controls the drive provided certain hard-wired elements in the circuit are ready. As shown in drawing 57QK011, PLC output QOOOI will close the contactor, provided:

- Control power is on
- Control circuit breaker is closed
- Motor circuit breaker is closed
- VSD has not tripped
- Pump protection relay has not tripped
- Local control isolator is closed
- Emergency stop pushbutton is closed
- Emergency mode selector is in normal position

The circuit has the following inputs to the PLC, with PLC pneumonics stated in brackets as shown in the PLC code (a copy of the PLC code is contained in Appendix 2).

- "Control Power Available" indicates circuit breakers are closed and control Power is on. (PPIPOW)

"Drive Running" indicates contactor closed. (PPIRLN)

"VF Drive Healthy" indicates VSD not tripped. (PPIVFD>)

"Pump Protection Healthy" indicates PPR not tripped. (PPI PP>)

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"Ready to Run" indicates that all field equipment (stop button/isolator) is ready.
(PPI RDY)

Auto indicates all hard-wired circuit elements are ready for an automatic start. A red indicating light in parallel with this input shows the operator that this drive is ready for a level-initiated start. (PPIAUT)

I

"Local Start" from the start pushbutton. (PPI STT)

Outputs are "Close Contactor" (PPIGO) to control the contactor and "VF Drive Fault", "Pump Protection Trip" and "Low Flow Trip" fault lights. Each sewage pump starter also has an hour run meter, ammeter, a run light, an auto-ready light, three pump protection relay fault lights, an Auto/Manual selector switch and an Emergency Mode selector switch.

Auxiliary wiring to control the VF drive is as shown in the drawings and includes:

Normally open CI contact to FWD terminal to start the drive. Reset pushbutton contact to RST terminal to reset faults.

Manual mode speed control wiring to terminals II, 12 and 13 from the door-mounted potentiometer.

Auto mode speed control wiring to terminals II and CI from the PLC. Auto manual mode selector contact to AUT terminal when in Auto position to select PLC speed control signal.

Link to-TIIR terminal as no external-to-VSD fault device is used to directly shut down the VF drive.

The dry well sump pump wiring is shown on drawing 57QK025. This starter is hard-wired only. It incorporates MCB and TOL protection, and a compartment-mounted emergency stop pushbutton and field-mounted power/control isolator. The drive has an auto/manual run mode selector. Auto running is determined by a level instrument in the pump's local sump set into the dry well basement floor, with the pump starting when this sump level is near basement floor level and stopping with the level near the bottom of the sump. The auto run relay overrides the mode selector when the pump is required to be running due to a dry well sump high level. The starter also has an hour run meter, ammeter, a run light, a ready light, and an overload light. A separate level alarm relay and main panel light indicates high level in the local sump.

Drawing 57QK017 shows miscellaneous control wiring to the PLC and specific 24 VCD outputs to the station telemetry unit.

4.8 PLC CODE

The PLC code is documented throughout the listing, however certain frequently used blocks of code are described in detail below. The PLC code is contained in Appendix 2.

The PLC controls all drives in manual and automatic modes.

The PLC code is arranged on a drive basis with each drive and its associated alarms being grouped.

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4.8.1 Motor Control

A typical motor control routine is shown for PPI starting at rung 63. This should be read in conjunction with schematic drawings CST-E451 and -E452. The following standard drive code arrangement is used.

RPA : run permit flag indicating in any mode that all protection flags are ready for Operation eg. PPI RPA at rung 64.

In the case of PPI these flags are:

PPI POW : flag from power failure logic indicating MCC drive power supply is on and balanced.

PPIRDY : PPI hardwired circuit is ready for service, ie. control power on, VF drive healthy, local isolator closed, emergency stop button not operated.

PPI.VFD# : PPI VFD fault alarm latch set, ie. alarm has occurred but has not been acknowledged and reset.

PPIPP# : PPI pump protection fault alarm latch set, ie. alarm has occurred but has not been acknowledged and reset.

PPILF# PPI low flow alarm latch set, ie. alarm has occurred but has not been acknowledged and reset.

PPIRF# PPI reflux valve fail-to-close alarm latch set, ie. alarm has occurred but has not been acknowledged and reset.

Provided the above conditions are correct, the permit flag PPIRPA will permit a start at rung 75.

GO : PLC output, which closes the drive contactor, eg. PPIGO at rung 63. These rung functions are as follows:

In manual mode when the local start button is pushed, (input PPISTT), the drive will start provided it is not in auto, (PPIAUT off) and the drive is permitted to run (PPIRPA on). The drive running input PPIRUN, will latch the drive after the contactor closes.

In automatic mode, the drive will start when the drive is in auto. And the drive has received a start call aligning with its duty status. This logic is set elsewhere.

REST Reset input. When the drive Reset pushbutton is pressed, a fault reset relay Resets VFD and PPR devices and PLC logic alarm latches, eg. PPIREST at rung 68.

The PLC provides a ramped deceleration of the pump when stopping in auto mode.

4.9 FIELD ALARMS

Alarms resulting from field equipment signals are handled by the code and cause appropriate. Annunciation and shutdown.

A typical alarm routine is shown at rung 73 for PPI Pump Protection Fault. The Following standard notation is used throughout the program for alarms:

Field input indicating alarm, eg. PPIPP>

Alarm flag, which is triggered after time delay, eg. PPIPPF

Alarm latch which latches when alarm occurs even if field input resets, eg.

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PP1PP#

Accept latch which latches when operator pushes the alarm accept pushbutton,

Eg. PPIPP%

Indicator lamp which flashes quickly (using %MOOOI) when alarm occurs, is steady after alarm is acknowledged and goes out when reset.

Trigger to cause flashing alarm light to operate, eg. PPIPP@

The action of each alarm and consequent events are stated at each alarm page.

4.9.1 As-Built Control Alterations

During commissioning of the pump station, a limitation on the station maximum

Discharge flowrate was implemented on a temporary basis, prior to permanent higher

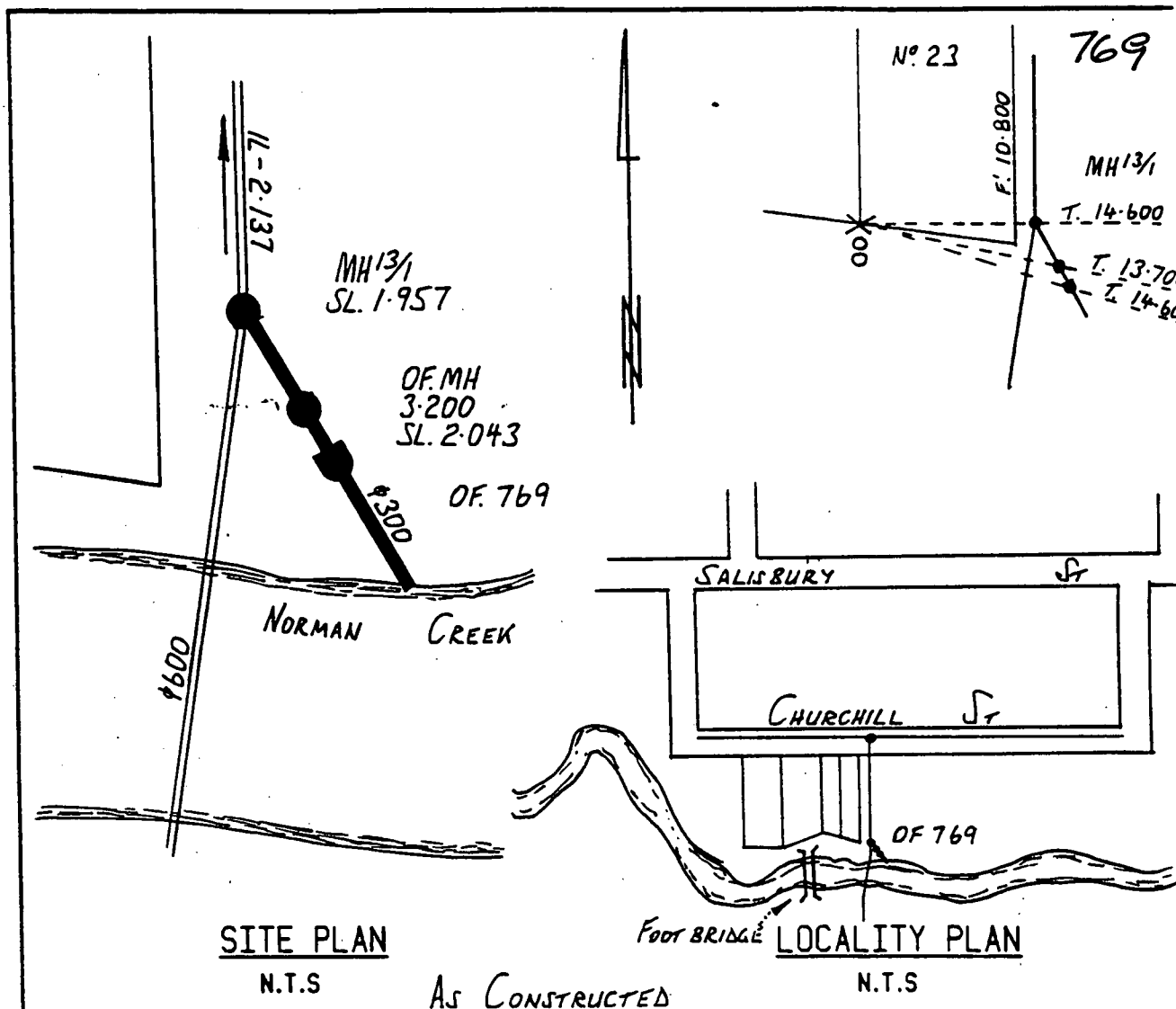
Level weirs being installed at the Hawthorn Park overflow. This involved suitable setting of the overall flow loop upper clamp limits, for the two cases when the lag pump is and is not running. The wet well level/demand flow.

Characteristic was limited to the same

Value as the overall flow controller.

Rungs 236 and 237 contain the overall flow controller upper clamp limit settings. Rung 321 contains the demand flow characteristic (upper clamp) limit setting. These should be set to the same value at all times.

Misc.



NOTES

Overflow Details:-

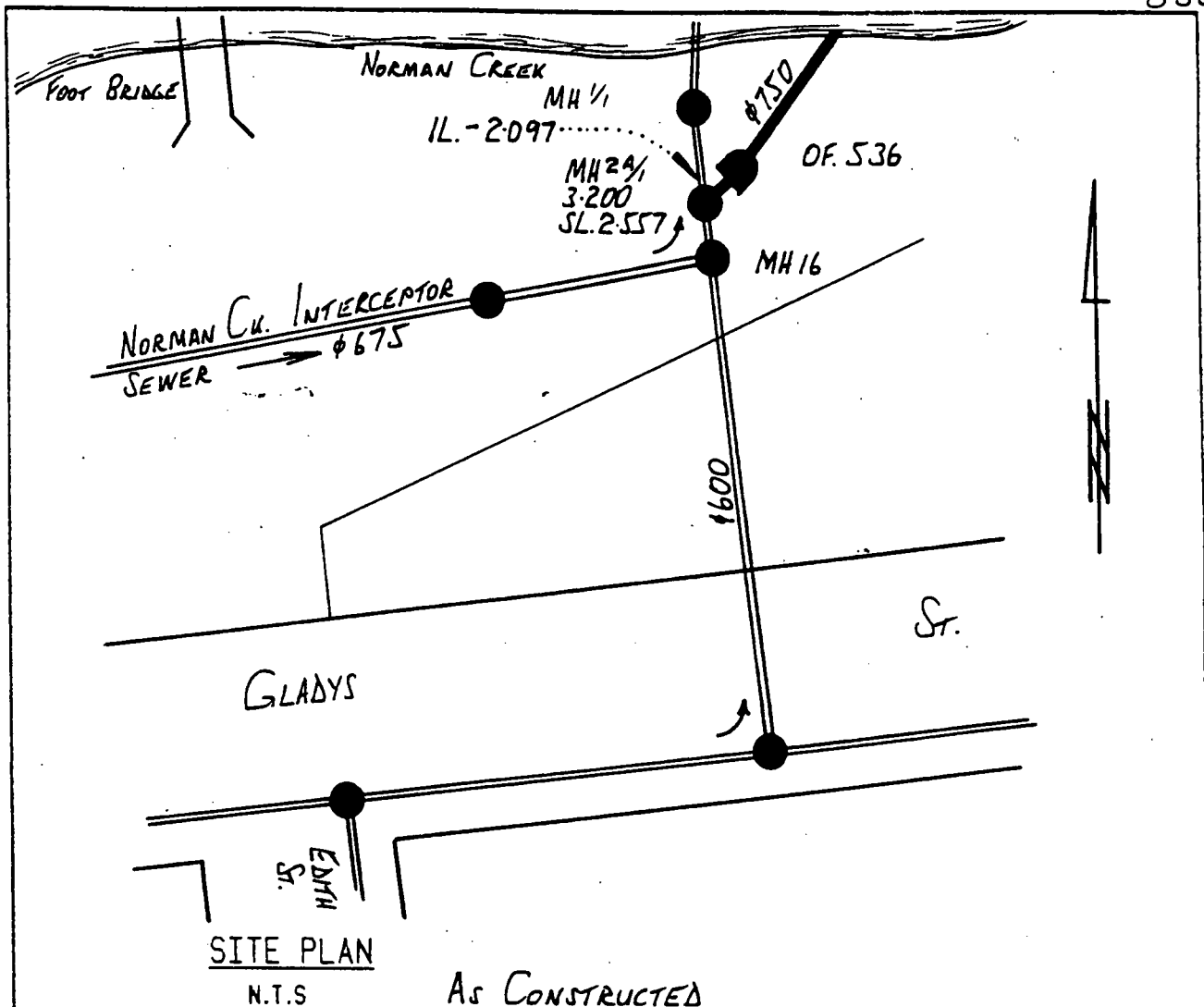
- (a) Distance between FVC and O.F. MANHOLE = 1.600
- (b) Flap Valve Type /
- (c) Invert Level of Overflow at Manhole =
- (d) Control Invert Level of Overflow at O.F. MANHOLE = 1.218 (WIER)
- (e) Invert Level of Overflow at FVC IN = 0.608
- (f) Surface Level at FVC approximately 1.988
- (g) Invert Level of Overflow Pipe at discharge =
- (h) Approx. Distance from FVC to discharge =

For further details of Overflow refer to Dwg No 3018/4005

WARD	THE GABBA
CATCHMENT	
MACRO	1118
MICRO	
RECEIVING WATERS	NORMAN CREEK

SUPERVISING ENGINEER
SEWER MAINTENANCE

BCC DEPT. OF W.S. & S	DESIGN			LEVEL BOOK		REF.	SCALE N.T.S
OVERFLOW No. 769	DRAWN			FIELD BOOK		DRG.	DRAWING No.
CHURCHILL ST	TRACED			SURVEYOR			486/5/15-76
WOOLLOONGABBA	CHECKED			PASSED			No OF SHEETS



NOTES

Overflow Details:-

- (a) Distance between FVC and Manhole = 1.500
- (b) Flap Valve Type 3
- (c) Invert Level of Overflow at Manhole = 0.646
- (d) Control Invert Level of Overflow at FVC in = 0.725
- (e) Invert Level of Overflow at FVC out = 0.573
- (f) Surface Level at FVC approximately 2.575
- (g) Invert Level of Overflow Pipe at discharge = 0.497
- (h) Approx. Distance from FVC to discharge =

For further details of Overflow refer to Dwg No 3018/4007 & 3018/875
D.P. 374

WARD	ERIBIN
CATCHMENT	
MACRO	1118
MICRO	
RECEIVING WATERS	NORMAN CREEK

SUPERVISING ENGINEER
SEWER MAINTENANCE

BCC DEPT. OF W.S. & S	DESIGN		LEVEL BOOK	REF.	SCALE N.T.S
OVERFLOW No. 536	DRAWN		FIELD BOOK	DRG.	DRAWING No.
GLADYS ST.	TRACED		SURVEYOR		486/5/15-536
GREENSLOPES	CHECKED		PASSED		No. OF SHEETS
					Page 34 of 119

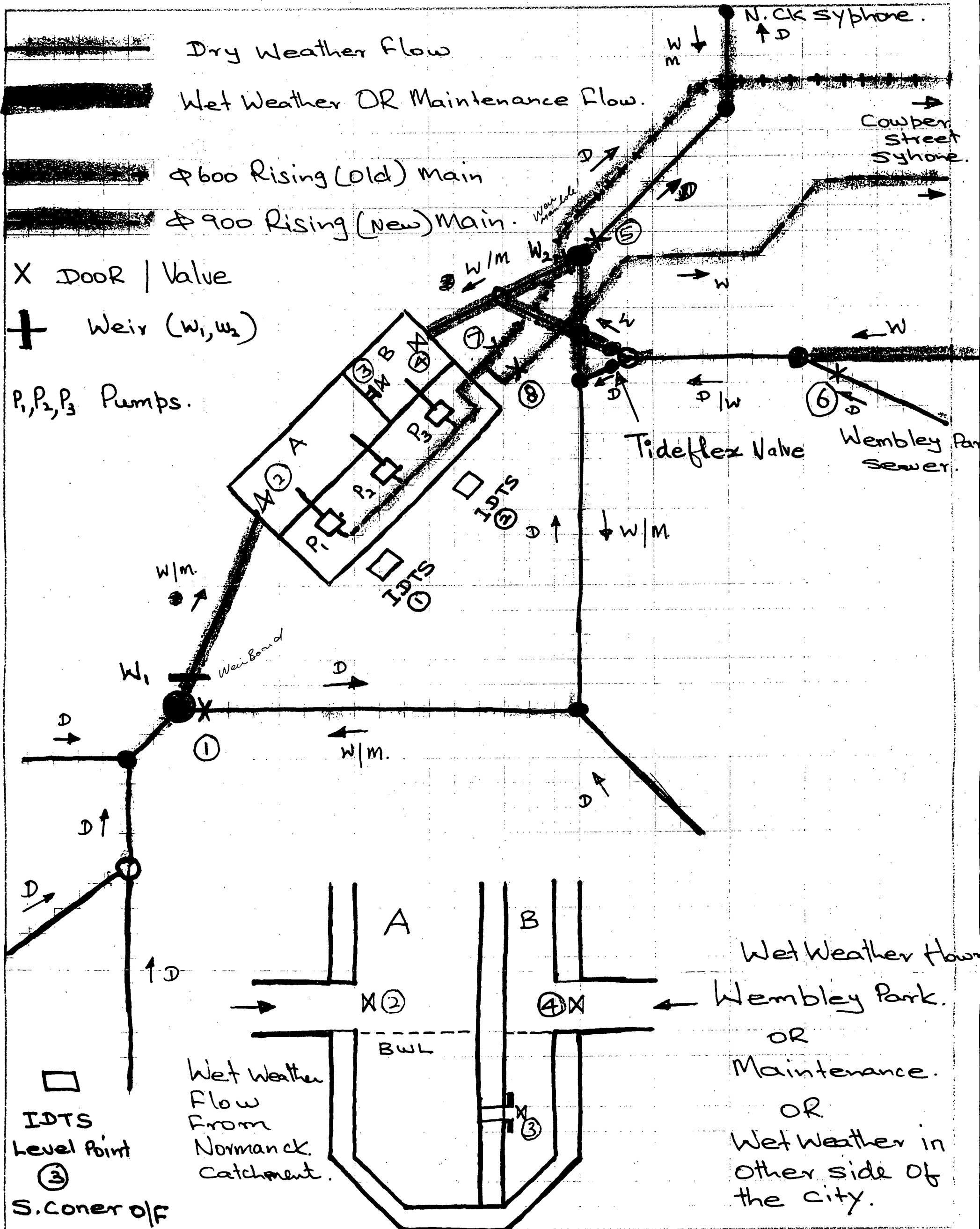
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	SP44 O/F P/S
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	IDTS ④

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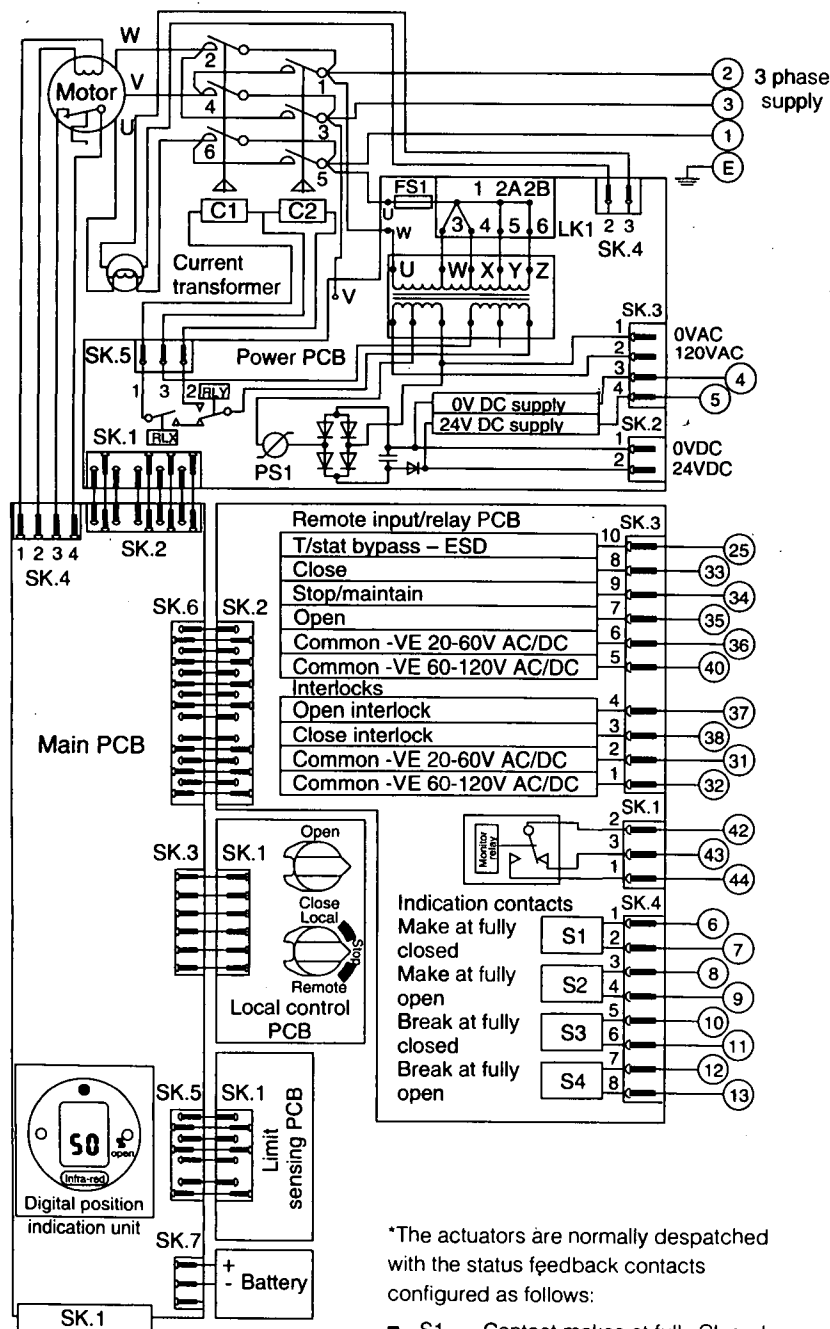
Rotork
Actuator

ACTUATOR CONTROL CIRCUITS

BASIC IQ ACTUATOR STANDARD WIRING DIAGRAM 200-000

Positive switching remote controls. Refer to Rotork for non-standard voltage options.

Circuit is drawn with power supply off



*The actuators are normally despatched with the status feedback contacts configured as follows:

- S1 - Contact makes at fully Closed
- S2 - Contact makes at fully Open.
- S3 - Contact breaks at fully Closed.
- S4 - Contact breaks at fully Open.

TRANSFORMER TAPPING OPTIONS

Type 1

Tap	Nom 50/60Hz	50Hz	60Hz
W	220/230	176-242	198-259
X	380/400	304-418	342-446
Y	415/420	332-457	374-487
Z	440/460	352-484	396-517

Fuse FS1 - 250mA anti-surge.

Type 2

Tap	Nom 50/60Hz	50Hz	60Hz
W	346/380	285-388	321-419
X	480/500	406-552	432-564
Y	240/250	192-261	216-282
Z*	550/575	445-605	501-654

Fuse FS1 - 250mA anti-surge.

*150mA anti-surge.

Type 3

Tap	Nom 50/60Hz	50Hz	60Hz
X	660/660	534-726	600-726

Fuse FS1 - 150mA anti-surge.

All transformer types - PS1 self resetting fuse.

Max external load on terminals 4 & 5 to be 5W.

Control signal threshold voltages to be minimum 'On' 20V AC/DC maximum 'Off' = 3V.

Minimum control signal duration to be 300ms.

Current drawn from each remote control signal is 5mA on 24V DC and pro rata on higher voltages.

Wires are identified at each end by terminal no. or tag no.

All socket connections between PCB's are wired pin 1 to pin 1 etc.

*NOTE Status feedback

Each indication contact can be individually configured to make or break for one of the following functions:

- An intermediate or end position
- Torque trip opening
- Torque trip closing
- Torque trip in mid travel
- Actuator closing
- Actuator opening
- Actuator output rotating
- Motor stalled
- Battery low
- Hand operation
- Blinker

ROTORK RANGE

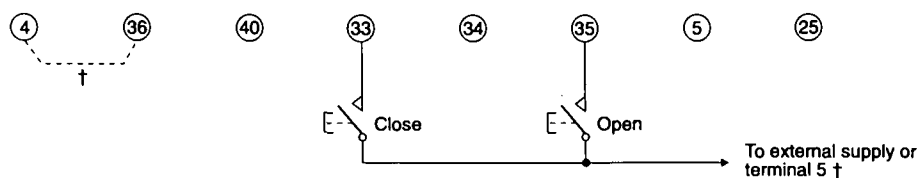
REMOTE CONTROL CIRCUITS

Max external load on 24V DC supply from actuator terminals 4-5 to be 5W.

Internal supply -ve (zero) Common for remote controls on 20 to 60V DC or AC Common for remote controls on 60V to 120V DC or AC Close Maintain Open Internal 24V DC supply +ve (or internal 120V AC) Emergency shut-down/thermostat by-pass

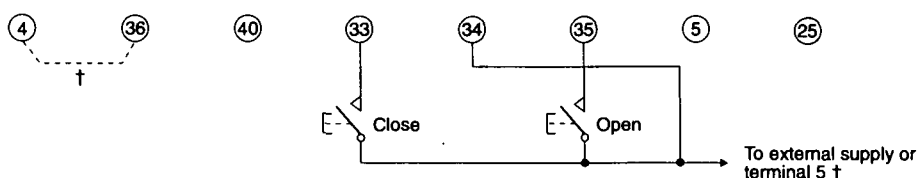
Form a

Open/Close push-to-run control.



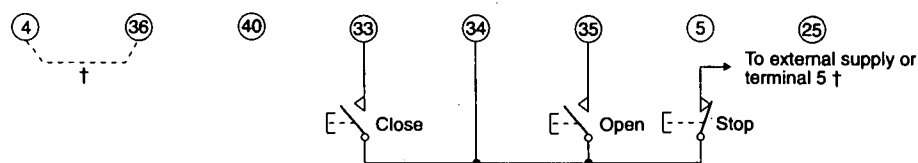
Form b

Open/Close maintained control with mid-travel reversal.



Form c

Open/Stop/Close maintained control.

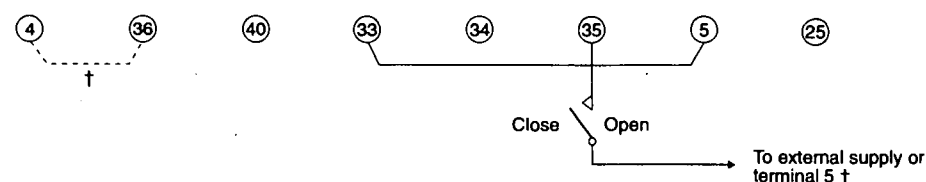


Form d

Two-wire control; energize to open, de-energize to close.

(Configure for Open priority.)

Customer to link 5 - 33.

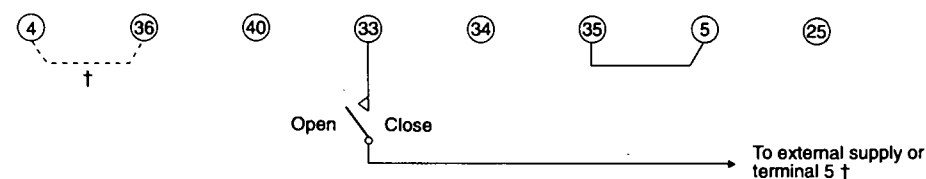


Form e

Two-wire control; energize to Close, de-energize to Open.

(Configure for close priority).

Customer to link 5 - 35.



Form f

Emergency shut-down to Close valve overriding thermostat* and any existing signal. (May be added to any of circuits above.) Actuator may be configured so that thermostat is not by-passed during ESD operation. To override external interlocks on ESD, additional remote contacts must be provided.

*Actuator hazardous enclosure certification is invalidated while the thermostat is overridden.

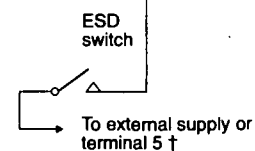
† Note

Remote controls may be fed from the internal 24V DC supply at terminal 5, when terminals 4-36 must be linked, (or 4-40 for 120V AC internal supply versions) or from an external supply when the zero/-ve of the supply should be connected as follows:

To terminal 36 for 20V to 60V DC or AC

To terminal 40 for 60V to 120V DC or AC

Terminals 4-36 also to be linked for Form d, e and f control.



Stayput contacts, make to Close Operates with actuator in Local or Remote. May be configured to 'break to close'.

CHECK LIST

Checking actuator settings requires the use of and keys only. Displays on actuator show set values. Return to the start of the setting procedure (Position Display) by pressing and together. Checking may be carried out with the actuator in either Setting or Checking mode.

	Until C1 (DIRECTION TO CLOSE) is displayed	or
	To display C2 (CLOSE ACTION)	or
	To display C3 (OPEN ACTION)	or
	To display tC (TORQUE VALUE CLOSING)	Display shows selected torque
	To display tO (TORQUE VALUE OPENING)	Display shows selected torque

Press and together to return to Position Display and move valve to fully closed condition checking that closed symbol and lamp appear just as the limit of travel is reached.

Move valve to fully open position checking that open symbol and lamp appear just as the limit of travel is reached

AUSTRALIA Ballarat tel (03 53) 381566 fax (03 53) 381570 CANADA Calgary tel (403) 569 9455 fax (403) 569 9414 CHINA (North & Central) Beijing tel (10) 646 21617 fax (10) 646 20713 FRANCE Paris tel (01) 43 11 15 50 fax (01) 48 35 42 54 GERMANY Hilden tel (02103) 54098 fax (02103) 54090 HONG KONG & S. CHINA tel 2520 2990 fax 2529 9746	INDIA Chennai tel (044) 6258494 fax (044) 6257108 INDONESIA Jakarta tel (21) 5906764 fax (21) 5912623 ITALY Milan tel (02) 45703300 fax (02) 45703301 KOREA (SOUTH) Seoul tel (02) 555 4803 fax (02) 555 4802 MALAYSIA Kuala Lumpur tel (03) 2446418 fax (03) 2446416 NETHERLANDS Rotterdam tel (010) 414 8911 fax (010) 414 4750	RUSSIA Moscow tel (803) 2349125 fax (803) 2349125 SAUDI ARABIA Al Khobar tel (03) 833 0702 fax (03) 833 9369 SINGAPORE tel 4571233 fax 4576011 SOUTH AFRICA tel (11) 453 9741 fax (11) 453 9841 SPAIN Bilbao tel (94) 676 6011 fax (94) 676 6018 THAILAND Bangkok tel (02) 2593918 fax (02) 2593920	UK Bath tel (01225) 733200 fax (01225) 333487 USA Rochester tel (716) 328 1550 fax (716) 328 9848 VENEZUELA Caracas tel (02) 2653536 fax (149) 250822
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As we are continually developing our products, the design of Rotork actuators is subject to change without notice. The name Rotork is a registered trade mark.

ROTORK IQ RANGE BASIC SETTING INSTRUCTIONS

Actuator indicator display window

Hold setting tool directly in front of indicator window.
Range 0.5 metres / 18 inches

Red Local / Stop / Remote selector.
Select to "Local"

Down Key

Plus Key

Minus Key

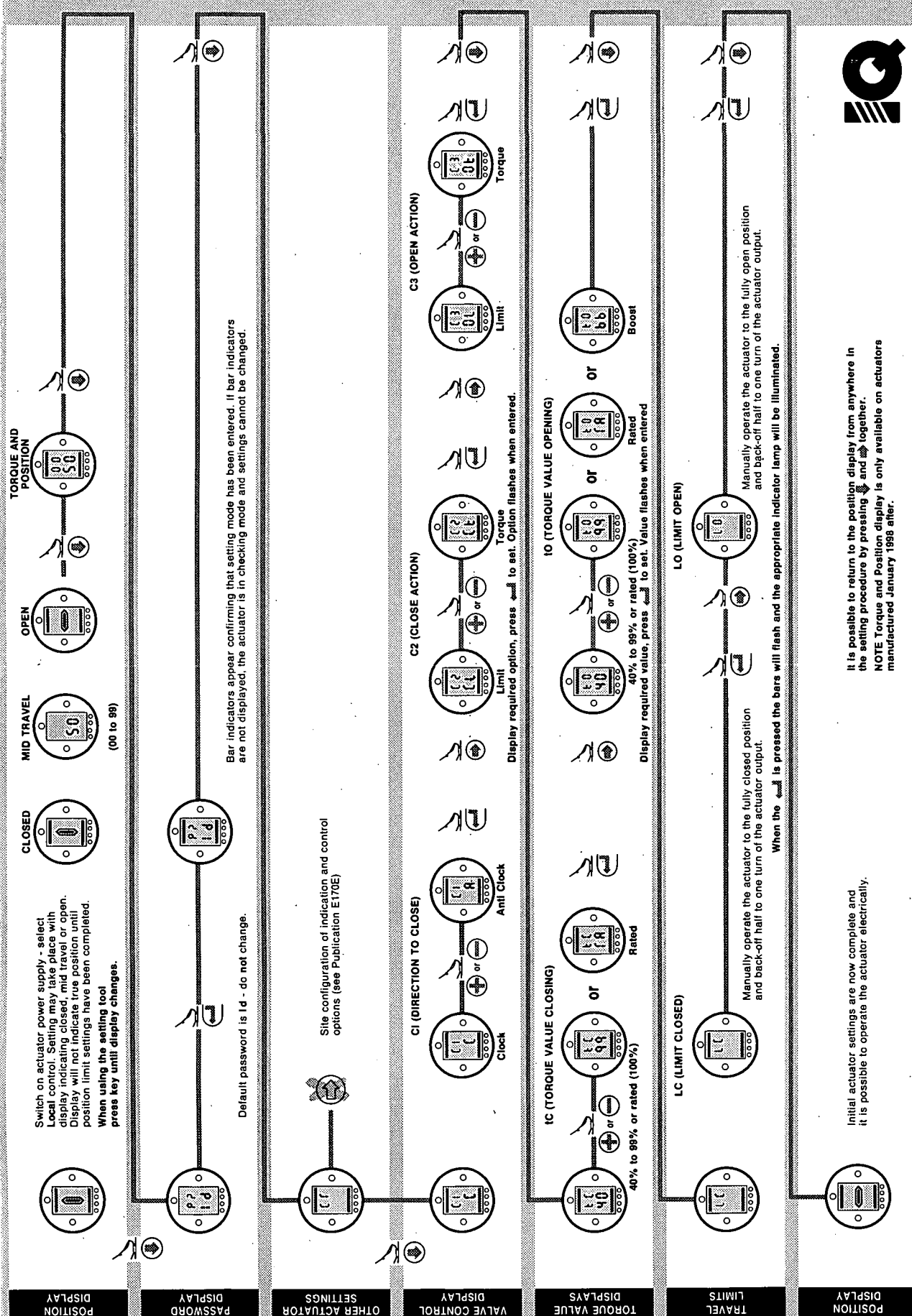
Enter Key

Across key

Infra-red setting tool.

These instructions enable the actuator to be configured to suit the valve and must be carried out before electrical start up. For complete instructions see Publication E170E.

PUBLICATION E171E ISSUE



rotork

ROTORK **IQ** RANGE

Installation and Maintenance Instructions



This instruction manual provides instruction on :-

- * Manual and electrical (local and remote) operation.
- * Preparation and installation of the actuator on to the valve.
- * Subsequent commissioning and adjustment of the Primary Settings for correct valve operation.
- * Commissioning and adjustment of the actuator Secondary Settings to suit site specific control and indication requirements.
- * Maintenance - Troubleshooting.
- * Sales and Service.

THE ROTORK IQ RANGE - THE WORLDS FIRST VALVE ACTUATOR THAT YOU CAN COMMISSION AND INTERROGATE WITHOUT REMOVING ELECTRICAL COVERS.

Using the supplied infra-red setting tool to access the actuator set up procedures, "point and shoot" setting of torque levels, position limits and all other control and indication functions can be made quickly and conveniently even in hazardous locations.

Standard diagnostics access information about the control system, valve and actuator status in the form of actuator display Help Screens.

Instantaneous torque and position can be monitored on the display with a simple key press of the setting tool.

The actuator containing the setting tool will be identified with a yellow label on the terminal cover.

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Health and Safety

This manual is produced to enable a competent user to install, operate, adjust and inspect Rotork IQ range valve actuators.

The electrical installation, maintenance and use of these actuators should conform to the requirements of the "Electricity at Work Regulations 1989" and the guidance given in the "16th edition of the IEEE Wiring Regulations", also any other National legislation applicable. The user should therefore make himself familiar with these regulations and other Statutory Provisions relating to the safe use of this equipment. Also the user should be fully aware of his duties under the Health and Safety Act 1974.

The mechanical installation should be carried out as outlined in the manual and also in accordance with the relevant British Standard Codes of Practice.

If the actuator has nameplates indicating that it is suitable for installation in Hazardous Gas Areas then the actuator is suitable for use in Zone 1 and Zone 2 explosive atmospheres only. They should not be installed in atmospheres where gases are present with an ignition temperature less than 135° C, unless suitability for lower ignition temperatures has been indicated on the actuator nameplate. Any test instruments applied to the actuator should be of equivalent certification. The electrical installation, maintenance and the use of these actuators should be carried out in accordance with BS 5345 Part 1 1976 and BS 5345 Part 3 1979.

No inspection or repair should be undertaken unless it conforms to the requirements given in these standards, and under no circumstances should any modification or alteration be carried out on the actuator as this could

very well invalidate the conditions under which the certification was granted

Access to live electrical conductors of the actuator is forbidden in the hazardous area unless this is done under a special permit to work, otherwise all power should be isolated and the actuator removed to a non hazardous area for repair or attention.

Only persons competent by virtue of their training and experience should be allowed to install, maintain and repair these actuators and they should carry out this work in accordance with the instructions given in the manual. The user and those persons working on this equipment should be familiar with their responsibilities under the Health and Safety at Work etc. Act 1974 and relevant Statutory Provisions relating to their work.

WARNING

Motor Temperatures

With excessive use motor surface temperature could reach 132° C.

Should further information and guidance relating to the safe installation, maintenance and use of the Rotork IQ Range actuator be required, this will be provided on request.

Storage

If your actuator cannot be installed immediately store it in a dry place until you are ready to wire up.

If the actuator has to be installed but cannot be wired up it is recommended that the plastic transit cable entry plugs are replaced with metal plugs which are sealed with PTFE tape.

The Rotork double sealed construction will preserve internal electrical components perfectly if left undisturbed.

It is not necessary to remove any electrical compartment covers in order to commission the IQ actuator.

Rotork cannot accept responsibility for deterioration caused on site once the covers are removed.

Every Rotork actuator has been fully tested before leaving the factory to give years of trouble free operation providing it is correctly commissioned installed and sealed.

Operating your IQ Actuator

3.1 Operating by Hand



Fig. 1

To engage handwheel drive depress the hand/auto lever into "hand" position and turn the handwheel to engage the clutch, the lever can now be released and it will return to it's original position. Handwheel will remain engaged until the actuator is operated electrically when it will automatically disengage and return to motor drive. If required the Hand/auto lever can be locked in either position using a padlock with a 7mm hasp.

3.2 Operating Electrically

Check that supply voltage agrees with that stamped on the actuator nameplate. Switch on power supply. It is not necessary to check phase rotation.

Do not operate the actuator electrically without first checking, using the infra-red setting tool, that at least the primary settings have been made. (See section 8)

Selecting Local/Stop/Remote Operation

The lower, red selector enables either Local or Remote control, lockable in each position using a padlock with a 6.5mm hasp. The Stop facility is still available. The selector can also be locked in the Stop position to prevent electrical operation by Local or Remote control.



Fig. 2

Local Control

With the red selector positioned at Local (clockwise) the adjacent black knob can be turned to select Open or Close, for Stop turn red knob anti-clockwise.

Remote Control

Rotate the red selector to the Remote position (anti-clockwise), this gives remote control only for Open and Close but local Stop can still be used by turning the red knob clockwise.

3.3 Local Valve Position Indication

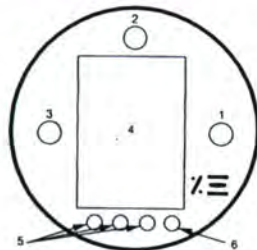


Fig. 3 The Actuator Display

The display consists of :

1. Red - position indication lamp
2. Yellow - position indication lamp
3. Green - position indication lamp
4. Liquid crystal display screen (LCD)
5. Infra-red sensors
6. Infra-red signal confirmation indicator (Red)

The liquid crystal display screen has 2 modes of position indication:

1. Valve position - power on
2. Valve position - power off

On power up the actuator's liquid crystal display screen is back-lit with a "soft amber" light and one of the indicator lamps will be on, dependent on position. The display screen will show percentage open or an end of travel symbol. (See Figs. 4.1, 4.2 and 4.3)

As standard, red lamp signifies valve open, yellow intermediate, and green lamp signifies valve closed. Colour functions can be reversed on request.

Automatic Self Test & Diagnosis (ASTD).

On Actuator power up, in the unlikely event of a diagnosed actuator problem electric operation will be inhibited and the Help Screen 7 (H7) alarm displayed (indicator lamps will flash and the LCD will indicate Help Screen 7; (H7) with a number between 1-7). (Refer to page 52 for information)

Open

Red indicator and open symbol displayed

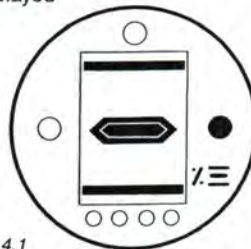


Fig. 4.1

Mid Travel

Yellow indicator and percentage open value displayed

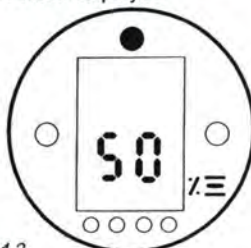


Fig. 4.2

Closed

Green indicator and closed symbol displayed

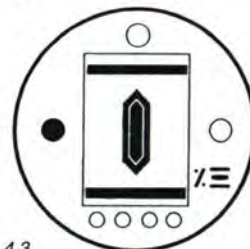


Fig. 4.3

With the mains supply switched off, the liquid crystal display screen is powered by a battery and continues to display actuator position. However, the battery does not power screen back-lighting, or position indicator lamps.

Preparing Drive Bush

1 IQ7 to IQ35 - Thrust Base Types "A & Z"

Removal of drive bush for machining

Bronze bush fitted into thrust taking base.



Fig. 5

Turn actuator onto it's side, remove the two cap head screws holding the base plate onto thrust base, pull the drive bush complete with it's bearing assembly.

Before machining the drive bush, remove the thrust bearing from it as follows:-

1. Locate and loosen the grub screw in the steel bearing stop ring.



Fig. 6

2. Unscrew the bearing stop ring from the drive bush, slide the bearing off the drive bush. Keep the stop ring and bearing in a safe, clean place ready for re-assembly.
3. Machine the drive bush to suit the valve stem, ensure that the male thread on the bush is not damaged.

Re-Assembly

1. Remove all swarf from the drive bush, ensuring that the "O" rings on the drive bush and bearing stop rings are in good condition, clean and greased.
2. Slide bearing onto drive bush and ensure that it is fitted down to the shoulder.
3. Screw bearing stop ring with the grub screws uppermost onto the drive bush, tighten down and lock with one grub screw.
4. Refit the drive bush assembly into the base casting on the actuator, ensuring that the slots in the drive bush are located into the drive dogs of the hollow output shaft.
5. Refit the base plate and secure with cap headed screws.

4.2 IQ7 to IQ35 - Non-Thrust Base Types "B"

Actuators for non-thrust applications have a steel bush with a spring clip.

This clip need not be removed



Fig. 7

A cast mounting plate is fitted to the actuator, which need not be removed.

Removal

Removal of the drive bush requires it to be tapped out from the top (handwheel end). Insert a suitable drift down the hollow output shaft and drive out.

Re-Fit

Machine the drive bush to suit, clean, grease and re-fit by tapping back into the actuator output shaft.

4.3 IQ40 to IQ95 Thrust Base Types "A & Z"

Removal of drive bush for machining

Engage "hand" and turn handwheel until retainer set screw is visible through hole in actuator base.



Fig. 8

Loosen set screw and unscrew retainer using hammer and punch. Remove drive bush and machine to suit valve stem or gearbox input shaft.

Allow generous clearance on screw thread for old rising stem valves.



Fig. 9



Fig. 10

Type A drive bush

If the actuator has a type A drive bush, this can be fitted in position 1 or 2 to suit the position of the valve mounting flange.



Fig. 11

Type A drive bush in position 1



Fig. 12

Type A drive bush in position 2

If the actuator has a type Z3 drive bush (Fig. 13) this can only be fitted below the actuator base (Fig. 14).



Fig. 13

Type Z3 drive bush



Fig. 14

Type Z3 drive bush in position 3

Assembly

Having confirmed the position required, insert the machined drive bush ensuring that the actuator output shaft dogs are in full engagement with the bush. Fit drive bush retainer securely, turning clockwise until fully tightened using hammer and punch. Rotate by hand wheel to align retainer set screw with hole in the side of base and lock tight.



4.4 IQ40 to IQ95 Non-Thrust Base Types "B"

Type B1

Output shaft bored and keyed to ISO 5210 standard. There is no drive bush to machine.

Type B3 & B4

Identical drive bushes secured by cap headed screws.

B3 is supplied pre-machined to ISO 5210 standard.

B4 is supplied blank and must be machined to suit the input shaft of the gearbox or valve that it will drive.



Fig. 16
B3/B4 Drive Bush



Fig. 17
B3/B4 Drive Bush in Situ.

Mounting the Actuator

Refer to Weights and Measures page 54 for Actuator weights.

Ensure the valve is secure before fitting the actuator as the combination maybe top heavy and therefore unstable.

If it is necessary to lift the actuator using mechanical lifting equipment certified slings should be attached as indicated in Fig.18a for vertical valve shafts and Fig.18b for horizontal shafts.

Trained and experienced personnel should ensure safe lifting particularly when mounting actuators at other angles.

WARNING

The actuator should be fully supported until full valve shaft engagement is achieved and the actuator is secured to the valve flange.

A suitable mounting flange conforming to ISO 5210 or USA Standard MSS SP101 must be fitted to the valve.

Actuator to valve fixing must conform to Material Specification ISO Class 8.8, yield strength 628 N/sq mm.

WARNING

Do not lift the actuator and valve combination via the actuator. Always lift the valve/actuator assembly via the valve.

Each assembly must be assessed on an individual basis for safe lifting.



Fig. 18a



Fig. 18b

Rising Stem Valves - Top Mounting

a) Fitting the Actuator and Base as Combined Unit. All Actuator Sizes



Fig. 19

Fit the machined drive nut into the thrust base as previously described, lower the actuator onto the threaded valve stem, engage "hand" and wind the handwheel in the opening direction to engage the nut onto the stem. Continue winding until the actuator is firmly down on the valve flange. Wind two further turns, fit securing bolts and tighten fully.

b) Fitting Thrust Base to Valve. Actuator sizes :- 7 to 35 only

Fit the machined drive bush into the thrust base as previously described. Remove the thrust base from the actuator, place it on the threaded valve stem with the slotted end of the drive bush uppermost and turn it in the opening direction to engage the thread. Continue turning until the base is positioned onto the valve flange. Fit securing bolts but do not tighten at this stage. Lower the actuator onto the thrust base and rotate the complete actuator until

the drive dogs on the actuator output shaft engage into the drive nut. Actuator flange should now be flush with base flanges.



Fig. 20

Continue to turn actuator until fixing holes align. Using bolts supplied fix actuator to thrust base and tighten down. Open valve by two turns and firmly tighten down fixings onto valve flange.

5.2 Valve with Gearbox - Side Mounting

Check that the mounting flange is at right angles to the input shaft, and that the drive bush fits the shaft and keyway with adequate axial engagement. Engage "hand", offer up actuator to the input shaft and turn handwheel to align keyway and key. Tighten mounting bolts.

5.3 Non Rising Stem Valves - Top Mounting

Treat as for side mounting except that when thrust is taken in the actuator, a thrust nut must be fitted above the drive bush and securely tightened.

5.4 Handwheel Sealing

Ensure that sealing plug in centre of handwheel (or spindle cover tube depending on which is fitted) is sealed with PTFE tape and fully tightened, ensuring that moisture does not pass down the centre column of the actuator.

5.5 IQM Modulating Actuators

The IQM range of actuators are suitable for modulating control duty of up to 1200 starts per hour in accordance with IEC 34-1 to S4 50%.

IQM actuators have a dynamic braking facility as standard. If mechanical overrun of the actuator and valve prove to be excessive for accurate control, the brake can be enabled by fitting a link to the actuator terminal block as indicated by the wiring diagram. With dynamic braking enabled, motor heating effects increase and therefore the number of actuator starts should be reduced to prevent motor thermostat tripping. (Refer to publication E 410E for more information).

Commissioning of IQM range actuators is identical to the standard IQ.

(Refer to sections 7/8/9)

5.6 IQML Linear Drive Unit

Consists of a lead screw assembly arrangement attached to the base of the actuator in order to provide a linear output stroke between 8mm (3/8in) minimum and 120mm (4 3/4in) maximum.

The IQML can be supplied with or without a yoke mounting adaptor, this adaptor consists of four pillars and a base flange to suit the valve.



Fig. 21 IQML with Yoke



Fig. 22 IQML without Yoke

5.7 Adjusting Linear Stroke

With actuator securely fitted to valve, but with the linear drive disconnected, ensure valve is at its fully closed (Down) position. Remove cover tube from actuator and wheel, locate the down stop adjustment on the linear drive unit and with two spanners loosen the lock nut, run the lock nut and tubular down stop to the end of the thread.



Fig. 23 Down stop 2 spanners

Turn the actuator hand wheel clockwise, linear drive will go down toward valve spindle, couple linear drive to valve spindle.

lubrication of the lead screw. Periodically, dependant on usage and temperature, apply two pumps of a grease gun.

Turn the tubular down stop clockwise into the actuator until it comes to a mechanical stop. If the valve must close onto its seat by "TORQUE ACTION" then back off (anti-clock) the down stop by one third of one turn (equivalent to 1mm). Run the lock nut down onto the tubular down stop and tighten with two spanners. There is no "up stop" (open) on the linear drive unit, the mechanical stop in the valve will give this position. Refit the top cover tube to the handwheel using teflon tape to seal the thread.

The linear drive unit is pre-packed with grease type Rocol MTS 1000, use this or an equivalent high temperature bearing grease.

Grease Nipple is situated in the base of the actuator to enable

Check that the supply voltage agrees with that stamped on actuator nameplate.

6.1 Earth/Ground Connections

A lug with a 6mm diameter hole is cast adjacent to the conduit entries for attachment of an external earthing strap by a nut and bolt. An internal earth terminal is also provided.

6.2 Removing Terminal Cover

Using a 6mm allen key loosen the 4 captive screws evenly. Do not attempt to lever off the cover with a screwdriver as this will damage the "O" ring seal and may damage the flamepath on a certified unit.

Actuators containing a setting tool fitted to the inside of the terminal compartment cover are identified with a self adhesive yellow label on the outside of the terminal compartment cover.



Fig. 24

The wiring code card fixed in the cover is particular to each actuator and must not be interchanged with any other actuator. If in doubt check the serial number on the code card with that of the actuator.



Fig. 25

A plastic bag in the terminal compartment contains :-
Terminal screws and washers
Spare cover "O" ring seal, Wiring diagram and Instruction book.

6.3 Cable Entry



Fig. 26

WARNING

Ensure all cables to be terminated are electrically isolated.

Only Explosion proof certified entry reducers and glands may be used in hazardous locations.

Remove red plastic transit plugs. Make cable entries appropriate to the cable type and size. Ensure that

threaded adaptors and cable glands are tight and fully waterproof. Seal unused conduit entries with a steel or brass threaded plug.

6.4 Connecting Terminals

On EExde enclosure units connections to the power and control terminals must be made using pre-insulated ring tags with a maximum tag thickness of 1mm for control and 2mm for power. Refer to the wiring diagram inside the terminal cover to identify functions of terminals. Check that supply voltage is the same as that marked on the actuator nameplate. Remove power terminal screen. Begin by connecting these cables and replace screen. When all connections are made ensure wiring diagram is replaced in the terminal compartment.

6.5 Replacing Terminal Cover

Ensure cover "O" ring seal and spigot joint are in good condition and lightly greased before re-fitting cover.

Commissioning

The Setting Procedure

The Rotork IQ Range of actuators is the first that enables commissioning to be carried out without removing covers after cabling has been completed. Setting torque, limit and other functions is achieved by using the infra-red Setting Tool. The Setting Tool is certified Intrinsically Safe to allow commissioning in hazardous areas with power on.

All the commissioning functions are stored in non-volatile memory in the actuator. The Setting Tool enables the user to view all the functions in turn via the actuator display window. As each function is viewed its setting can be checked and, if required, changed within the bounds of that function. The Setting procedure is divided into two stages:

1. Primary functions -
Settings for end of travel Limit Actions, Torque Values, Limit Positions etc.
2. Secondary functions -
Settings covering the control, indication and optional equipment functions.

All IQ actuator functions are configured before dispatch to Rotork standard default settings unless alternatives have been specified with the order. Should difficulty be encountered during commissioning the default settings can be re-instated, returning the actuator configuration to its original manufactured state. Site commissioning can then begin again.

(See section 9.10 page 42)

The default function should be used with caution as settings selected after manufacture may be essential for the safe operation of the valve and/or plant.

Positional Display
(This may be an open or closed symbol or a percentage open value).

Position Display

50

Torque and Position



refer to Section 10 Monitoring

Password

P?

PC

**Setting Branch
(cross-road)**

Cr

Primary Functions
Direction
Limit Actions
Torque Values
Limit Positions

Secondary Functions
Indication
Contacts
Control Mode
Options
Help Screens
Defaults

NOTE: The primary functions must be commissioned first.






7.2 The Setting Tool

Specification

Enclosure	IP67
Certification	Ex ia IIC T4 (intrinsically safe).
Power Supply	■ 9V Battery (supplied & fitted).
Operating range	0.75m (from actuator display window)

Name

Instruction

1.  Key* Display next function down
2.  Key* Display next function across
3.  Key Decrease/change displayed function's value or option setting
4.  Key Increase/change displayed function's value or option setting
5.  Key Enter displayed value or option setting
- * Pressing the two arrow keys together returns the actuator display to the position indication mode

Infra-red local operation (when enabled)




5.  Key Stop actuator
6.  Key Open actuator
7.  Key Close actuator
8. Infra-red Transmitter Window



Fig. 27 The Setting Tool

■ Battery status can be checked by looking at the Infra-red transmitter window while depressing any setting tool button. A flashing red indicator should be seen.

To replace the battery remove the six caphead screws in the back of the tool. Remove the back cover to expose battery.

Take notice of the Approved Hazardous Area Battery Types

label on the inside of the cover for replacement battery types.

Refit cover ensuring red indicator LED faces the transmitter window in the back cover.

When a button is depressed the Setting Tool transmits the relevant instruction to the actuator by infra-red pulses and must therefore be directly in front of the actuator indicator window and at a distance no greater than 0.75m.

Entering the actuator setting procedure

With the actuator securely mounted on the valve, the mains supply on and local control or stop selected.

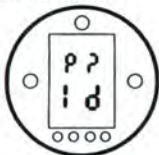
PRESS THE ↓ KEY

The actuator display will change and the Torque + Position display will be seen.

For instantaneous torque + position monitoring (refer to section 10, Monitoring, page 44).

PRESS THE ↓ KEY

The actuator display will change and the password protection display will be seen.



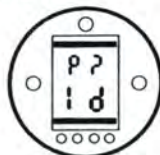
The Actuator function settings can be protected by the use of a password.

7.4 Setting Mode-Password

To enable setting and adjustment of the actuator functions the correct password must be entered. The factory set (default) password is [1d]. If the actuator has previously been set with a site password this must be displayed. Use the + or - keys to scroll through the available passwords 00 - FF (hexadecimal). With the correct password displayed press the enter key.

PRESS THE ↵ KEY

Two "setting" bars will appear and will remain visible on every function display screen.

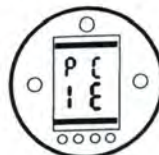


Default password, setting mode enabled

7.5 New Password [P?]

To configure a new password, the actuator must be in setting mode with the password display - setting mode enabled - showing, **PRESS ↵ KEY**. The display will change to [PC]. Using the + or - key scroll through the available passwords until the desired password is displayed.

PRESS THE ↵ KEY

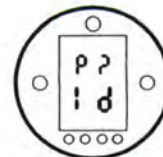


Password changed to [IE]

NOTE: The new password becomes effective the next time setting mode is entered

7.6 Checking mode

The actuator function settings can be checked without entering the correct password. The settings can only be viewed and not altered. The setting bars will not be seen.



Password Display, checking mode

Once the procedure has been entered in the required mode

PRESS THE ↓ KEY

the procedure branch (cross-road) display can now be seen:

(Refer to 7.7 page 16)

7.7 Procedure Branch - Cross-road

With procedure branch [Cr] displayed: (Refer to 7.6 page 15)



To access the primary settings press the **↓** arrow key.

(Refer to Section 8)

Commissioning Primary Functions

To access the secondary settings press the **⇒** arrow key.

(Refer to Section 9)

Commissioning Secondary Functions

7.8 The Actuator Display: Setting / Checking Mode

Actuator functions as laid out in the Primary and Secondary Commissioning stages, can be individually displayed by using the Setting tool arrow keys.

The **↓** arrow key will always display the FIRST function on the next level DOWN within the procedure. The **⇒** arrow key will always display the NEXT function on the SAME level and will wrap around the functions on same level. The actuator display indicator lamps will continue to indicate valve position.

Actuator functions are displayed in code form in the top portion of the liquid crystal display screen.

The setting for the displayed function is shown in the lower portion of the screen. Depending on the actuator function displayed, its setting may be an option or a value. In setting mode the setting tool **+** or **-** keys will cause the setting to be changed. In checking

mode the settings cannot be altered.

In setting mode, once displayed, a new setting can be entered into the actuator memory by **pressing the **←** key**. The setting will flash off and back on, confirming its selection.



TOP PORTION

Function e.g.
tC = Torque Close

LOWER PORTION

Function Setting
e.g. Value = 40%

Typical Actuator Function Display - Setting Mode Enabled

7.9 Returning to Valve Position Display

There are four ways of returning to valve position display:

1. Approximately 5 minutes after the last setting tool operation the display will automatically return to position display.
2. Press the **↓** and **⇒** arrow keys together.
3. Press the **↓** arrow key until the display returns to position.
4. With any actuator Function Screen displayed, select Remote Control using the red Local/Stop/Remote selector.

8

Commisioning Primary Functions



Fig. 28

The actuators Primary Function settings affect the correct operation of the valve by the actuator. If the actuator has been supplied with the valve, the valve maker or supplier may have already made these settings.

ELECTRICAL OPERATION MUST NOT TAKE PLACE UNTIL THE PRIMARY SETTINGS HAVE BEEN MADE AND CHECKED.

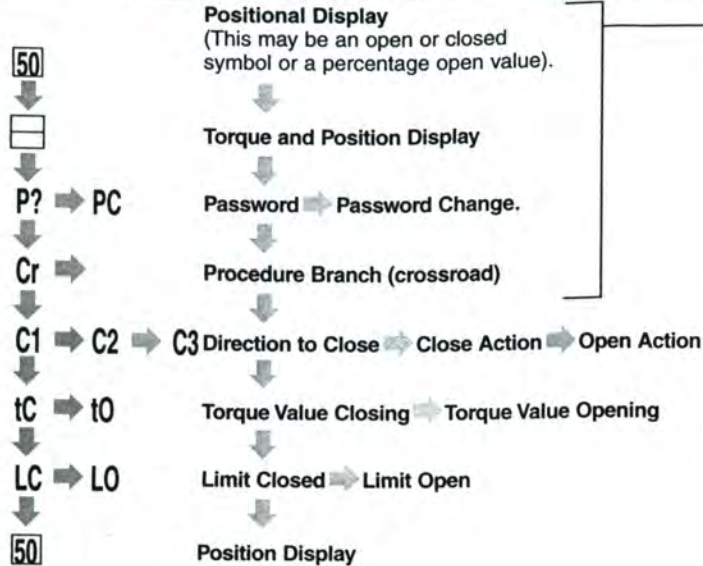
This instruction assumes Setting mode has been entered (*Refer to 7.4 page 15*) and that full primary settings must be set/checked.

Viewing the Primary Function Settings

With the actuator mounted on the valve, the mains supply on and local or stop control selected, point the Setting Tool at the actuator indicator window from a distance of less than 0.75m. By pressing the ↓ key and when appropriate, the → key, it is possible to move through the procedure, displaying the various functions and their settings as shown in Fig. 29, page 18. The right-hand side of Fig. 29 explains the function of each LCD display.

Viewing the Primary Function Settings

Refer to section 7
Commissioning Information



INDEX TO PRIMARY FUNCTIONS

C1	Direction to Close	Page 19
C2	Close Action	Page 20
C3	Open Action	Page 21
tC	Torque Value Closing	Page 22
tO	Torque Value Opening	Page 23
LC	Limit Closed	Page 24
LO	Limit Open	Page 25

Fig. 29 Primary setting function displays

C1**Direction to Close**

actuator can be configured to be clockwise or anti-clockwise to close. Manually operate actuator and valve to establish correct closing direction. If the handwheel labelling is found to be incorrect please apply to Rotork for conversion labels.

50



P? → PC



Cr →



C1 → C2 → C3



tC → tO

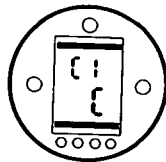


LC → LO

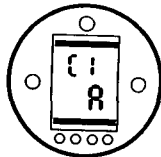


50

Using the + or - key, display character conforming to correct closing direction.



[C] in the setting field indicating clockwise to close.



[A] in the setting field indicating anti-clockwise to close.

Having ensured that the display corresponds to the established closing direction.

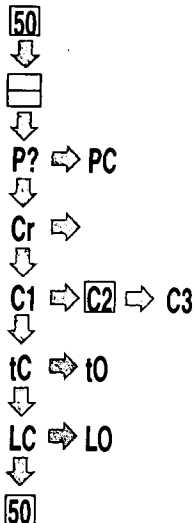
PRESS THE ← KEY

The displayed option will flash, indicating that it has been set.

PRESS THE → KEY

C2**Close Action**

The actuator can be configured to close on torque for seating valves and limit for non-seating valves.

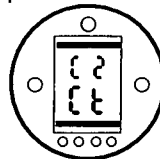


(Refer to valve manufacturer for recommended selection).

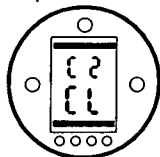
In the absence of valvemaking instructions refer to the following table

Valve type	"close"	"open"
Wedge gate or globe	"torque"	"limit"
Butterfly, thru conduit, ball, plug, sluice gate / penstock or parallel slide	"limit"	"limit"

Using the **+** or **-** key, display the desired option.



[tC] in the setting field indicating close on torque.



[CL] the setting field indicating close on limit.

Having selected the required option

PRESS THE ← KEY

The displayed option will flash, indicating that it has been set.

PRESS THE → KEY

NOTE: When set to close on torque, the actuator will apply the value of torque as set for [tC] in seating the valve.
(Refer to tC page 22)

The actuator can be configured to open on torque for back seating valves or limit for non back seating valves (Refer to valve manufacturer for recommended setting). In the absence of valvemaker instructions set "Open Limit".

50



tC

Torque Value Closing

The value of torque available in the close direction can be configured (Refer to valve manufacturer for recommended value).

The closing torque value can be varied between 40% and Rated, in 1% increments.

50



P? ➔ PC



Cr ➔



C1 ➔ C2 ➔ C3



tC ➔ t0



LC ➔ L0



50

Using the + and - keys display recommended value.
In the absence of a recommended torque value, try a low setting and increase until satisfactory valve operation is achieved.

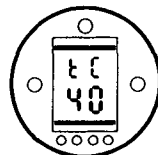
PRESS THE ➔ KEY

The displayed value will flash, indicating that it has been set.

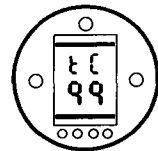
Should the set value of torque be developed in closing, the actuator will torque trip and stop.

PRESS THE ➔ KEY

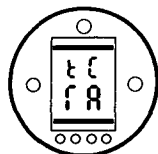
NOTE: Rated torque is quoted on the actuator nameplate.



40% of Rated Torque



99% of Rated Torque



Rated Torque

Torque Value Opening

The value of torque available in the open direction can be configured.

(Refer to valve manufacturer for recommended value).

50



P? → PC



Cr →



C1 → C2 → C3



tC → tO



LC → LO



50

The opening torque value can be varied between 40% and Rated, in 1% increments. In addition "boost" can be configured when no open torque protection is required.

BOOST SHOULD NOT BE SELECTED WHEN THE ACTUATOR HAS BEEN CONFIGURED TO OPEN ON TORQUE as in C3 page 21

unless back seating at rated torque is acceptable.

Using the + and - keys display the recommended torque value.

In the absence of a recommended torque value, try a low setting and increase until satisfactory valve operation is achieved.

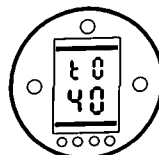
NOTE: Rated torque is quoted on the actuator nameplate. Boost torque is at least 140% of rated torque.

PRESS THE ← KEY

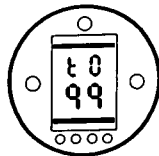
The displayed value will flash, indicating that it has been set.

Should the set value of torque be developed in opening, the actuator will torque trip and stop.

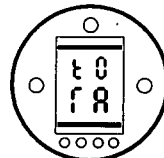
PRESS THE ↓ KEY



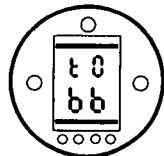
40%



99%



Rated



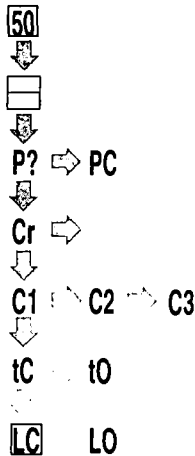
Boost

In checking mode, on pressing ↓ key after reviewing open torque setting, the display will revert to valve position.

LC

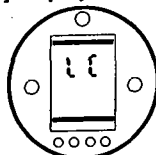
Set Limit Closed

NOTE: It is possible to set the Open Limit Position [LO] first.



NOTE: When in checking mode Set Limit Closed [LC] does not appear.

With [LC] displayed



Limit closed

Move valve manually to the closed position. Allow for overrun by winding actuator output open up to one turn.

PRESS THE ← KEY

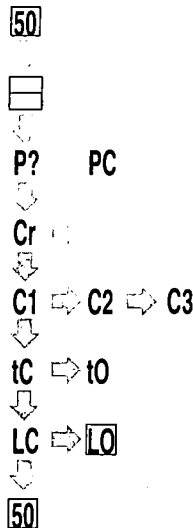
The two bars will flash and the closed indicator lamp will illuminate, indicating closed limit position has been set.

PRESS THE → KEY

To check closed limit position hand wind valve open one turn, when amber lamp should illuminate and the closed lamp should extinguish. Wind valve back closed one turn, when closed lamp should illuminate with the amber lamp extinguished.

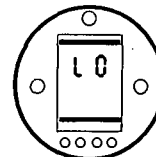
LO

Set Limit Open



NOTE: When in checking mode Set Limit Open [LO] does not appear.

With [LO] displayed



Limit open

Move valve manually to the open position. Allow for overrun by winding actuator output closed up to one turn.

PRESS THE ← KEY

The two bars will flash and the open indicator lamp will illuminate, indicating open limit position has been set.

PRESS THE ↓ KEY

The open symbol (See Fig. 4.1) should now appear.

Return to Positional Display

50



P?

→ PC



Cr



C1

→ C2 → C3



tC

→ tO



LC

→ LO



50

If the procedure has been followed as described, the positional display will indicate that the actuator is in the open position.

Select Remote Control, momentarily using the red Selector to exit setting procedure and then select required control: Local, Stop or Remote.

With the correct settings made electric operation can now be carried out safely.

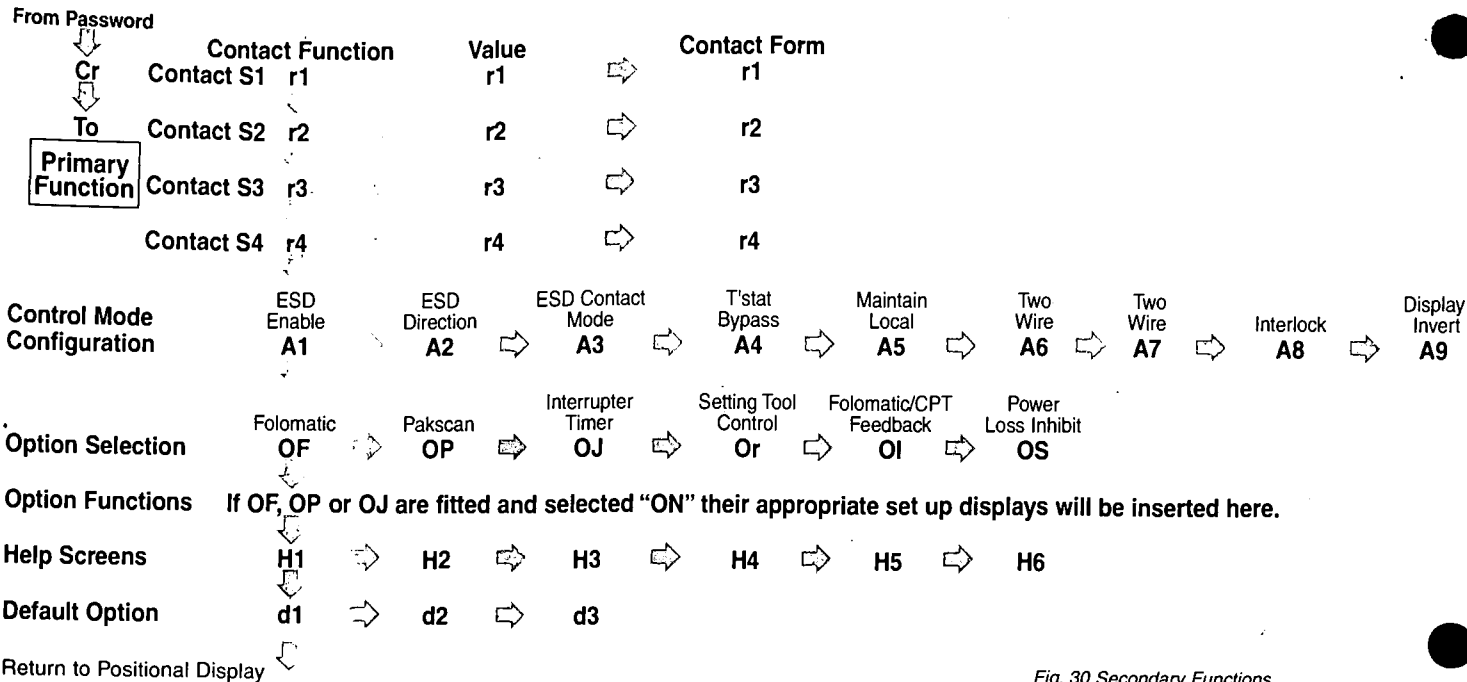


Fig. 30 Secondary Functions

SECONDARY FUNCTION INDEX

9.1 Accessing the Secondary Settings	page 27
9.2 Indication Contacts S1 - S4	28
9.3 Control Mode Configuration	29
9.4 Option Folomatic	32
9.5 Option Pakscan	34
9.6 Option Interrupter Timer	39
9.7 Option Setting Tool Local Control	41
9.8 Option CPT (Current Position Transmitter)	41
9.9 Option Power Loss Inhibit	42
9.10 Default Options	42
10.1 Help Screens refer to Section	46

Having established that the primary settings have been correctly set, the secondary settings can now be configured to suit site control and indication requirements.

It is possible to move through the various secondary functions as shown in Fig. 30 using the **→** and **↓** keys.

The actuator wiring diagram will indicate any Options fitted.

Options Infra-red Control **[Or]** and Power Loss Inhibit **[OS]** are standard features their use being optional.

In order to display the secondary functions it is necessary to press the **↓** key until **[Cr]** appears.

If you have chosen to enter secondary functions in the checking mode the display will be as Fig. 31.

If you have chosen to enter secondary functions in the setting mode the display will be as Fig. 32 (Refer to section 7).

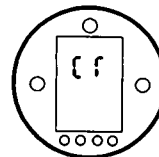


Fig. 31

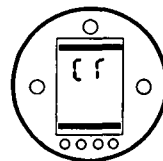


Fig. 32

PRESS THE **→ KEY**

9.2 Indication Contacts S1 S2 S3 and S4

Indication contacts S1 [r1], S2 [r2], S3 [r3], and S4 [r4] may each be set to trip for any one of the following functions:-

CL	closed limit
OP	open limit
tt	torque trip mid travel
bA	battery low
dC	actuator closing
dO	actuator opening
d?	actuator moving
St	motor stalled
HA	handwheel operation
bL	blinker (moving)
tS	torque trip - any position
tO	torque trip - opening
tC	torque trip - closing
Po	intermediate position indication

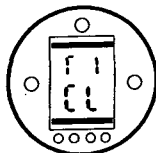
S Contact form can be set normally open (NO) or normally closed (NC).
Procedure for setting up contacts S2, S3 and S4 are the same as those shown for S1.

r1 Contact S1 : Function

Using the **+** or **-** key display the desired function.

PRESS THE **←** KEY

The displayed function will flash indicating that it has been set.



Contact S1 has been configured to trip at valve closed limit.

PRESS THE **→** KEY

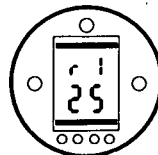
r1 Contact S1 : Value

When the S Contact function is set to [Po], the required intermediate position value must be set.
No other contact function requires a value to be set.

The value can be set from 1% open to 99% open in 1% increments.
Using the **+** or **-** key, display the required value.

PRESS THE **←** KEY

The displayed value will flash indicating that it has been set.



Value set to indicate 25% open

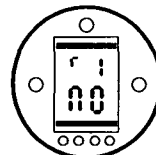
PRESS THE **→** KEY.

r1 Contact S1: Contact Form

Use the **+** or **-** keys to select between [nO] (normally open) and [nC] (normally closed).

PRESS THE **←** KEY

The displayed option will flash indicating that it has been set.



Contact S1 configured as a normally open contact

NOTE: If function [Po] is selected and it is configured as a normally open contact it will make at the set value with the actuator moving in the open direction.

To access S2 - S4

PRESS THE **↓** KEY

9.3 Control Mode Configuration

If it is necessary to change the default control configuration follow the instructions given in this section.

There are 9 configurable control functions as follows:-

- A1 ESD enable
- A2 ESD direction
- A3 ESD contact mode
- A4 Thermostat bypass
- A5 Local maintain
- A6 2 Wire control
- A7 2 Wire control
- A8 Interlock enable
- A9 Display invert

A1 ESD Enable

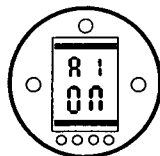
The default setting for Emergency Shut Down control is **[On]**.

With the actuator control set to Local or Remote, an ESD signal will override any existing open or close signal, moving the valve to the required emergency position. ESD will not override Stop control or an active interlock.

To disable ESD control press the **+** or **-** key. The display will change to **[OF]**.

PRESS THE KEY

The displayed option will flash indicating that it has been set.



ESD enabled

(Refer to A2, A3 and A4)

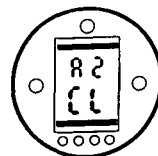
A2 ESD Direction

The default setting for Emergency Shut Down direction is close **[CL]**.

If the actuator is required to open the valve in the event of an ESD press the **+** or **-** key. The display will change to **[OP]**.

PRESS THE KEY

The displayed option will flash indicating that it has been set.



ESD set to close

A3 ESD Contact Mode

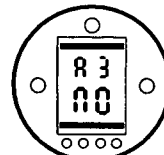
The default setting for ESD Contact Mode is **[nO]**.

The actuator responds to an applied ESD signal derived from a external - normally open contact making.

For ESD, where an external - normally closed ESD contact breaks and the signal is removed use the **+** or **-** key. The display will change to **[nC]**.

PRESS THE KEY

The displayed option will flash indicating it has been set.



Actuator shuts down when ESD signal is applied. If Pakscan FCU option is fitted, A3 must be set to **[nO]**.

A4**Thermostat By-pass**

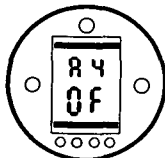
The default value for motor thermostat by-pass is enabled [ON].

The thermostat is normally in circuit. When an ESD signal is applied the thermostat will automatically be by-passed. To enable thermostat during ESD (thermostat by-pass disabled) A4 should be changed by pressing **+** or **-** key to display [OF].

WARNING: Actuator hazardous enclosure certification is invalidated while the thermostat is By-passed.

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.



Thermostat by-pass disabled

A5**Self-maintained Local Control**

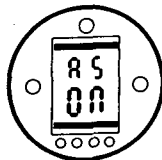
The default for local actuator pushbutton control is self-maintained [On].

If non-maintained (jogging, inching, push-to-run) actuator pushbutton control is required, press the **+** or **-** key.

The display will change to [OF].

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.



Self-maintained local control

A6**Two Wire Control**

For 2-wire remote control form (d) and form (e) (Refer to actuator wiring diagrams).

The combination of settings for [A6] and [A7] give the following priorities.

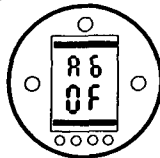
OF OF - Close priority
On On - Open priority

The default condition is for both [A6] and [A7] to be [OF], giving Closed priority.

If you require to change the priority press the **+** or **-** key. The display for [A6] will change to [ON].

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.



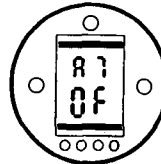
2-wire control - close priority

PRESS THE \rightarrow KEY**A7****Two Wire Control**

Press the **+** or **-** key the display for [A7] will change to [On].

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.



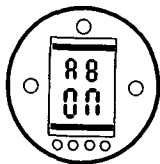
2-wire control - close priority

A8**External Interlocks**

Actuators are delivered with the interlock facility disabled. To enable the interlock facility use the **+** or **-** key to change the display from **[OF]** to **[ON]**.

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.

PRESS THE \rightarrow KEY

NOTE: If an external interlock is required in one direction only, it will be necessary to connect a link between the actuator terminals associated with the other direction.

A9**Display Invert**

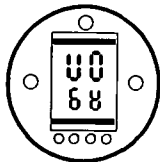
The default setting for display invert is **[Of]**. The display characters are oriented with the top towards the yellow indicator lamp.

To rotate the characters through 180° (bottom towards yellow lamp) press the **+** or **-** key.

The display will change to on **[On]**.

PRESS THE \leftarrow KEY

The displayed option will flash and the screen display will invert. All Position, Torque + Position, Help and Setting displays will be inverted.



Display inverted

Setting instructions for actuators including a Folomatic (proportional) Controller for use in (analog) valve position control.

The Folomatic is an optional control device - Check actuator wiring diagram for inclusion.

Folomatic set up screens can be turned OFF to provide extra security.

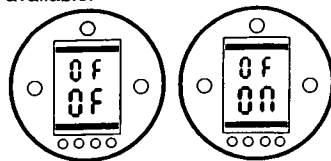
Once selected ON the option function displays allow commissioning of the Folomatic to be undertaken.

NOTE: Turning ON/OFF the Folomatic set up screens (when fitted) does **not** affect its operation.

This instruction lists the Folomatic function displays in their sequence and assumes that all Folomatic functions are to be checked/set.

The actuator should be selected in Local or Stop with the set point signal connected to terminals 26(+) and 27(-) (Refer to Wiring diagram).

The action of turning on the Folomatic option makes an additional series of settings available.



Folomatic Set Up screens OFF

Folomatic Set Up screens ON

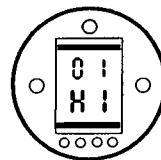
Use the + or - key to select Folomatic Display [ON].

PRESS THE ← KEY

The displayed option will flash indicating that it has been set.

Press the → key until [OI] is Displayed.

Before commissioning of the Folomatic functions can begin, the Folomatic Feedback must be set to suit the applied set point signal.



With [HI] displayed, an increasing set point signal will correspond to valve opening.

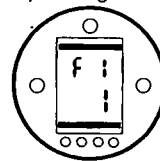
If a high set point signal is required to correspond to valve closing use the + or - key to change to [LO].

PRESS THE ← KEY

The displayed option will flash indicating that it has been set. If setting [OI] is modified after commissioning the Folomatic, it will be necessary to re-commission the Folomatic.

Press the ↓ key to access the Folomatic set up displays.

Using the + or - key select [I] for current set point signal or [U] for voltage set point signal.



Current mode selected

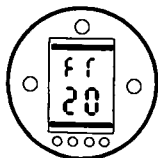
PRESS THE ← KEY

The displayed option will flash indicating that it has been set.

Press the → key to display [Fr].

Fr Set-point Signal Range

Using the **+** or **-** key select [05], [00] or [20] to correspond with the set point signals within the range of 0-5mA or volts, 0-10mA or volts or 0-20mA or volts. (i.e. 4 - 20mA).



0-20mA or Volt
range selected

PRESS THE **↔** KEY

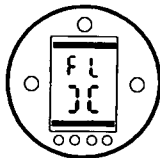
The displayed option will flash indicating that it has been set.

Press **→** key to display [FL].

FL Valve Position - LOW Set Point

APPLY MINIMUM SET POINT SIGNAL

Using the **+** or **-** key select:
[] = valve closed
[01] to [99] = percent open
[≡≡] = valve open
to correspond with the **LOW**
set point signal.



Valve closed
on **LOW** signal

PRESS THE **↔** KEY

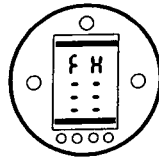
The displayed value will flash indicating that it has been set.

Press **→** key to display [FH].

FH Valve Position - HIGH set Point

APPLY MAXIMUM SET POINT SIGNAL

Using the **+** or **-** key select:
[] = valve closed
[01] to [99] = percent open
[≡≡] = valve open
to correspond with the **HIGH**
set point signal.



Valve open
on **HIGH** signal

PRESS THE **↔** KEY

The displayed value will flash indicating that it has been set.

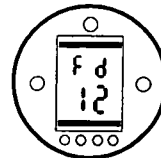
Press **→** key to display [Fd].

Fd Deadband Adjustment

If the actuator hunts or responds unnecessarily to a fluctuating set point signal the deadband must be increased. If more accurate control is required the deadband may be decreased.

Use the **+** or **-** key to select the Deadband width. Range 00 - 99 corresponds to 0% - 9.9% of setpoint signal.

NOTE: Maximum deadband is 9.9% of valve stroke. Normally minimum deadband should not be less than 1%.



Deadband set to 1.2%
of Valve Stroke

PRESS THE **↔** KEY

The displayed value will flash indicating that it has been set.

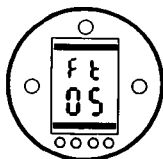
Press **→** key to display [Fu].

Ft Motion Inhibit Timer Adjustment

The Motion Inhibit Timer introduces a delay in the actuator response to a rapidly fluctuating set point signal, preventing unnecessary movement. Once the system stabilises the actuator will respond to steady changes in the set point signal as necessary.

Use **+** or **-** key to adjust motion inhibit time in seconds - range 0-99. Normally it is recommended that motion inhibit time should not be set to less than 5 seconds.

(See note on page 41)



Motion inhibit time set to 5 seconds

PRESS THE **←** KEY

The displayed value will flash indicating that it has been set.

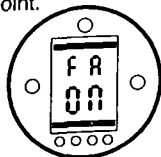
Press **→** to display [FA].

FA Action on Loss of Set Point Signal

Use **+** or **-** key to enable [On] or disable [OF] action on loss of set point signal.

[ON] - Failsafe as determined by [FF].

[OF] - Failsafe to position corresponding to low set point.



Enabled

PRESS THE **←** KEY

The displayed option will flash indicating that it has been set.

NOTE: Failsafe action "ON" will be effective only for systems using an offset or live zero signal range, for example 4-20 mA.

Press **→** to display [FF].

FF Failsafe Action

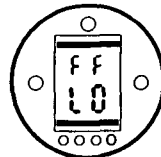
Failsafe action when [FA] enabled.

Use **+** or **-** key to select, on loss of set point signal:

[LO] - move valve to position corresponding to minimum set point.

[SP] - stayput on loss of set point

[HI] - move valve to position corresponding to maximum set point.



PRESS THE **←** KEY

The displayed option will flash indicating that it has been set.

Commissioning of the Folomatic is now complete. Remote control may be selected.

9.5 Option Pakscan

Setting instructions for actuators including a Pakscan Field Control unit for use in conjunction with Rotork Pakscan 2-wire control system.

Pakscan (Field Control Unit) is an optional device - check wiring diagram for inclusion.

Pakscan setup screens can be turned OFF to provide extra security.

Once selected ON the Pakscan option displays enable commissioning of Pakscan to be undertaken.

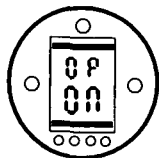
NOTE: Turning ON/OFF the Pakscan set up screens (when fitted) does **not** affect its operation.

This instruction lists the Pakscan function setup displays in their sequence and assumes that all Pakscan functions are to be set/checked.

Display Pakscan Set Up Screens

The action of turning ON the Pakscan function makes an additional series of settings available.

Use the **+** or **-** key to turn ON the Pakscan set up display screens.



Pakscan set up screens ON

PRESS THE **←** KEY

The displayed option will flash indicating that it has been set.

Press the **↓** key to display Pakscan set up displays.

Loop Address

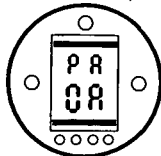
The actuator Pakscan field control unit must be allocated a unique loop address.

The actuator must be in "Loopback" for its address to be set or changed. Loopback can be achieved in two ways:

1. Turn OFF the Master Station.
2. Disconnect the actuator from the 2-wire control loop.

Using the **+** or **-** keys display the required loop address.

Address to be set within the range 01 - FO (Hexadecimal).



PRESS THE **←** KEY

The displayed option will flash indicating that it has been set.

Press the **→** key to display [Pb].

Loop Baud Rate Selection

The actuator Pakscan field control unit must be set up with the loop baud rate. For a Pakscan 2-wire control loop the selected baud rate must be common to the Master Station and all the Field Control Units included on the loop.

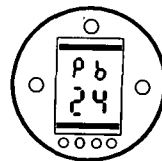
The actuator must be in "Loopback" for its baud rate to be set or changed.

Loopback can be achieved in two ways:

1. Turn OFF the Master Station.
2. Disconnect the actuator from the 2-wire control loop.

Using the **+** or **-** keys display the required baud rate.

- 01 = 110 baud
- 03 = 300 baud
- 06 = 600 baud
- 12 = 1200 baud
- 24 = 2400 baud



2400 baud rate set

PRESS THE **←** KEY

The displayed option will flash indicating that it has been set.

PF

Remote Auxilliary Input

Press the **→** arrow key to display **[PF]**.

This facility is used when supplementary remote control or volt free digital auxiliary inputs are required in addition to Pakscan control or actuator status information. It is also possible to have a combination of both.

eg. Remote open and close pushbutton control (maintained operation) with tank level high and low alarm inputs.

Normally open or normally closed external contacts can be used.

There are numerous combinations of input function and form. The common combinations are listed below. Apply to Rotork for other options. Use the **+** or **-** keys to display the required option:

INPUT REQUIRED				CODE
ESD (NO)	STOP/MAINT	CLOSE	OPEN	= [Fb]
ESD (NC)	STOP/MAINT	CLOSE	OPEN	= [F3]
AUX4	STOP/MAINT	CLOSE	OPEN	= [7F]
AUX4	AUX3	CLOSE	OPEN	= [3F]
ESD	STOP/MAINT	AUX2	AUX1	= [CF]
ESD	AUX3	AUX2	AUX1	= [8F]
AUX4	STOP/MAINT	AUX2	AUX1	= [4F]
ESD	AUX3	CLOSE	OPEN	= [bF]
AUX4	AUX3	AUX2	AUX1	= [0F]

NOTE: All external contacts to be wired in accordance with publication E120E - Remote Control Circuits Forms a, b, c and f.

OF

Pakscan Position Control

When valve position control is required via the Pakscan system additional setting must be made.

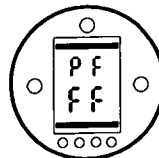
Return to valve position display by pressing the down and across arrow keys together.

After entering the correct password to put the actuator in setting mode:

Display **OF** - (Option Folomatic Screen)

Folomatic set up displays are used for setting Pakscan Position Control Parameters.

NOTE: The actuator does not include a Folomatic.



Remote auxiliary input selected for function/forms **FF**.

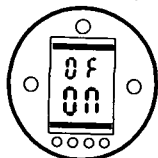
PRESS THE ← KEY

The displayed option will flash indicating that it has been set.

OF Display Pakscan Position Set up Screens

The Pakscan position control set up screens can be suppressed to provide extra security.

Use the **+** or **-** key to turn ON the Pakscan position set up screens.



Pakscan position control set up screens selected ON

PRESS THE **↔** KEY

The displayed option will flash indicating that it has been set.

Press **↓** to display Pakscan position control display screens.

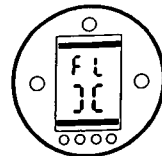
Once **[FI]** is displayed
Press **→** key to display **[FL]**.

FL Pakscan Valve Position - 0% DV

On receipt of a 0% desired valve (DV) command from the Masterstation, the actuator will respond by moving to the position as set for **[FL]**. The reported position, measured value (MV) will relate to the DV.

Use the **+** or **-** keys to display the valve position at, or nearest to the 0% (closed) valve position.

NOTE: On receipt of a digital command to close from the master station the actuator will move to its set closed limit position ignoring any other position that may have been entered.



0% DV = Valve closed

PRESS THE **↔** KEY

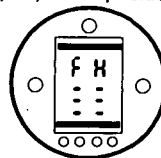
The displayed value will flash indicating that it has been set.

Press **→** key to display **[FH]**.

FH Pakscan Valve Position - 100% DV

On receipt of a 100% desired value (DV) command from the masterstation, the actuator will respond by moving to the position as set for **[FH]**. The reported position, measured value (MV) will relate to the DV.

Use the **+** or **-** keys to display the valve position at, or nearest to the 100% (open) valve position.



100% DV - Valve open

NOTE: On receipt of a digital command to open from the masterstation the actuator will move to its set open limit position ignoring any other position that may have been entered.

PRESS THE **↔** KEY

The displayed value will flash indicating that it has been set.

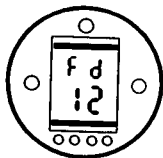
Press **→** key to display **[Fd]**

Fd**Pakscan Deadband Adjustment**

If the actuator hunts or responds unnecessarily to a fluctuating desired value the deadband must be increased. If more accurate control is required the deadband may be decreased.

The deadband is adjustable from [00] to [99] (0% to 9.9% of valve stroke).

Use the + or - keys to display the required setting.



Deadband set to 1.2%

PRESS THE ← KEY

The displayed value will flash indicating that it has been set.

Press the → key to display [Ft].

Ft**Pakscan Motion Inhibit Timer Adjustment**

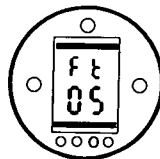
Whenever the actuator comes to rest, the Motion Inhibit Timer (MIT) is started. Further operation in response to a change in desired value is delayed until the MIT times out.

By adjusting the MIT time to suit the control application, unnecessary actuator/valve operation as a response to a rapidly fluctuating DV can be eradicated. Once a system stabilises and steady changes in DV take place the actuator will respond as necessary.

Rotork general advice is to set the longest possible motion inhibit time while maintaining an acceptable response time for control. This will maximise the working life of the actuator and valve.

Use the + or - keys to display the required setting.

Range 2 - 99 seconds.



Motion inhibit time set to 5 seconds.

PRESS THE ← KEY

The displayed value will flash indicating that it has been set.

and Functional Specification OM Manual

9.6

Option
Interrupter Timer

Following instructions for actuator including an Interrupter Timer.

The interrupter timer enables pulsed "stop/start" operation by the actuator as a response to local and remote control commands.

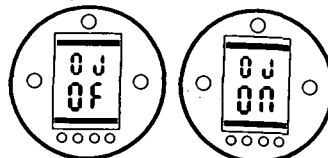
This effectively increases the valve stroke time and can be adjusted to prevent hydraulic shock (water hammer) and flow surges in pipelines.

The interrupter timer is an optional extra - check wiring diagram for inclusion.

OJ Interrupter Timer
Enabled / Disabled

When fitted, the timer will be made available for operation.

The Interrupter cannot be enabled or disabled using the setting Tool.



Interrupter timer disabled Interrupter timer enabled

When the timer option is available an additional series of settings can be accessed by pressing the \downarrow key

NOTE: If the timer option is not available pressing the \downarrow key will not access to settings.

Press \downarrow key to display interrupter timer set up displays.

Jd Interrupter Timer -
Direction

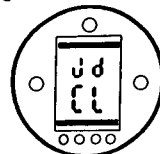
The default for timer direction is [CL], timer operation will start in closing and stop in opening - pulsing operation around the close position.

If pulsing operation is required to stop in closing and start in opening - around the open position, use the \pm or \leftarrow key.

The display will change to [OP].

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.



Pulsed operation around the closed position.

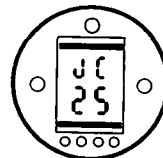
NOTE Instructions [JC] and [JO] are for timer operation around the closed position. For timing around the open position, read stop for start [JC] and start for stop [JO].

Press \rightarrow key to display [JC].

JC Position in Valve Closing
Stroke for Timer to Start

Using the \pm or \leftarrow key select the position for the **TIMER TO START WHEN THE VALVE IS CLOSING.**

[X] = valve closed,
[01]-[99] = percentage open
[≡] = valve open



Timer set to start pulsing when closing valve reaches 25% open

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.

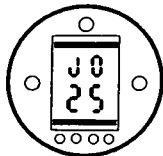
If the timing is not required in the closing stroke select [JC] to [X] Valve closed position.

Press \rightarrow key to display [JO].

JO Position in Valve Opening Stroke for Timer to Stop

Using the **+** or **-** key select the position for the **TIMER TO STOP WHEN THE VALVE IS OPENING**.

[**∏**] = Valve Closed
 [00]-[99] = Percentage Open
 [≡≡] = Valve Open



Timer set to stop pulsing when opening valve reaches 25% open

PRESS THE \leftarrow KEY

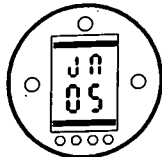
The displayed option will flash indicating that it has been set.

If the timing is not required in the opening stroke select **[JO]** to [**∏**].

Press \Rightarrow key to display **[JN]**.

JN Contactor 'On' Time

Using the **+** or **-** key select the actuator run period in the range 1 - 99 seconds.



Actuator run period set for 5 seconds

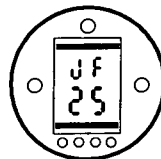
PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.

Press the \Rightarrow key to display **[JF]**.

JF Contactor 'Off' Time

Using the **+** or **-** key select the actuator stop period in the range 1 - 99 seconds.



Actuator OFF period set for 25 seconds

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.

Example

An actuator fitted with the interrupter timer and set as the example shown in these instructions would operate at:

Rated speed from full open to 25% open.

1/6 rated speed from 25% open to fully closed and from fully closed to 25% open.

Rated speed from 25% open to fully open.

Note

a Folomatic Option fitted AND the Interrupter Timer enabled, the Folomatic "Motion Inhibit Timer" must be adjusted to the same time as that set for the Interrupter Timer "Contactor Off".

Failure to do so will cause the actuator response to defer to the lower time which may cause control or process problems.

For 'ON' and 'OFF' times in excess of 99 seconds apply to Rotork.

9.7 Setting Tool Control [Or]

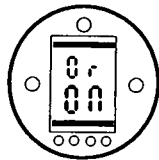
The default setting for Setting Tool control is [OF].

To enable Tool control press the **+** or **-** key to select [On].

PRESS THE \leftarrow KEY

The displayed option will flash indicating that it has been set.

With the red control selector in Local, Setting Tool control keys are active (Refer to page 14).



Local Setting Tool control enabled
Vandal resistant actuators ONLY
 (red/black selectors not supplied)
 For control, the selection of [Or] is as follows:

[On] Local Setting Tool control only.

[OF] Local/ Remote control disabled.

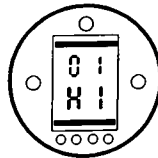
[rE] Remote control only.

9.8 CPT Current Position Transmitter [OI]

Setting instructions for actuators including a CPT providing 4-20 mA analog position feedback.

The CPT is an optional extra. It may be internally or externally powered.

Check wiring diagram for inclusion and connection details.



With [HI] displayed, the (CPT) 20 mA output will correspond to actuator fully open.

If 20mA is required to correspond to actuator closed use the **+** or **-** key to change to [LO].

PRESS THE \leftarrow KEY

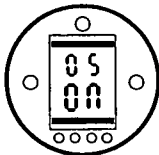
The displayed option will flash indicating that the option has been set.

NOTE: If the actuator has options Folomatic and CPT, redefining the CPT, will require the Folomatic to be re-commissioned.

(Refer to 9.4 Folomatic [OI] page 32)

9.9 Inhibit Operation After Power Loss [OS]

The default setting for this option is enabled [On]. This ensures that the actuator cannot be operated electrically if the position sensing circuits have not been updated after manual operation during a combined power failure and low battery condition - a black out.



This feature may be disabled by using the + or - key so that [OF] appears in the lower part of the display. If the feature is disabled it is important that the actuator is not manually operated during a power failure if the battery is low. Manual operation can be prevented by locking the actuator hand/auto lever in the auto position.

PRESS THE ← KEY

The displayed option will flash indicating that it has been set.

Q-Pulse Id TMS734

9.10 Default Options [d1], [d2] and [d3]

All IQ actuator functions are configured before dispatch to a set of Rotork standard (default) settings. If requested, alternatives specified with the order will be used. When site commissioning using the setting tool takes place, entered settings overwrite the Rotork defaults and these "Current" settings are used by the actuator for operation along with the remaining unadjusted defaults.

Should difficulty be encountered during commissioning the default settings can be re-instated, returning the actuator configuration to its original manufactured state. Site commissioning must then begin again.

There are two levels of Default.

- D1 Rotork standard or Customers specified settings.
- D2 Rotork basic test settings.
- D3 Rotork only

NOTE: D1 will return the torque values to their default settings. The set limit positions are not changed.
D2 will reset the limit positions to 25 turns apart, the actuator being at the 50% position. The set torque values are not changed.

The functions associated with the Folomatic and Pakscan options are not altered by reinstating the defaults. The Interrupter timer option is unaffected by the D1 default but the D2 default will disable the option. Subsequent reinstating of D1 will re enable the timer but it will require all its functions resetting.

The following table indicates the Rotork Standard D1 and D2 default actuator function settings. The Current settings used in operation will be those as set using setting tool.

NOTE: The D1 default settings shown below are those used by Rotork when no alternative has been specified. On re-installing defaults all listed functions and their settings must be checked and if necessary adjusted to suit site operating conditions. Rotork reserve the right to modify default settings without notice.

PRIMARY FUNCTION	D1	D2
C1 Close direction	Clockwise	Clockwise
C2 Close action	Limit	Limit
C3 Open action	Limit	Limit
tC Close torque	40%	As set
tO Open torque	40%	As set
LC Close limit position	As set	25 turns from open
LO Open limit position	As set	25 turns from close
N/A Current position	As indicated	Position = 50%
N/A Close Colour	Green	Green

SECONDARY FUNCTIONS

	D1	D2
r1 S1	Close N/O	Close N/O
r2 S2	Open N/O	Open N/O
r3 S3	Close N/C	Close N/C
r4 S4	Open N/C	Open N/C
A1 ESD	ON	ON
A2 ESD direction	Close	Close
A3 ESD on	Make contact	Make contact
A4 Thermo-stat bypass	ON	ON
A5 Local maintain	ON	ON
A6/7 2-wire priority	Close	Close
A8 Interlock facility	Off	Off
OF Option Folomatic menu	as fitted	Off
OP Option Pakscan menu	as fitted	Off
OJ Option Int. Timer menu	as fitted	Off
Or I-R Control	Off	Off
OI C P T (close)	4 MA	4 MA
Os Power loss inhibit	ON	ON

To reinstate D1 settings, with [d1] displayed:

PRESS THE ← KEY

The setting bars will flash indicating the D1 defaults have been reinstated.

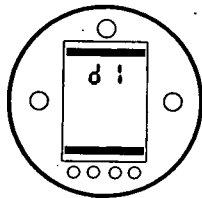
To reinstate D2 settings, with [d2] displayed:

PRESS THE ← KEY

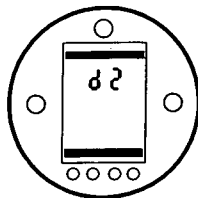
The setting bars will flash indicating the D2 defaults have been reinstated.

The Default settings for the listed Actuator functions are subject to change by Rotork and as such cannot be regarded as comprehensive.

If the D1 or D2 defaults are reinstated using the default option, the current settings must be checked and adjusted using the Setting Tool to suit site operating conditions.



D1 Displayed



D2 Displayed

Maintenance

Every Rotork actuator has been fully tested before despatch to give years of trouble free operation providing it is installed, sealed and commissioned in accordance with the instructions given in this publication.

The IQ actuator's unique double sealed, non intrusive enclosure provides complete protection for the actuator components.

Covers should not be removed for routine inspection as this may be detrimental to the future reliability of the actuator.

The electrical control module cover is bonded by the Rotork quality control seal. It should not be removed as the module contains no site serviceable components.

Routine maintenance should include the following:

- * Check actuator to valve fixing bolts for tightness.
- * Ensure valve stems and drive nuts are clean and properly lubricated.
- * If the motorised valve is rarely operated, a routine operating schedule should be set up.
- * Replace actuator battery every 5 years.

The Actuator Battery

The battery supports the actuator position updating circuits and the position (LCD) display when the main power supply is turned off. It ensures the current position is updated and displayed when manual operation takes place with the main power turned off. The battery is not required to support the EEPROM memory.

A unique circuit has been incorporated into the battery function of the IQ, effectively reducing the overall drain and significantly increasing the battery life.

Tests show for a "typical" actuator, a battery life of 7 years can be expected.

Allowing for a conservative margin, Rotork recommend that the battery should be replaced every 5 years.

Battery level status indication is available as a standard feature (Refer to Help screens -10.1 page 46 and S contacts Section 9.2 page 28).

Battery Replacement

Proceed as follows:

The actuator battery is located in a separately sealed compartment on the main electrical control module cover, to the left of the control selector knobs. If the actuator is located in a hazardous area a "hot work" permit must be obtained. Once the actuator can be removed to a non hazardous location.

It is recommended that the Battery is replaced with the mains power turned ON.

For actuators shipped before 1998 with the optional Data-Logger fitted it is essential that battery replacement is undertaken with main power on, otherwise logged data will be lost. Alternatively, Logged Data can be downloaded and stored using the Rotork Communicator (Refer to Publication E172E for information).

For actuators shipped after 1997 the battery can be changed with the main power on or off.

- * Undo the 4 caphead screws in the battery box cover and remove battery. Used batteries should be disposed of in accordance with the relevant regulations.
- * Fit replacement battery: For CENELEC Actuator enclosures use a Duracell Procell MN 1604 9 volt 6LR61 Alkaline battery ONLY.

For Watertight (WT)- FM - CSA actuator enclosures Rotork recommend the use of an Ultracell Lithium U9VL 9 volt battery as it has a long shelf life but any equivalent may be used.

- * Replace battery box cover. Ensure cover 'O' ring is in good condition and correctly fitted.
- * Reset Limit Closed and Limit Open positions.

(Refer to section 8 Commissioning Primary Functions LC and LO page 24)

Oil

Unless specially ordered for extreme climatic conditions, Rotork actuators are despatched with gearcases filled with SAE 80EP oil - suitable for ambient temperatures ranging from -22 F/-308C to 160 F/708C.

IQ Actuators do not require regular oil changes.

(Refer to Weights & measures section 11, page 54)

Monitoring

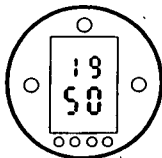
The IQ range of actuators are the worlds first to incorporate real time, instantaneous torque + position monitoring as standard.

Torque + position can be used to monitor valve performance during operation. The effect of process changes (differential pressure etc) can easily be evaluated. Tight spots in valve travel can be pinpointed as well as gauging torque developed through stroke for Torque Value Setting (See pages 22, 23).

Using the Setting Tool, the display can be set to indicate torque and position. With the actuator displaying current position and selected to local or stop.

Press the ↓ key

The display will split, the top indicating the instantaneous torque, (% rated), the bottom indicating the measured position (% open).



Example shows 19% (of rated) torque at 50% open position.
 Display torque range: [00] - [99] % of rated in 1% increments. For values of torque above 99% the display will indicate [HI].
 Display position range:
 [II] valve closed
 [00] - [99] % open
 [≡≡] valve open
 For a stationary actuator the display will capture the last measured value.

To keep the torque + position display active press + or - keys. The display will remain active for approximately 5 minutes from the last key operation.

Troubleshooting

The IQ range of actuators are the worlds first that can be commissioned and interrogated without removing electrical covers. Help screen diagnostics enable fast and complete fault finding to be carried out.

With power On, the actuator display is not backlit. Position indicator lamp not illuminated.
 With mains power on, the actuators display should be backlit.
(Refer to 3.3 - the Actuator Display.)

Check that 3 phase supply is available and is of the correct voltage as stated on the actuator nameplate. Measure Voltage phase to phase across terminals 1, 2 & 3 of the actuator terminal bung.

With power Off, the actuator does not display position.
 With mains power off the actuator battery supports position indication liquid crystal display only.
(Refer to 3.3 - the Actuator Display.)

If the display is blank the actuator battery must be replaced and limit reset.

(Refer to Section 10, Page 44 The Actuator Battery.)

10.1 Help Displays

With the actuator powered up and Local or Stop control selected, six help displays can be accessed using the Setting Tool.


(Refer to Section 9 fig 30 page 26 for their location.)

With remote selected press the ↓ key. The help screens will be displayed.

Each display uses bars to indicate the status of a particular control or indication function. Each bar reacts to changes in the status of its actuator function by turning "on" or turning "off".

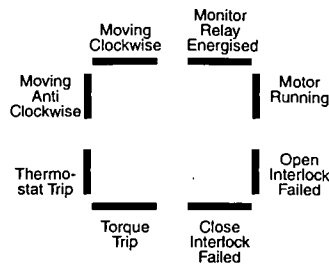
For troubleshooting, access the following Help displays and read text:

- H1** - Factors inhibiting electrical operation and monitoring direction of movement.
- H2** - Monitor Local and Remote control inputs to the actuator.
- H3** - Monitor remote indication outputs derived by the actuator.
- H4** - Monitor the actuators position sensing devices.
- H5** - Monitor the actuators battery status and position limit status.
- H6** - Torque Trip, Flux and mains power supply monitoring.

Help screen bars marked  are undefined and may be ON, OFF or flashing.

H1 Factors Inhibiting Electrical Operation and Monitoring Direction of Movement

H1



Monitor Relay Energised

Bar OFF= Monitor Relay de-energised

The monitor relay having a changeover contact rated at 8 Amp 240V AC, 30V DC, normally made between terminals 42 and 44 with its coil energised via the internal

control circuit supply, will de-energise in the event of the any of the following:

- Loss of one or more of the power supply phases.
- Loss of control circuit supply.
- Actuator selected for local control.
- Local stop selected
- Motor thermo-stat tripped.

Motor Running

Bar ON = Actuator Motor running

Combined with Running Anti-clockwise or Running clockwise.

Open Interlock Failed

Bar ON = Open interlock failed

Unauthorised Open electrical operation can be prevented by interlocking the actuator (open) control with an external contact. If external interlocks are not required the interlock function must be selected OFF.

(Refer to Section 9 [A8] page 31)

Close Interlock Failed

Bar ON = Close interlock Failed

Unauthorised Close electrical operation can be prevented by interlocking the actuators (close) control with an external contact. If external interlocks are not required the interlock function must be selected OFF.

(Refer to Section 9 [A8] page 31)

Torque Trip

Bar ON = Torque Trip

When the actuator generates a value of torque equal to that set for Open (when opening) or Close (when closing) it will stop, protecting itself and the valve from damage. This feature is known as Overtorque Protection.

Once a torque trip has occurred, further operation IN THE SAME DIRECTION is prevented. This "latching" of the event protects the actuator and valve from repeated hammering against the obstruction as a response to a

maintained control signal.
To "delatch" the actuator it must be reversed. For actuator torque adjustment (Refer to section 8. [TC] and [TO] pages 22 & 23).

Thermo-stat Tripped

Bar ON = Thermo-stat tripped

The actuator motor is protected by a thermo-stat.

Should the motor get too hot the thermo-stat will trip and the actuator stops. On cooling the thermo-stat automatically resets, enabling operation. See the actuator nameplate for Motor rating.

Moving Anti-clockwise

Bar ON = The motor is turning in an Anti-clockwise direction.

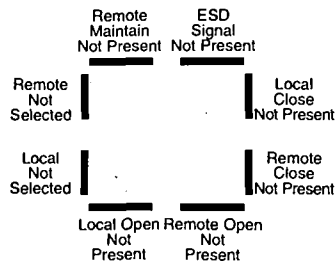
Moving Clockwise

Bar ON = The motor is turning in a Clockwise direction.

NOTE: When motor drive is engaged, clockwise rotation will result in the actuator output moving Clockwise.

H2 Monitor Local and Remote Control Inputs to the Actuator

H2



ESD Signal Not Present

Bar ON = ESD signal NOT PRESENT

Bar OFF = ESD signal PRESENT.
When applied an Emergency Shut Down signal will override any existing local or remote control signal, causing the actuator to

respond in the way selected for, ESD. An ESD signal will not override actuator selected to stop on its red selector knob.

(Refer to Section 9- A1, A2, A3 & A4 pages 29 & 30)

The actuator will not respond to any local/remote control signal while an ESD signal is maintained.

Local Close Not Present

Bar ON = Local Close SIGNAL NOT PRESENT.

Bar OFF = Local Close signal PRESENT.

Remote Close Not Present

Bar ON = Remote Close signal NOT PRESENT.

Bar OFF = Remote Close signal PRESENT.

Remote Open Not Present

Bar ON = Remote Open signal NOT PRESENT.

Bar OFF = Remote Open signal PRESENT.

Local Open Not Present
Bar ON = Local Open signal NOT PRESENT.

Bar OFF= Local Open signal PRESENT.

Local Not Selected
Bar ON = Local Control NOT SELECTED.

Bar OFF= Local Control SELECTED.

Remote Not Selected
Bar ON = Remote Control NOT SELECTED.

Bar OFF= Remote Control SELECTED.

NOTE: When Remote is selected the actuator display will return to Position Mode.

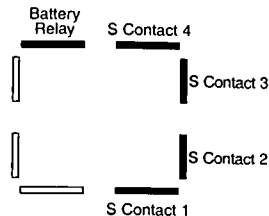
Remote Maintain Not Present
Bar ON = Remote Maintain Signal NOT PRESENT
(and/or Remote Stop ACTIVE)

Bar OFF= Remote Maintain Signal PRESENT

(Refer to Actuator Circuit Diagram - Remote Control Circuits)

H3 Monitor Remote Indication Outputs Derived by the Actuator

H3



Switch Contacts S1, S2, S3, S4

Bar ON = S contact is CLOSE CIRCUIT.

Bar OFF = S contact is OPEN CIRCUIT.

Bar indication is real time and reactive.

(Refer to Section 9 [r1] page 28 for configuration of "S" contacts)

Battery Relay
 Indicates contact status of optional Battery Alarm Relay.

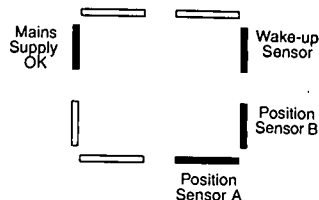
Bar ON = contact is CLOSE CIRCUIT

Bar OFF= contact is OPEN CIRCUIT

For a Low battery condition the relay contact will respond in a way dependent on whether it was configured to be N/C or N/O *(Refer to actuator circuit diagram).*

H4 Monitor the Actuators Position Sensing Devices

H4



Wake Up Sensor

The wake up sensor is used to "wake up" the position sensing circuit when manual operation starts with mains power off. This ultimately reduces the drain on the actuator battery. Correct operation of the sensor is indicated by the Bar being ON (and OFF) 24 times per output revolution. When the motor is running, ON and OFF bit duration should be equal.

Position sensor B

Senses output rotation. Used for the position sensing circuit. Correct operation of the sensor is indicated by the Bar being ON (and OFF) 12 times per output revolution. When the motor is running, ON and OFF bit duration should be equal.

Position sensor A

Senses output rotation. Used for the position sensing circuit. Correct operation of the sensor is indicated by the Bar being ON (and OFF) 12 times per output revolution. When the motor is running, ON and OFF bit duration should be equal.

For the two sensors; Wake Up, A and B, correct operation is indicated by the following truth tables:

With manual operation selected and turning the actuator in the indicated direction, starting with all sensor Bars OFF;

	— CLOCKWISE —→ 30°				
Sensor B	0	1	1	0	0
Sensor A	0	0	1	1	0
	30° ← ANTICLOCKWISE —				

When hand winding the actuator the bit duration will not be equal.

Mains Supply OK

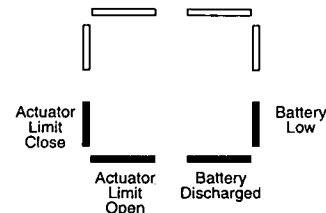
Bar ON = Mains Supply OK

Bar OFF = Mains supply Fault:

Incoming phase supply to actuator terminal 3 missing.

H5 Monitor the Actuators Battery Status and Position Limit Status

H5

**Battery Low**

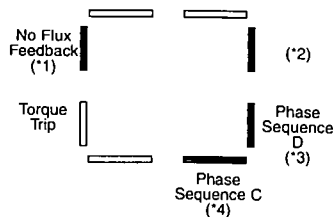
Bar ON = Battery Level Low

Bar OFF = Battery Level OK

Bar ON when the battery is low but still able to support the necessary actuator functions. The battery should be replaced at the earliest opportunity.

Battery Discharged**Bar ON = Battery Discharged:**

ON when the battery is no longer able to support actuator functions. The battery must be replaced and Limit Positions reset.

Actuator Limit Open**Bar ON when the set Open limit position is reached.***(Refer to Section 8 [LO] page 24)***Actuator Limit Close****Bar ON when the set Close limit position is reached.***(Refer to Section 8 [LC] page 24)***H6 Torque Trip, Flux & Mains Power Supply Monitoring****H6****Phase sequence C and D:****Bit ON = 1**

C	D
0	0 = Apply to Rotork.
0	1 = Positive phase rotation sequence.
1	0 = Negative phase rotation sequence.
1	1 = Phase lost.

Torque Trip**Bar ON = Torqued off:**

Actuator stopped by torque limitation.

*(See also H1, "Torque Trip")***No Flux Feedback****Bar ON - No flux Feedback.**

The actuators motor flux is measured as part of the torque sensing circuits calculation of torque.

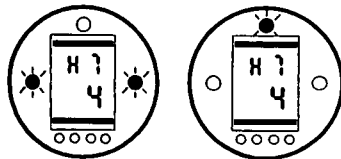
No flux feedback indicates a fault to the flux sensing circuit or a failure of the motor contactor to operate.

The actuator will not run.

*	IQ10 DC Only
*1	Torque Sensor Failure
*2	Temperature Sensor Failure
*3	*4
0	0 Apply to Rotork
1	0 Motor Over Temperature
0	1 Normal Operation
1	1 Apply to Rotork

(1 = Bar on)

H7 Automatic Self-Test and Diagnosis (ASTD)



On power up the actuator automatically tests its vital operational circuits and memory devices to ensure correct operation.

In the unlikely event of a device problem the IQ diagnoses the cause and will automatically present this information in the form of Help Screen 7 Alarm display. Electrical operation can be inhibited to prevent possible damage to the actuator and valve. The problem can then be accurately investigated and corrected by maintenance personnel.

ASTD is carried out every time mains power is applied and only in the event of a problem will H7 Alarm be displayed. Help Screen 7 therefore cannot be accessed using the Setting Tool.

After circuits and communication are checked, ASTD tests for the following conditions:

- * Actuator Position Error - the actuator current position is in error
- * Black Out - the actuator was subjected to a combined mains supply and actuator battery supply failure (Refer to The Actuator Battery p44)
- * Actuator configuration Error - the actuator configuration (settings) are in error.

Should any one (or combination) of these tests fail Operation will be inhibited *, and an alarm displayed: the display lamps will flash and the appropriate H7 display will indicate the cause by using a number between 1 and 7.

Remote indication of inhibited operation will be indicated by the monitor relay.

NOTE: Operation will be inhibited a standard. Whether a combined mains and battery supply failure will inhibit operation is determined by the setting of OS (Refer to 9.9 Inhibit Operation After Power Loss p42).

The following table interprets all combinations of H7 alarm displays:

- H7 - 1 = Configuration error alarm
- H7 - 2 = Position error alarm
- H7 - 3 = Config error + Position error alarms
- H7 - 4 = Supply black out alarm
- H7 - 5 = Supply Black Out + configuration error alarms
- H7 - 6 = Supply Black Out + Position error alarms
- H7 - 7 = Config error + position error + Supply Black Out alarms

Remedial Actions

Position Error Alarm: The actuator detects an error in its recorded position.

1. Using the setting tool enter the setting procedure.
2. Enter the correct password.
(Refer to section 7, p15)
3. Reset Limit Closed and Limit Open.
(Refer to LC & LO, p24)
4. With LC or LO screens displayed, select remote control using the Red selector.

Black Out Alarm: The actuator was subjected to a combined mains supply and actuator battery supply failure with Power Loss Inhibit (OS) selected ON.
(Refer to the Actuator Battery p44 and Inhibit Operation after Power Loss (OS) p42)

1. Replace the the actuator battery.
(Refer to p44)
- Using the setting tool enter the setting procedure.

3. Enter the correct password.
(Refer to section 7, p15)
4. Reset Limit Closed and Limit Open.
(Refer to LC & LO p24)
5. With LC or LO screens displayed, select remote control using the Red selector.

Configuration Error Alarm

The actuator detects an error in its set up.

To Override Alarm

1. Using the setting tool enter the setting procedure.
2. Enter the correct password.
(Refer to section 7, p15)
3. Check all primary and secondary actuator function settings.
(Refer to sections 8, p17 and 9, p27)
4. With any actuator function screen displayed, select remote control using the Red selector.
5. Power down the actuator and then power it back up.
6. Operate the actuator over the full valve stroke and monitor its performance.

Carry out the above remedial actions for the alarm as indicated by the displayed H7 number. Operation should then become available and the H7 alarm display cancelled.

NOTE: That both during and after an H7 alarm display, help Screens 1-6 are available for diagnosis.

If any of the remedial actions are unsuccessful, contact your nearest Rotork representative.

Weights and Measures

Oil

Unless specially ordered for extreme climatic conditions, Rotork actuators are despatched with gearcases filled with SAE 80EP oil suitable for ambient temperatures ranging from -228F/-308C to 1608F/708C.

NOTE: Excludes second stage gearbox if fitted.

Food grade lubricating oil is available as an alternative, contact Rotork.

Actuator Size	Nett Weight	Oil Capacity
IQ7	27 kg	0.3L
IQ10	30 kg	0.3L
IQ11	27 kg	0.3L
IQ12	30 kg	0.3L
IQ13	27 kg	0.3L
IQ14	46 kg	0.95L
IQ16	46 kg	0.95L
IQ18	30 kg	0.3L
IQ20	46 kg	0.95L
IQ25	46 kg	0.95L
IQ30	69 kg	1.1L
IQ35	69 kg	1.1L
IQ40	127 kg	4.0L
IQ70	197 kg	5.0L
IQ90	203 kg	5.0L
IQ95	203 kg	5.0L

If your Rotork actuator has been correctly installed and sealed, it will give years of trouble-free service.

If you require technical assistance or spares, Rotork guarantees the best service in the world. Contact your local Rotork representative or the factory direct at the address on the nameplate, quoting the actuator type and serial number.

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fax (503) 2349125

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S-435 86 Partille
SWEDEN
telephone (53) 342060
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Al-Khouja Building
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Horns
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Kuangfu North Road
Taipei
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No. 46/14-16 Soi Sukhumvit 36
Sukhumvit Road
Prakanong, Klongtoey
Bangkok 10110
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fax (02) 2593920

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Trinidad Valve & Fitting Co. Ltd.
P.O. Box 166
105 Pointe-A-Pierre Road
San Fernando
Trinidad
WEST INDIES
telephone 6524889/6523422
fax 6522651

TURKEY

OMAS Ltd
Sinan Ercan Cad.
Erdemir Erenkoy Sit.
1 Blok Kat 11 D.32
Kozyatagi, Istanbul
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telephone (216) 3857449/3599087
fax (216) 3025712

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Universal Computers Company
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fax (2) 211934
telex 24458

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Rotork Controls Inc
P.O. Box 330
Plainfield
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fax (815) 436 1789

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Rotork-Controls de Venezuela S.A.
Calle 69, 8 - 85, Qta. Lucila
Maracaibo
Estado de Zulia
VENEZUELA
telephone (061) 979216/98
fax (061) 979216

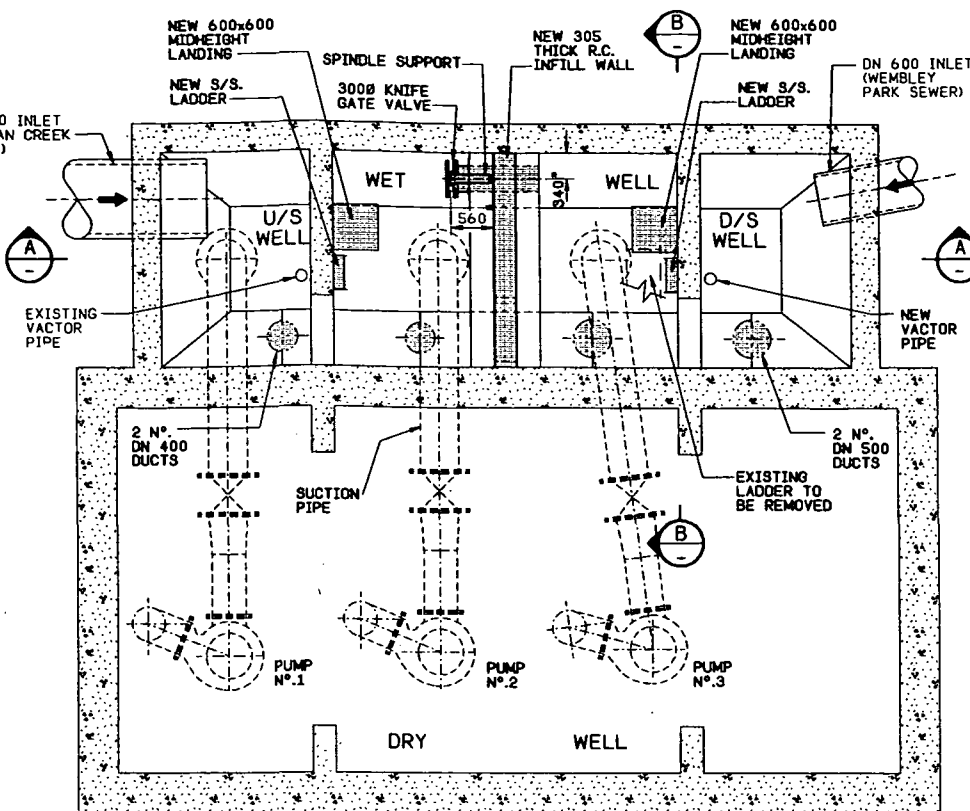
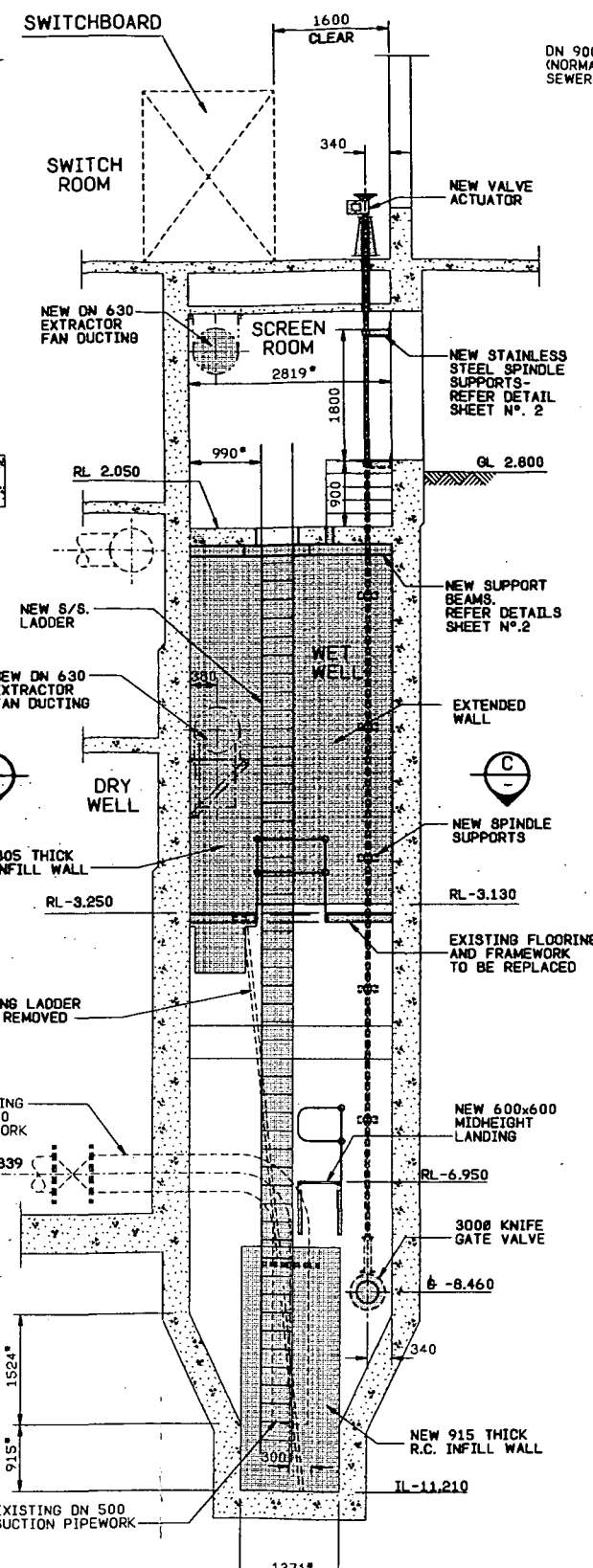
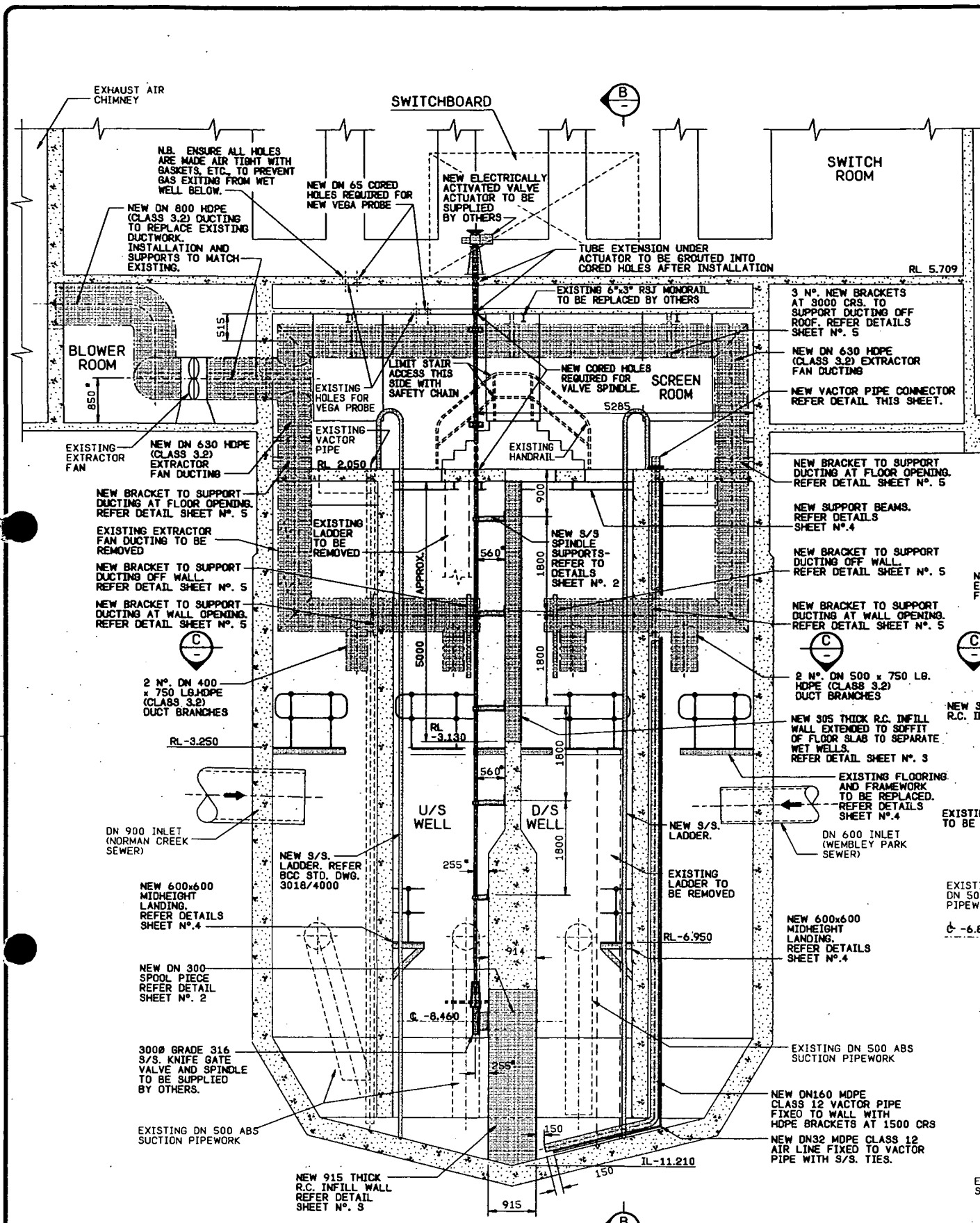
VIETNAM

TDNC Company Limited
90C Vo Thi Sau Road, Dist 1
Ho Chi Minh
S R VIETNAM
telephone (08) 820 3174
fax (08) 820 3176

YEMEN

Safir Services Ltd
Al Qasir Street - House no. 32
P.O. Box 1108 - Sana'a
REPUBLIC OF YEMEN
telephone (1) 272988/272956
fax (1) 271890/274148
telex 2203 HSA YE

As we are continually developing our products, the design of Rotork actuators is subject to change without notice. The name Rotork is a registered trade mark.



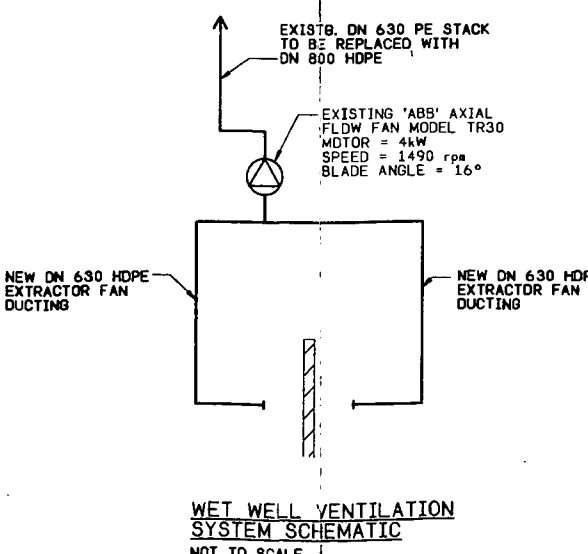
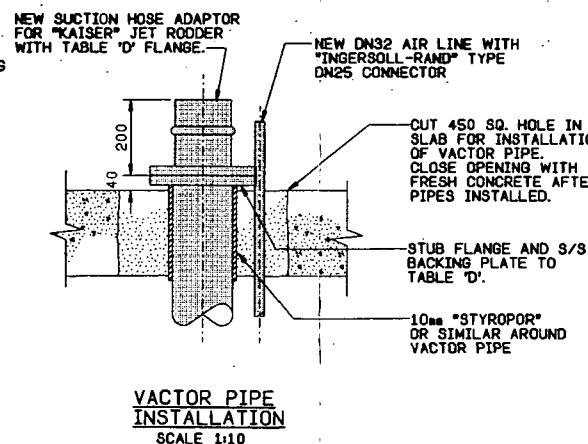
SECTIONAL PLAN C

NEW LADDERS AND PLATFORMS

ONLY FOR CLARITY

REFER PLAN SHEET D

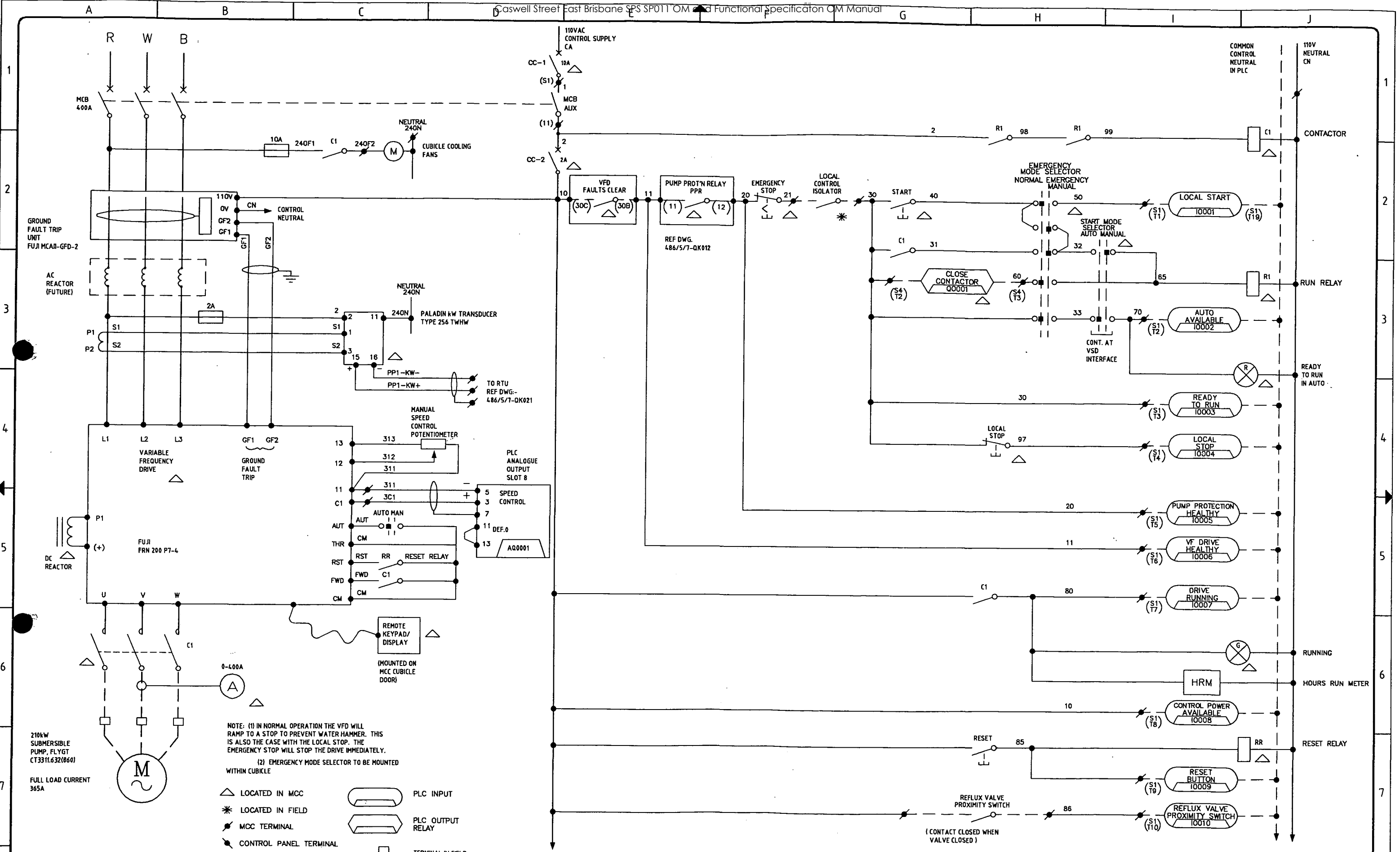
SCALE 1:50



NO	DATE	AMENDMENT	INITIALS
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PROJECT	NORMAN CREEK SEWER OVERFLOW ABATEMENT CASWELL ST. PUMP STATION
TITLE	WET WELL MODIFICATIONS GENERAL ARRANGEMENT
SCALE	AS SHOWN
DRAWING NO	486/5/7-QK001
DATE	DEC'98
ENGINEER	R. Keal
CHECKED	B.O.B.
SURVEYED	FIELD BOOK
SCALE	AS SHOWN
DRAWING NO	486/5/7-QK001
DATE	DEC'98
ENGINEER	R. Keal
CHECKED	B.O.B.
SURVEYED	FIELD BOOK



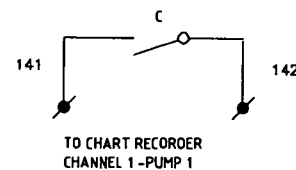
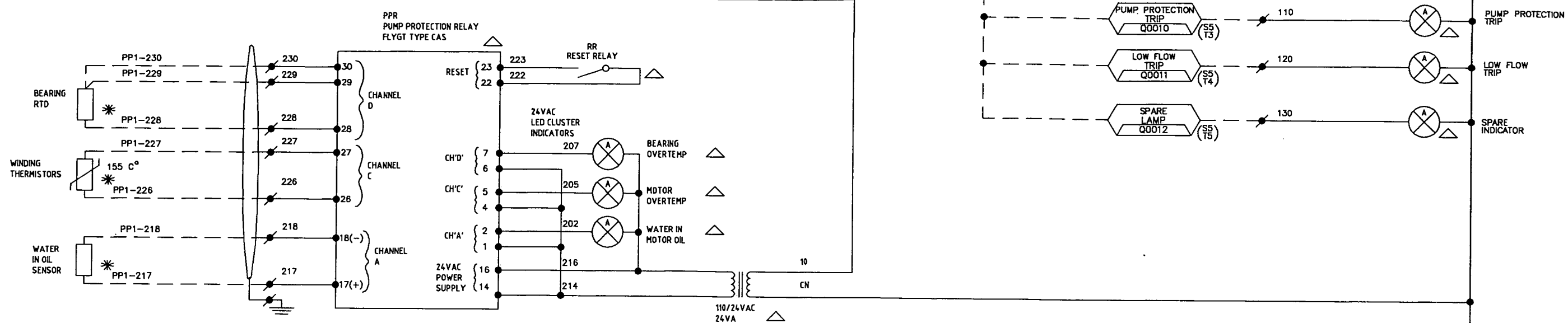
NOTE: (1) IN NORMAL OPERATION THE VFD WILL RAMP TO A STOP TO PREVENT WATER HAMMER. THIS IS ALSO THE CASE WITH THE LOCAL STOP. THE EMERGENCY STOP WILL STOP THE DRIVE IMMEDIATELY.
(2) EMERGENCY MODE SELECTOR TO BE MOUNTED WITHIN CUBICLE

- △ LOCATED IN MCC
 - * LOCATED IN FIELD
 - MCC TERMINAL
 - CONTROL PANEL TERMINAL
 - (1) TERMINAL NUMBER
 - 10 WIRE NUMBER
- PLC INPUT
- PLC OUTPUT RELAY
- TERMINAL IN FIELD



CONTINUED ON DRAWING 486/5/7-QK012
SUPERCEDES DRAWING No:- 486/7/7-JF-2C2153E REVISION A

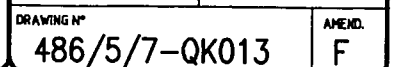
F 8/00 AS CONSTRUCTED				MIL DIRECTOR OF P.D. & P.S.				JOB FILE				PROJECT				TITLE			
E 5/99 REDRAWN				MIL				ACAD FILE	57QK011	SHEET SIZE	A1	CASWELL STREET SEWAGE PUMPING STATION SP11				SEWAGE PUMP PP1 SCHEMATIC DIAGRAM SHEET 1 OF 2			
D 12/83 AS BUILT				PH	ENGINEER IN CHARGE	DATE	12/92	SURVEY No.		FIELD BOOK		SCALE NTS				N° 1 OF 2 SHEETS			
C 7/83 AS WORKS TESTED				WM	SUPERVISING ENGINEER	DATE	12/92	SURVEYED		A.H. DATUM		DRAWING N°				AMEND.			
B 1/83 ISSUED FOR TENDER				WM								486/5/7-QK011				F			
A 1/83 AMENDMENT				WM															

CONTINUED FROM DRAWING-
486/5/7-QK011

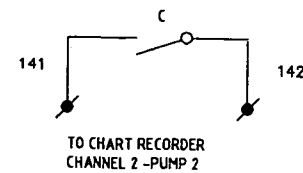
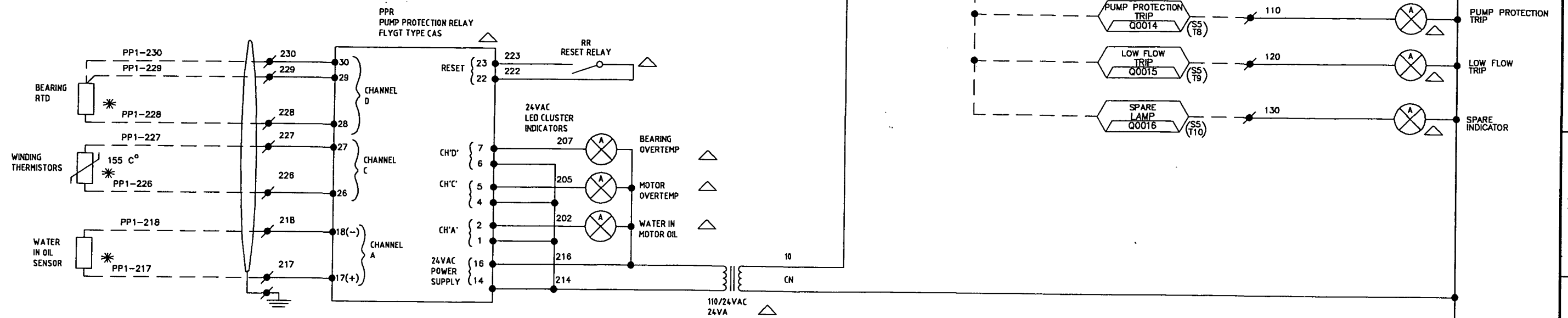


- △ LOCATED IN MCC
- * LOCATED IN FIELD
- MCC TERMINAL
- CONTROL PANEL TERMINAL
- (1) TERMINAL NUMBER
- 10 WIRE NUMBER
- MCC TERMINAL
- CONTROL PANEL TERMINAL
- ⊕ TERMINAL IN FIELD
- PLC INPUT
- PLC OUTPUT RELAY

F	B/D	AS CONSTRUCTED	ML	DIRECTOR OF P.D. & P.S.	DATE	DESIGN	CK	12/92		JOB FILE					PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11	TITLE SEWAGE PUMP PP1 SCHEMATIC DIAGRAM SHEET 2 OF 2	SCALE NTS	N° 2 OF 2 SHEETS	DRAWING N° 486/5/7-QK012	AMEND. F
E	5/99	RETRAIN.	ML	ENGINEER IN CHARGE	DATE	DRAWN	W.M.	12/92		ACAD FILE	57QK012	SHEET SIZE	A1							
D	12/93	AS BUILT	PH	ENGINEER IN CHARGE	DATE	CHECKED	PT	5/99		SURVEY No.		FIELD BOOK								
C	7/93	ISSUED FOR TENDER	WM	SUPERVISING ENGINEER	R.P.E.Q. NO.	DATE														
B	1/93	AS WORKS TESTED	WM	SUPERVISING ENGINEER	R.P.E.Q. NO.	DATE														
A		AMENDMENT	INITIALS																	

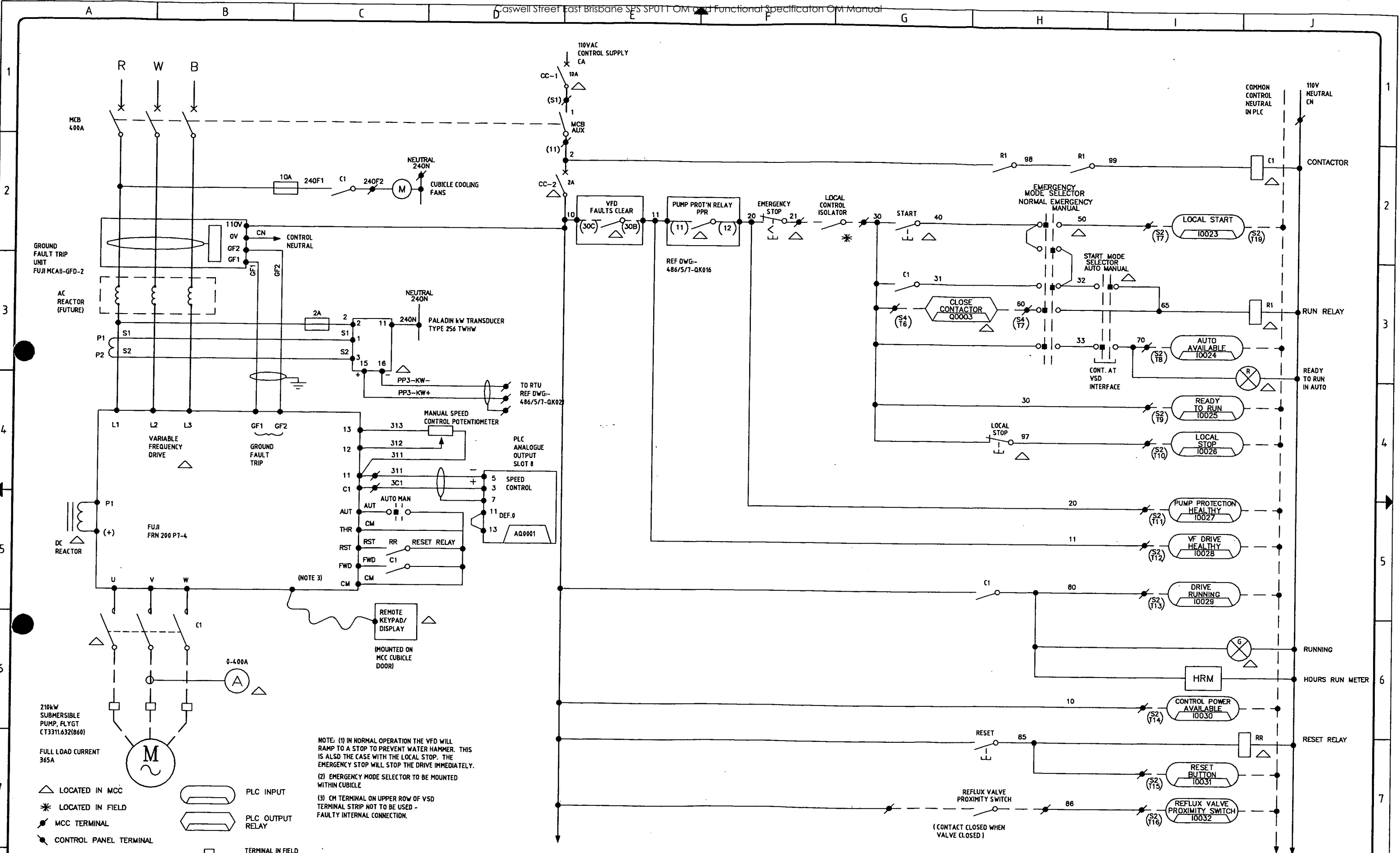


CONTINUED FROM DRAWING--
486/5/7-QK013



- △ LOCATED IN MCC
- * LOCATED IN FIELD
- MCC TERMINAL
- CONTROL PANEL TERMINAL
- PLC INPUT
- PLC OUTPUT RELAY
- TERMINAL IN FIELD

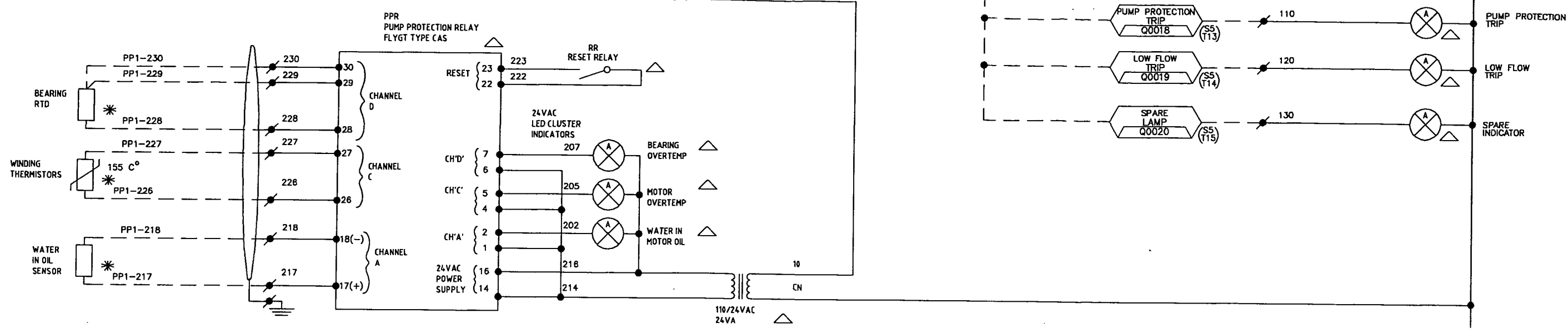
F 8/00 AS CONSTRUCTED		M.L. DIRECTOR OF P.D. & P.S.		DATE		NAME		DATE		JOB FILE		ACAD FILE		SHEET SIZE		A1		PROJECT		TITLE		SCALE		N° 2 OF 2 SHEETS		DRAWING N°		AMEND.	
E 5/99 REDRAWN		M.L. ENGINEER IN CHARGE		DATE		CK		12/92		57QK014		FIELD BOOK						CASWELL STREET SEWAGE PUMPING STATION SP11		SEWAGE PUMP PP2 SCHEMATIC DIAGRAM SHEET 2 OF 2		NTS				486/5/7-QK014		F	
D 12/93 AS BUILT		PH		DATE		W.M.		12/82																					
C 7/93 AS WORKS TESTED		WM		DATE		PT		5/99																					
B 1/93 ISSUED FOR CONSTRUCTION		WM		DATE																									
A NO. DATE		AMENDMENT		INITIALS		SUPERVISING ENGINEER		R.P.E.Q. NO.		DATE																			



CONTINUED ON DRAWING:-
486/5/7-QK016

F 8/00 AS CONSTRUCTED		M.L. DIRECTOR OF P.D. & P.S.		DATE		DESIGN CK 12/92		JOB FILE		ACAD FILE 57QK015		SHEET SIZE A1		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 1 OF 2		SCALE NTS		N° 1 OF 2 SHEETS		DRAWING N° 486/5/7-QK015		AMEND. F	
E 5/99 REDRAWN		M.L. ENGINEER IN CHARGE		DATE		DRAWN W.M. 12/92		SURVEY No.		FIELD BOOK		A.H. DATUM		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 1 OF 2		SCALE NTS		N° 1 OF 2 SHEETS		DRAWING N° 486/5/7-QK015		AMEND. F	
D 12/93 AS BUILT		P.H. SUPERVISING ENGINEER		DATE		CHECKED PT 5/99		SURVEYED		FIELD BOOK		A.H. DATUM		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 1 OF 2		SCALE NTS		N° 1 OF 2 SHEETS		DRAWING N° 486/5/7-QK015		AMEND. F	
C 7/93 AS WORKS TESTED		W.M. SUPERVISING ENGINEER		DATE		R.P.E.Q. NO.		DATE		FIELD BOOK		A.H. DATUM		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 1 OF 2		SCALE NTS		N° 1 OF 2 SHEETS		DRAWING N° 486/5/7-QK015		AMEND. F	
B 1/93 ISSUED FOR CONSTRUCTION		W.M. SUPERVISING ENGINEER		DATE		R.P.E.Q. NO.		DATE		FIELD BOOK		A.H. DATUM		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 1 OF 2		SCALE NTS		N° 1 OF 2 SHEETS		DRAWING N° 486/5/7-QK015		AMEND. F	
A 1/93 AMENDMENT		W.M. SUPERVISING ENGINEER		DATE		R.P.E.Q. NO.		DATE		FIELD BOOK		A.H. DATUM		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 1 OF 2		SCALE NTS		N° 1 OF 2 SHEETS		DRAWING N° 486/5/7-QK015		AMEND. F	

CONTINUED FROM DRAWING:-
486/5/7-QK015



- △ LOCATED IN MCC
- * LOCATED IN FIELD
- MCC TERMINAL
- CONTROL PANEL TERMINAL
- (1) TERMINAL NUMBER
- 10 WIRE NUMBER
- PLC INPUT
- PLC OUTPUT RELAY
- TERMINAL IN FIELD

F 8/00 AS CONSTRUCTED		M.E. DIRECTOR OF P.D. & P.S.		DATE		NAME		DATE		JOB FILE		ACAD FILE		SHEET SIZE		A1		PROJECT		TITLE	
E 5/99 REDRAWN		M.E. ENGINEER IN CHARGE		DATE		CK		12/92		57QK016		SHEET SIZE		A1		CASWELL STREET SEWAGE PUMPING STATION SP11		SEWAGE PUMP PP3 SCHEMATIC DIAGRAM SHEET 2 OF 2			
D 12/83 AS BUILT		P.H. SUPERVISING ENGINEER		DATE		W.M.		12/92		SURVEYED		FIELD BOOK				486/5/7-QK016		F			
C 7/83 AS WORKS TESTED		W.M. SUPERVISING ENGINEER		DATE		PT		5/99		Brisbane City		A.H. DATUM									
B 1/83 ISSUED FOR CONSTRUCTION		AMENDMENT		R.P.E.Q. NO.		CHECKED		DATE													

AS CONSTRUCTED

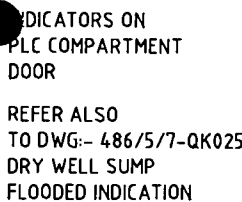
PLOTTED *[Signature]* DATE 08/00

CHECKED *[Signature]* DATE 08/00

SCALE NTS

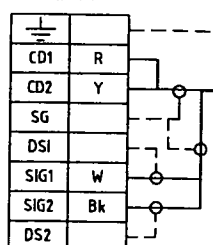
DRAWING N° 486/5/7-QK016

AMEND. F

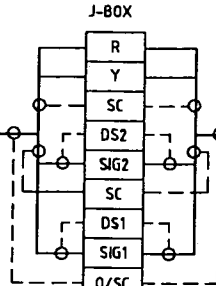
Page 110 of 119

SEWAGE PUMP PP1
DISCHARGE FLOW

FE100



FIELD
J-BOX



F100-S1

F100-S2

CORE	TML	DESCRIPTOR/ FERRULE	TML	CORE
		F100-110	L	1
		F100-CN	N	2
		FT100+	IC+	W
		FT100-	IC-	Bk
		OUTER SCN		
R		CD1		
Y		CD2		
		SG		
DS1		SCN		
W		SIG1		
Bk		SIG2		
DS2		SCN		

ABB MAGMASTER

MAGNETIC FLOW TRANSMITTER
WITH DIGITAL RATE AND
TOTALISER DISPLAYS SPAN
0-600.0 l/SEC
(MOUNTED ADJACENT TO MCC)

MCC-RTU-AI
10 PAIR OAS (PART)

CONTINUED BELOW

CH.1

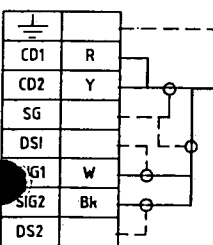
FT100/1	1W	FT100-1	1W
FT100-	1Bk	FT100	1Bk

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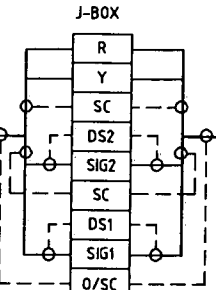
TELEMETRY REMOTE
TERMINAL UNIT
ANALOGUE INPUT
CHANNEL

SEWAGE PUMP PP2
DISCHARGE FLOW

FE200



FIELD
J-BOX



F200-S1

F200-S2

CORE	TML	DESCRIPTOR/ FERRULE	TML	CORE
		F200-110	L	1
		F200-CN	N	2
		FT200+	IC+	W
		FT200-	IC-	Bk
		OUTER SCN		
R		CD1		
Y		CD2		
		SG		
DS1		SCN		
W		SIG1		
Bk		SIG2		
DS2		SCN		

ABB MAGMASTER

(MOUNTED ADJACENT TO MCC)
MAGNETIC FLOW TRANSMITTER
WITH DIGITAL RATE AND
TOTALISER DISPLAYS SPAN
0-600.0 l/SEC

MCC-RTU-AI
10 PAIR OAS (PART)

CONT. FROM ABOVE

CH.1

FT200/1	2W	FT200-1	2W
FT200-	2Bk	FT200	2Bk

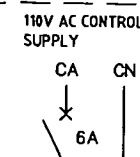
CONTINUED BELOW

TELEMETRY REMOTE
TERMINAL UNIT
ANALOGUE INPUT
CHANNEL

NOTES

- 1) 4-20mA SIGNAL -VE CONNECTED TO EARTH VIA COMMON TERMINALS TO LIMIT COMMON MODE VOLTAGES. IE ALL LOOPS HAVE A COMMON REFERENCE POINT
- 2) INSTRUMENT SCREENS AND COMMON TERMINALS TO BE CONNECTED TO EARTH AT ONE POINT ONLY

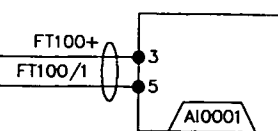
MCC



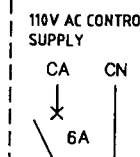
CORE	TML	FERRULE
1	1	FT100-110
2	2	FT100-CN
W	101	FT100+
Bk	102	FT100-
1W	103	SCN
1Bk	104	FT100/1
	105	FT100-
	106	SCN

NOTE (1)

NOTE (2)



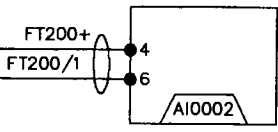
PLC ANALOGUE
CURRENT INPUT MODULE
IC693ALG221
PLC SLOT 7



CORE	TML	FERRULE
3	3	FT200-110
4	4	FT200-CN
W	107	FT200+
Bk	108	FT200-
	109	SCN
2W	110	FT200/1
2Bk	111	FT200-
	112	SCN

NOTE (1)

NOTE (2)



PLC ANALOGUE
CURRENT INPUT MODULE
IC693ALG221
PLC SLOT 7

CONTINUED ON DWG:-
486/5/7-QK019

AS CONSTRUCTED

PLOTTED *[Signature]* DATE 08/00
CHECKED *[Signature]* DATE 08/00

SCALE NTS N° 1 OF 1 SHEETS

DRAWING N° 486/5/7-QK018 AMEND. E

NO.	DATE	AS CONSTRUCTED	INITIALS	DIRECTOR OF P.D. & P.S.	DATE
D	5/99	REDESIGN	ML		
C	12/03	AS BUILT	PH		
B	1/03	ISSUED FOR CONSTRUCTION	WM		
A	12/02	ISSUED FOR TENDER	WM		
		AMENDMENT	INITIALS		

DESIGN	NAME	DATE
CK		12/92
DRAWN	NAME	DATE
W.M.		12/92
CHECKED	NAME	DATE
PT		5/99

JOB FILE	ACAD FILE	SHEET SIZE	A1
57QK018			
SURVEY No.	FIELD BOOK	A.H. DATUM	



PROJECT
CASWELL STREET
SEWAGE PUMPING STATION SP11

TITLE
SEWAGE PUMP
DISCHARGE FLOWS
LOOPS F-100 & F-300

SEWAGE PUMP PP3
DISCHARGE FLOW

FE300

CD1	R
CD2	Y
SG	
DS1	
SIG1	W
SIG2	Bk
DS2	

F300-S1

FIELD
J-BOX

R	
Y	
SC	
DS2	
SIG2	
SC	
DS1	
SIG1	
O/SC	

F300-S2

CORE	TML	DESCRIPTION/ FERRULE	TML	CORE
		F300-110	L	1
		F300-CN	N	2
		FT300+	IC+	W
		FT300-	IC-	Bk
		OUTER SCN		
R	CD1			
Y	CD2			
	SG	SIGNAL GROUND		
	DS1	SCN		
W	SIG1	WHITE COAX		
Bk	SIG2	BLACK COAX		
	DS2	SCN		

ABB MAGMASTER

FT300P

FT300I

CORE	TML	FERRULE
5	5	FT300-110
6	6	FT300-CN
W	113	FT300+
Bk	114	FT300-
	115	SCN
3W	116	FT300/1
3Bk	117	FT300-
	118	SCN

CONTINUED FROM DWG:-
486/5/7-QK018

110V AC CONTROL
SUPPLY

CA CN
6A

NOTE (1)

CONTINUED ON DWG:-
486/5/7-QK020

PLC ANALOGUE
CURRENT INPUT MODULE
IC693ALG221
PLC SLOT 7

FT300+
FT300/1

TELEMETRY REMOTE
TERMINAL UNIT
ANALOGUE INPUT
CHANNEL

MAGNETIC FLOW TRANSMITTER
WITH DIGITAL RATE AND
TOTALISER DISPLAYS SPAN
0-600.0 I/SEC
(MOUNTED ADJACENT TO MCC)

CONT. FROM DWG:- 486/5/7-QK018

CH.1	FT300/1	3W	FT300-1	3W
	FT300-	3Bk	FT300	3Bk

CONTINUED BELOW

MCC-RTU-AI
10 PAIR OAS (PART) CONT. ON DWG:- 486/5/7-QK020

NOTES

- 1) 4-20mA SIGNAL -VE CONNECTED TO EARTH VIA COMMON TERMINALS TO LIMIT COMMON MODE VOLTAGES. IE ALL LOOPS HAVE A COMMON REFERENCE POINT
- 2) INSTRUMENT SCREENS AND COMMON TERMINALS TO BE CONNECTED TO EARTH AT ONE POINT ONLY

AS CONSTRUCTED

PLOTTED *WJ* DATE 08/00
CHECKED *RJ* DATE 08/00

SCALE NTS N° 1 OF 1 SHEETS

DRAWING N° 486/5/7-QK019 AMEND. E

NO.	DATE	DESCRIPTION	INITIALS	ENGINEER	R.P.E.Q. NO.	DATE
E	8/00	AS CONSTRUCTED				
D	5/99	REDRAWN				
C	12/93	AS BUILT				
B	1/93	ISSUED FOR CONSTRUCTION				
A	12/92	ISSUED FOR TENDER				

DESIGN	NAME	DATE
CK		12/92
DRAWN	NAME	DATE
W.M.		12/92
CHECKED	NAME	DATE
PT		5/99



JOB FILE	ACAD FILE	SHEET SIZE	A1
57QK019			
SURVEY No.	FIELD BOOK	A/L DATUM	



PROJECT
CASWELL STREET
SEWAGE PUMPING STATION SP11

TITLE
SEWAGE PUMP
DISCHARGE FLOWS
INSTRUMENT FLOWS F-300

VEGA
D37H
CAPACITIVE LEVEL
SENSOR

LE500I

WET WELL "A"
LEVEL SIGNAL J.B.

CORE	TML	FERRULE	TML	CORE
Br	1	LT500A	1	W
BI	2	LT500	2	Bk
Y	3			
SCN				

BREATHER CAPILLARY
E25 OSCILLATOR

LE500I1

CORE	TML	FERRULE	CORE
W	119	LT500A	
Bk	120	LT500	
	121	SCN	
	122	LT500/1	
	123	LT500/1	
4W	124	LT500/2	
	125	SCN	
4Bk	126	LT500C	

CONTINUED FROM DWG:-
486/5/7-QK019

TO PLC
24V DC
+
-

LT500
LT500/1

PLC ANALOGUE
CURRENT INPUT MODULE
IC693ALG221
PLC SLOT No7

LT500/1
LT500/2

LI500

MANN
LPD350
WET WELL LEVEL
INDICATOR MTD IN
FRONT OF PLC DOOR

TELEMETRY REMOTE
TERMINAL UNIT
ANALOGUE INPUT
CHANNEL

CH.4

LT 500/2
LT 500C

4W
4Bk

CONT. FROM DWG:-
486/5/7-QK019

MCC-RTU-AI

10 PAIR OAS
CONT. ON DWG:-
486/5/7-QK021

CONTINUED ON DWG:-
486/5/7-QK021

VEGA
D37H
CAPACITIVE LEVEL
SENSOR

LE800I

WET WELL "B"
LEVEL SIGNAL J.B.

CORE	TML	FERRULE	TML	CORE
Br	1	LT800A	1	W
BI	2	LT800	2	Bk
Y	3			
SCN				

BREATHER CAPILLARY
E25 OSCILLATOR

LE800I1

CORE	TML	FERRULE	CORE
W	148	LT800A	
Bk	149	LT800	
	150	SCN	
17W	151	LT800/2	
	152		
17Bk	153	LT800/C	
	154		
	155		
	156		

CONTINUED ON DWG:-
486/5/7-QK021

CONTINUED ON DWG:-
486/5/7-QK021

LT800
LT800/2

PLC ANALOGUE
CURRENT INPUT MODULE
IC693ALG221
PLC RACK 1 SLOT No 1

TELEMETRY REMOTE
TERMINAL UNIT
ANALOGUE INPUT
CHANNEL

CH.11

LT 800/2
LT 800C

17W
17Bk

CONT. FROM DWG:-
486/5/7-QK019

MCC-RTU-DI

20 PAIR OAS
CONT. ON DWG:-
486/5/7-QK021

CONT. ON DWG:-
486/5/7-QK021

NOTE (1)
REMOVE LINK ON PLC ANALOGUE INPUT

AS CONSTRUCTED

PLOTTED *W. J. G. G.* DATE 08/00
CHECKED *W. J. G. G.* DATE 08/00

SCALE NTS N° 1 OF 1 SHEETS

DRAWING N° 486/5/7-QK020 AMEND. E

NO.	DATE	AS CONSTRUCTED	INITIALS	DIRECTOR OF P.D. & P.S.	DATE
E	8/00	AS CONSTRUCTED			
D	5/99	REDRAWN			
C	12/93	AS BUILT			
B	1/93	ISSUED FOR CONSTRUCTION			
A	12/92	ISSUED FOR TENDER			
		AMENDMENT			

DESIGN	NAME	DATE
CK		12/92
DRAWN	NAME	DATE
W.M.		12/92
CHECKED	NAME	DATE
PT		5/99



JOB FILE	ACAD FILE	SHEET SIZE	A1
57QK020			
SURVEY No.	FIELD BOOK	A.H. DATUM	



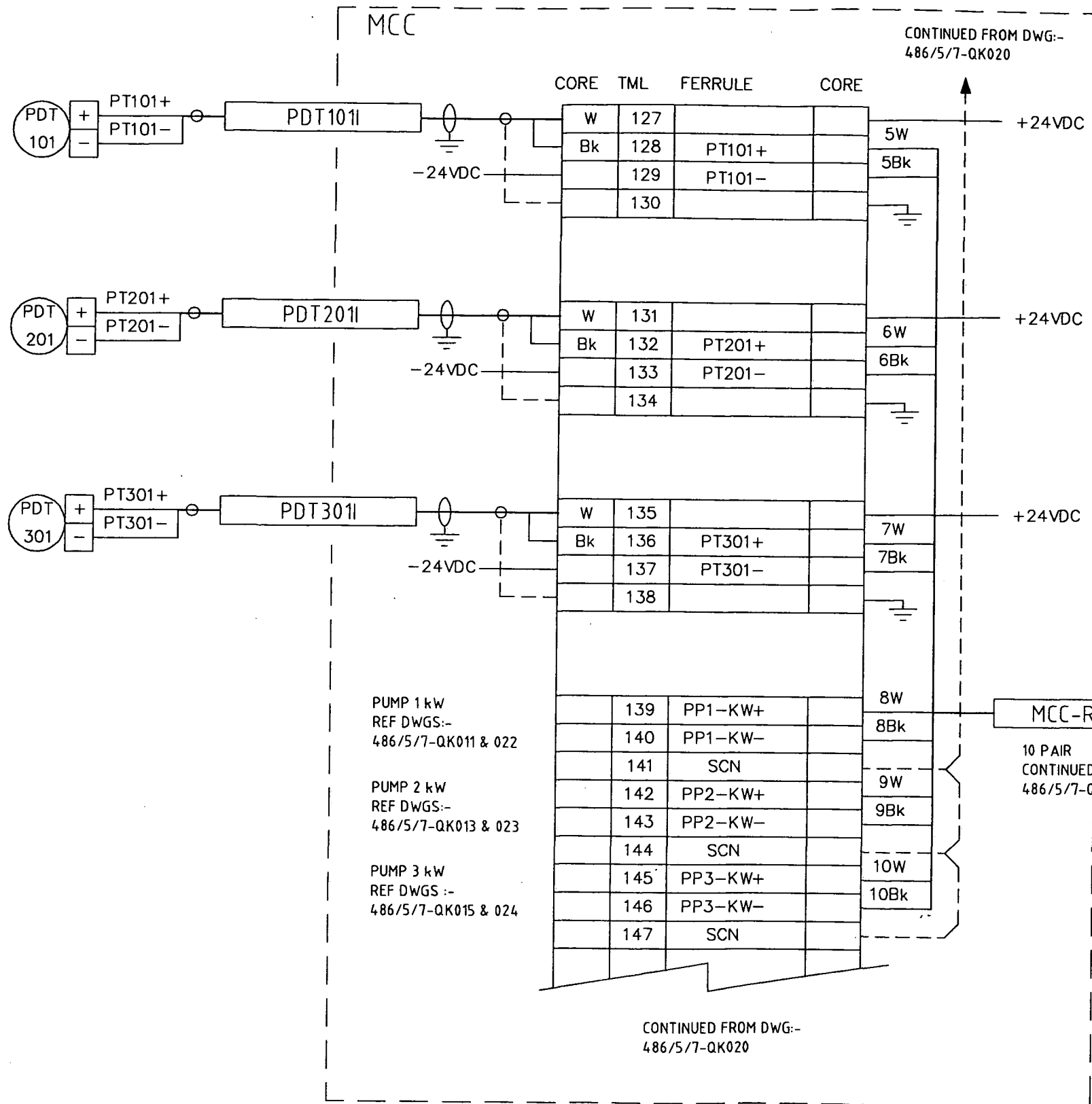
PROJECT
CASWELL STREET
SEWAGE PUMPING STATION SP11

TITLE
WET WELL LEVEL
INSTRUMENT LOOPS

SEWAGE PUMP PP1
DIFFERENTIAL PRESSURE
TRANSMITTER
SPAN 0-??? kPa
(0-??? METRES HEAD)

SEWAGE PUMP PP2
DIFFERENTIAL PRESSURE
TRANSMITTER
SPAN 0-??? kPa
(0-??? METRES HEAD)

SEWAGE PUMP PP3
DIFFERENTIAL PRESSURE
TRANSMITTER
SPAN 0-??? kPa
(0-??? METRES HEAD)



TELEMETRY REMOTE TERMINAL UNIT
ANALOGUE INPUT TERMINALS

CORE	TML	FERRULE	
5W		PT101+	CH.5
5Bk		PT101-	
6W		PT201+	CH.6
6Bk		PT201-	
7W		PT301+	CH.7
7Bk		PT301-	
8W		PP1-KW+	CH.8
8Bk		PP1-KW-	
9W		PP2-KW+	CH.9
9Bk		PP2-KW-	
10W		PP3-KW+	CH.10
10Bk		PP3-KW-	

E 8/00 AS CONSTRUCTED		M.L.		DIRECTOR OF P.D. & P.S.		DATE		DESIGN CK 12/92		JOB FILE		ACAD FILE 57QK021		SHEET SIZE A1		PROJECT CASWELL STREET SEWAGE PUMPING STATION SP11		TITLE DIFFERENTIAL PRESSURE AND PUMP kW INSTRUMENT LOOPS		SCALE NTS		N° 1 OF 1 SHEETS		DRAWING N° 486/5/7-QK021		AMEND. E	
D 5/99 RE-DRAWN		M.L.		ENGINEER IN CHARGE		DATE		DRAWN W.M. 12/92		SURVEYED		FIELD BOOK		A.H. DATUM		Brisbane Water				PLOTTED 08/00		DATE 08/00		CHECKED 03/00		DATE 03/00	
C 12/93 AS BUILT		P.H.		SUPERVISING ENGINEER		DATE		CHECKED PT 5/99		Brisbane City																	
B 1/93 ISSUED FOR CONSTRUCTION		W.W.																									
A 12/92 ISSUED FOR TENDER		W.W.																									
NO. DATE		AMENDMENT		INITIALS		R.P.E.Q. NO.		DATE																			

SEWAGE PUMP PP1

PP1
MODULE
TERMINALS

MCC INTERNAL WIRING
TO PLC

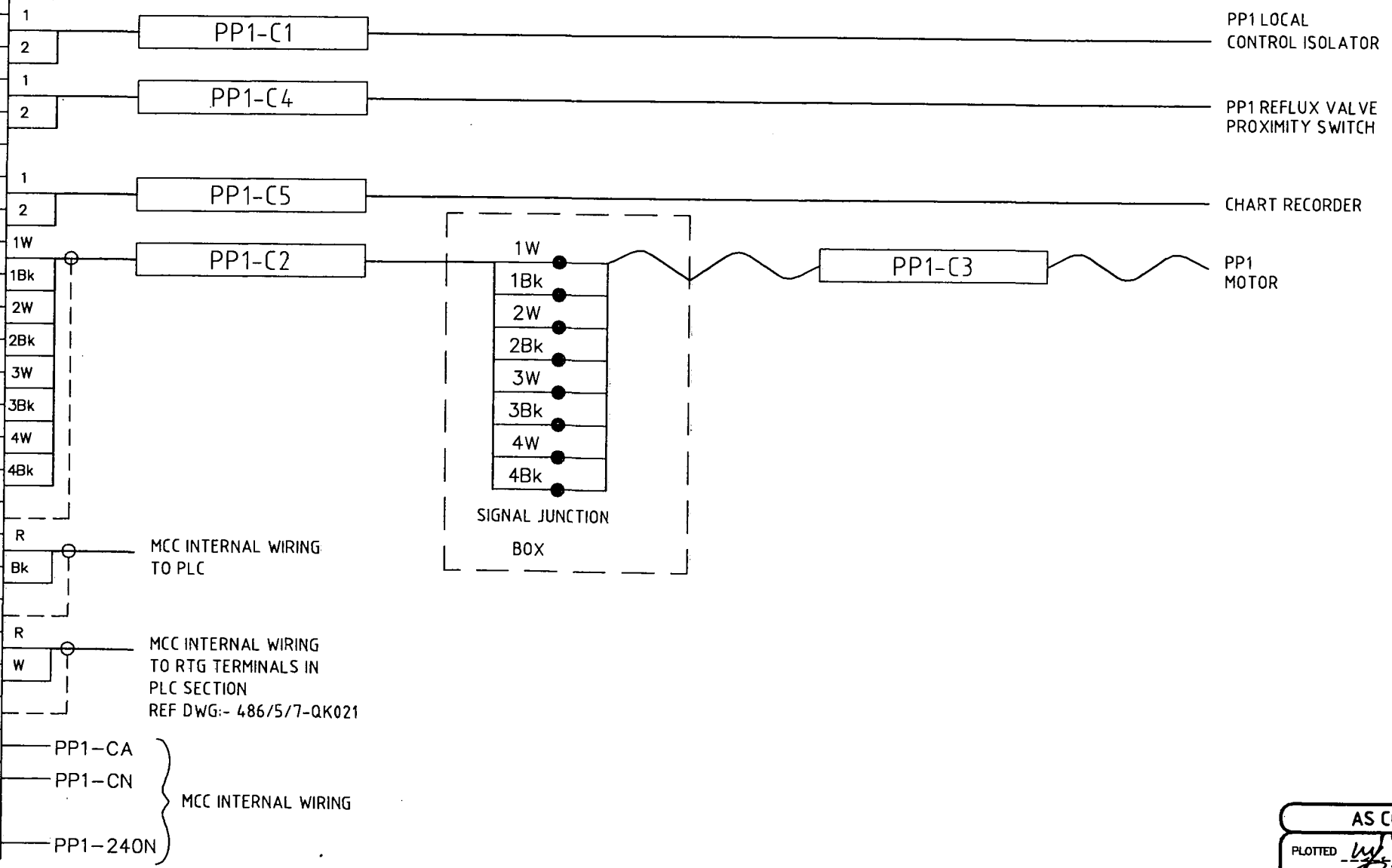
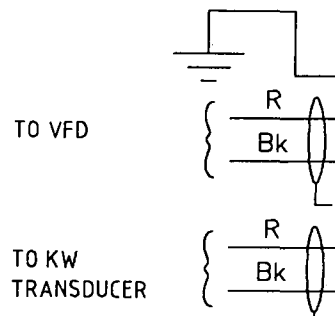
MCC INTERNAL WIRING

PP1 LOCAL
CONTROL ISOLATOR

PP1 REFLUX VALVE
PROXIMITY SWITCH

CHART RECORDER

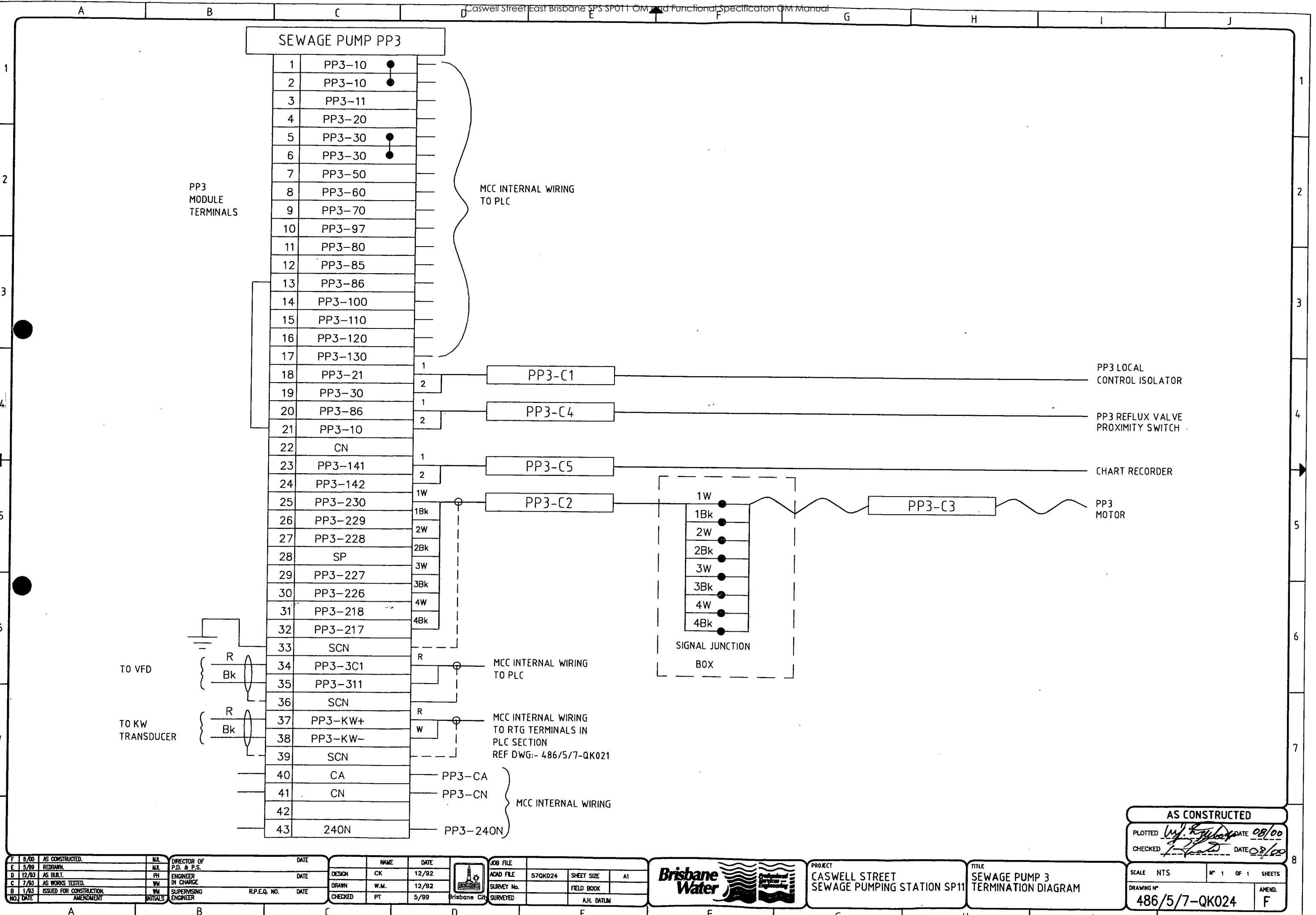
PP1
MOTOR



F 8/00 AS CONSTRUCTED		M.E.		DIRECTOR OF P.D. & P.S.		DATE		DESIGN		NAME		DATE		JOB FILE		ACAD FILE		SHEET SIZE		A1		PROJECT		TITLE		SCALE		NTS		1 OF 1 SHEETS		DRAWING NO.		486/5/7-QK022		AMEND.		F	
E 5/99 REDRAWN		M.L.		ENGINEER IN CHARGE		DATE		DRAWN		W.M.		DATE		SURVEYED		SURVEYED		FIELD BOOK		A.H. DATUM		CASWELL STREET SEWAGE PUMPING STATION SP11		SEWAGE PUMP 1 TERMINATION DIAGRAM															
D 12/03 AS BUILT		P.H.		SUPERVISING ENGINEER		DATE		CHECKED		P.T.		DATE																											
C 7/03 AS WORKS TESTED		W.W.																																					
B 1/03 ISSUED FOR CONSTRUCTION		W.W.																																					
A 1/03 AMENDMENT		W.W.																																					



SCALE NTS		N° 1 OF 1 SHEETS	
DRAWING N° 186/5/7-OK023			AMEND. E



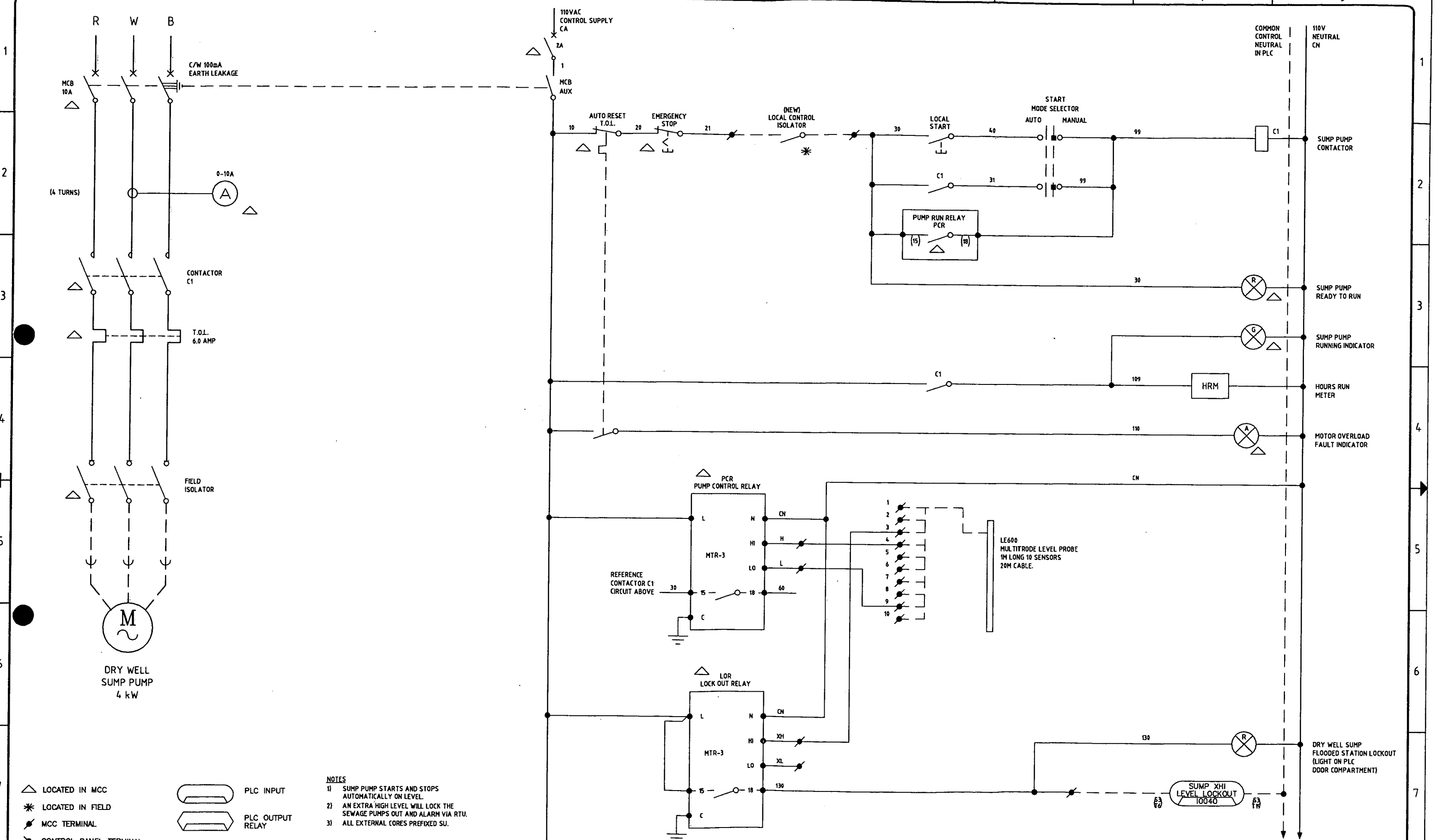
F 8/00 AS CONSTRUCTED		M.L. DIRECTOR OF P.D. & P.S.		DATE	
E 5/99 REDRAWN		M.L. ENGINEER IN CHARGE		DATE	
D 12/93 AS BUILT		P.H. SUPERVISING ENGINEER		DATE	
C 7/93 AS WORKS TESTED		W.M. R.P.E.Q. NO.		DATE	
B 1/93 ISSUED FOR CONSTRUCTION		AMENDMENT		DATE	
NO. DATE		INITIALS			

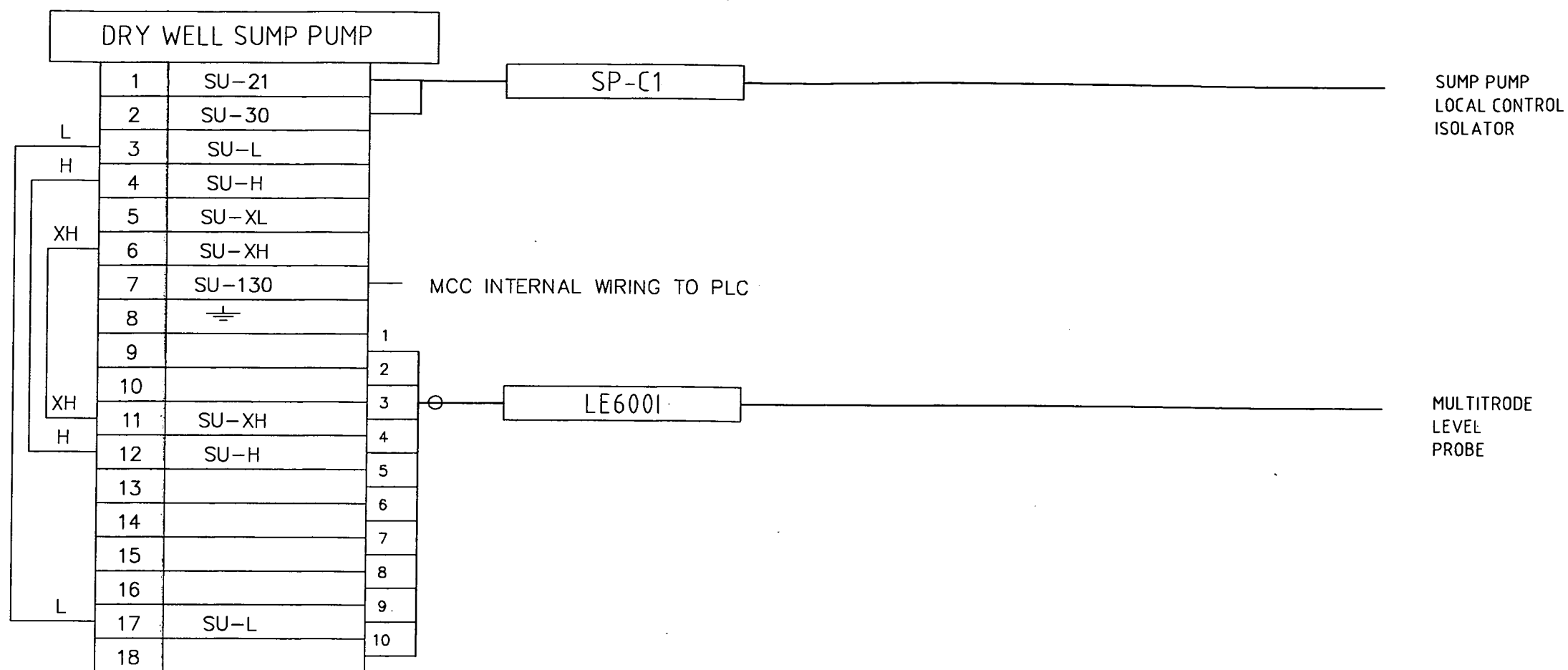
DESIGN	CK	DATE	12/92
DRAWN	W.M.	DATE	12/92
CHECKED	PT	DATE	5/99

JOB FILE	ACAD FILE	57QK024	SHEET SIZE	A1
SURVEY No.			FIELD BOOK	
SURVEYED			A.H. DATUM	

PROJECT		CASWELL STREET SEWAGE PUMPING STATION SP11	
TITLE		SEWAGE PUMP 3 TERMINATION DIAGRAM	

AS CONSTRUCTED	
PLOTTED	DATE 08/00
CHECKED	DATE 08/00
SCALE	NTS
DRAWING N°	486/5/7-QK024
AMEND.	F

[illegible]



NO.	DATE	AMENDMENT	INITIALS	ENGINEER	R.P.E.Q. NO.	DATE
8	1/93	ISSUED FOR CONSTRUCTION	WM	SUPERVISING ENGINEER		
7	7/93	AS WORKS TESTED	WM	IN CHARGE		
6	12/93	AS BUILT	PH	ENGINEER		
5	5/99	REDRAWN	MIL	DIRECTOR OF P.D. & P.S.		
4	8/00	AS CONSTRUCTED	MIL			



DESIGN	NAME	DATE
CK		12/92
DRAWN	NAME	DATE
W.M.		12/92
CHECKED	NAME	DATE
PT		5/99



PROJECT	CASWELL STREET SEWAGE PUMPING STATION SP11
TITLE	DRY WELL SUMP PUMP TERMINATION DIAGRAM

SCALE	NTS
DRAWING NO.	486/5/7-QK026
AMEND.	F

AS CONSTRUCTED

PLOTTED *WJ* DATE *08/00*

CHECKED *WJ* DATE *08/00*

SCALE NTS

N° 1 OF 1 SHEETS

AMEND. F