CDS TECHNOLOGIES™

The solution to water pollution

CDS PTY LTD
ACN 066 909 591

CORPORATE HEADQUARTERS
1140 Nepean Highway
Mornington, Victoria 3931

Phone 03 5977 0305
Facsimile 03 5977 0302

E-mail info@cdstech.com.au
http://www.cdstech.com.au

SYDNEY OFFICE
Suite 54
Chatswood Village
47 Neridah Street
Chatswood,
New South Wales 2067

Phone 02 9411 3751
Facsimile 02 9411 6347

BRISBANE OFFICE
Ambrosia House
4 Gardner Close
PO Box 1793
Milton,
Queensland 4064

Phone 07 3369 3651
Facsimile 07 3367 2034

SCSQ

Brisbane City Council Contract No 929798

Operation and Maintenance Manual

at Norman Creek Sewer Overflow
4BRI-06

Issue C
8th November 1999

CDS Pty Ltd
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Clean Up Australia

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Australian Technology Awards

BANKSIA ENVIRONMENTAL FOUNDATION INC.
1998
AWARD WINNER

CASE EARTH AWARDS

Contents

Appendix

1 Introduction to CDS Unit Principles and Operation

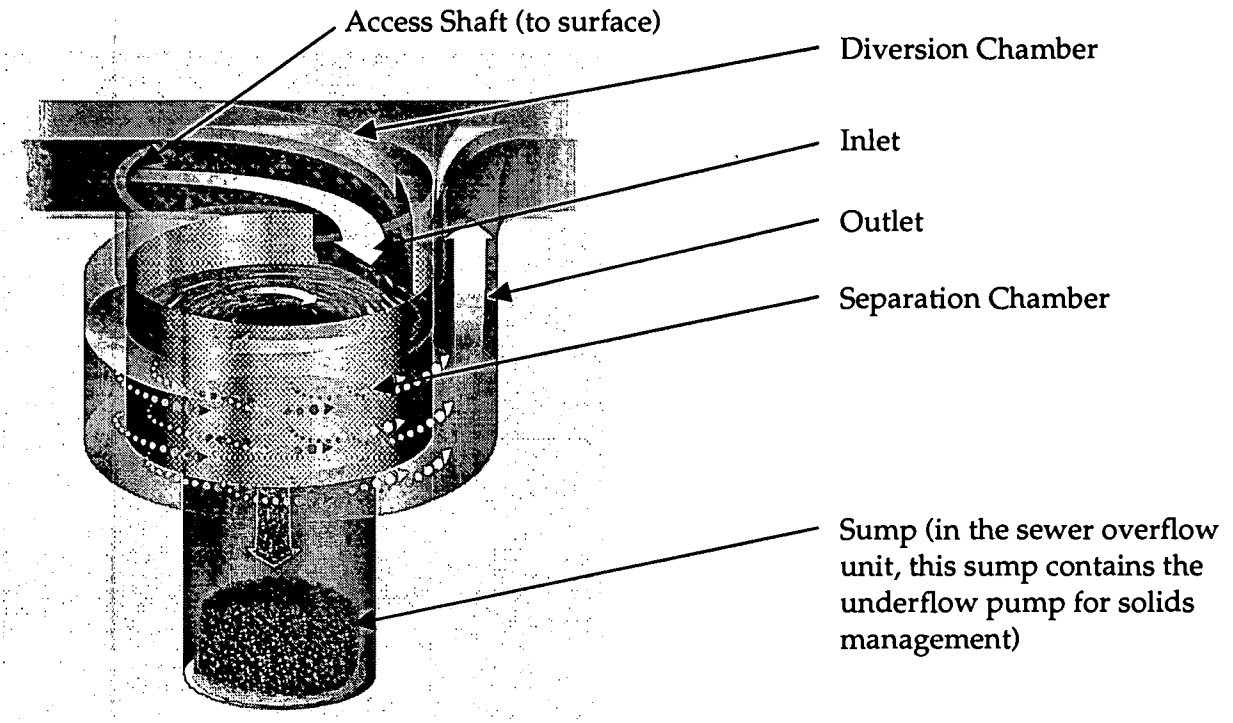
1.1 Preamble

1.1.1 CDS Technologies has been established to provide a cost-effective way to achieve environmental sustainability in water quality for both stormwater and sewer overflow systems. The Company is committed to its Clients and the environment, however its focus is on development, manufacturing, construction and maintenance of the CDS units.

1.1.2 The CDS owner may opt to perform their own cleaning or contract the cleaning to a pre-qualified contractor. Pre-qualified contractors are approved by CDS Technologies to perform inspections and cleaning in conformance with CDS Technologies Specification. They have demonstrated that they can meet all safety and environmental legislation and are adequately insured. These contractors can provide very competitive rates, provide valuable feedback on the CDS operation and will take the worry and effort out of the maintenance process.

1.1.3 Definitions

CDS For simplicity, the letters CDS will mean a CDS unit or treatment plant.



1.1.4 Waste Removal – Sewer Overflow Unit

As an addition to the standard stormwater CDS design, this sewer overflow unit is equipped with a mechanical means for removal of the collected debris. The operation of the removal device maintains the level of debris in the sump and the separation chamber within acceptable limits, and is critical to the operation of the CDS unit.

1.2 Operation

1.2.1 Description

1.2.1.1 The CDS unit removes particles of sewage from the overflow by passing the flow through the circular screens. The circular screens are continuously cleaned by the rotational energy within the unit.

1.2.1.2 The captured particles are concentrated in the sump and for neutrally buoyant material in the separation chamber from which they are pumped back to the sewer. This process is called under flow pumping.

1.2.1.3 At the end of the overflow event the unit is pumped out into the sewer and then cleaned by the wash process to remove residual debris and prevent anaerobic bacterial growth and dangerous gases.

1.2.2 Screening

1.2.2.1 The patented Continuous Deflective Separation (CDS) technology allows screening of solids from liquids at high flow rates without blinding of the screen. A CDS unit consists of an approximately cylindrical tank with specially shaped inlet and outlet channels to lead the water smoothly to and from the unit. A cylindrical screen is located inside this tank and the influent is introduced tangentially to the inside of the screen, forming a continuously rotating body of water, while water that has passed through the screen flows along the outside in the opposite direction to this rotation. The region inside the screen is known as the separation chamber and trapped solids either float on the top of the fluid there or settle below this chamber into a collection sump. Figure 1 presents a schematic of the cross section of a CDS unit.

1.2.2.2 The non-blinding nature of the system is achieved because indirect rather than direct screening is employed. The water rotating inside the screen in the separation chamber tends to continually "wash" solids away from the screen, overcoming any tendency for the solids to be "pinned" by the water flowing through the screen.

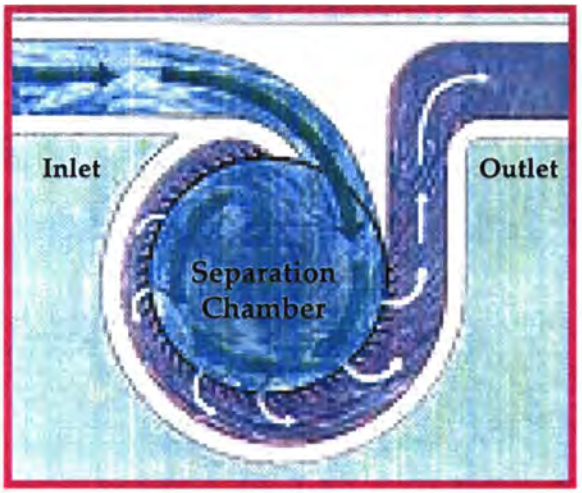


Figure 1
Schematic of the cross section of a CDS unit

1.2.3 Underflow Pumping

1.2.3.1 The collected particles are removed from the sump by the operation of the sump pump.

1.2.3.2 This pump is a grinder submersible type operating at 2900 RPM.

1.2.3.3 Typically the rate at which particles are collected is proportional to the flow through the CDS unit and the underflow pump cycle time and cycle frequency are controlled accordingly. **Note**: The duration of underflow can be critical to the operation of the screening process and should not be varied without consultation with CDS. In the underflow pump cycle the pump operates at 10 l/sec approximately. The duration and frequency of running is related to the inflow rate.

1.2.3.4 The flow through the CDS unit is measured at two locations in the inlet pipe and converted to flow by algorithm in the PLC. The underflow pump is continuously reprogrammed from this varying value.

1.2.4 Wash Process

1.2.4.1 The wash process is arranged to clean the screens and other areas of the CDS unit of residual particles and scum and pump these to the sewer. The wash and pump cycle may be optimised to suit the operational residue and to suit the cleanliness standard required.

1.2.4.2 Wash water is delivered via a rotating spray head solenoid valve and located in an isolated compartment in the control board. The rotating spray head is driven by the thrust of the water sprays, which are aligned to cover the total screen area. The flow rate through the spray head is approximately 1 l/sec and requires a minimum mains pressure of 3 bar.

1.2.4.3 Pumping in the wash process is by the underflow pump operating at approximately 7 l/sec.

1.2.4.4 Control of the wash process by the PLC is on a time basis for the sprays and on a water level for the pump. The level sensor has been selected to measure through the wash water spray to the water surface area available in the sump.

1.2.5 Variables

1.2.5.1 The PLC has capacity to control the functions of GPT in any manner considered appropriate. Variations to the program can be made through the interface facility which is described in the manufactures literature.

1.2.5.2 Variations to the process program may be recommended with operational experience of the particular sewage concentration.

1.2.6 Filling

1.2.6.1 The CDS unit is designed to be left full of 'clean' water between the overflow events. Filling with mains water via the spray head will take between 8 and 10 hours and may be considered an inappropriate use of this water.

1.2.6.2 As an alternative, the CDS unit may be filled with raw water via a road tanker through the manhole cover. This option may be activated in the PLC when conditions dictate.

1.3 Routine Inspections

1.3.1 Routine inspections are necessary to ensure the CDS is functioning correctly and indicate when cleaning is necessary. These inspections should be carried out on a regular monthly basis. Additionally, it is recommended that a non-scheduled inspection be carried out after any prolonged period of heavy loading. These inspections are the responsibility of the CDS unit owner, unless other arrangements have been made with CDS Pty Ltd. Due to the efficiency of the CDS design, it is likely that they will collect large quantities of pollutants during heavy loading events. Inspections after these events are therefore even more important than scheduled inspections.

1.3.2 The routine inspection involves removing the access hatch in the CDS main lid pumping down the unit by manual control of the sump pump and visually checking the screen, percentage of water surface occupied by floatables and measuring the level of accumulated debris in the sump.

1.3.3 The sump pump will not remove articles larger than the pump inlet or heavy items which will remain on the floor of the sump. Also, the sump pump will not remove floatables. If floatables, large or heavy objects are found during the inspection an arrangement should be made for a total clean out using a variation of the stormwater suction cleaning procedure described in Section 1.4 – 1.7.

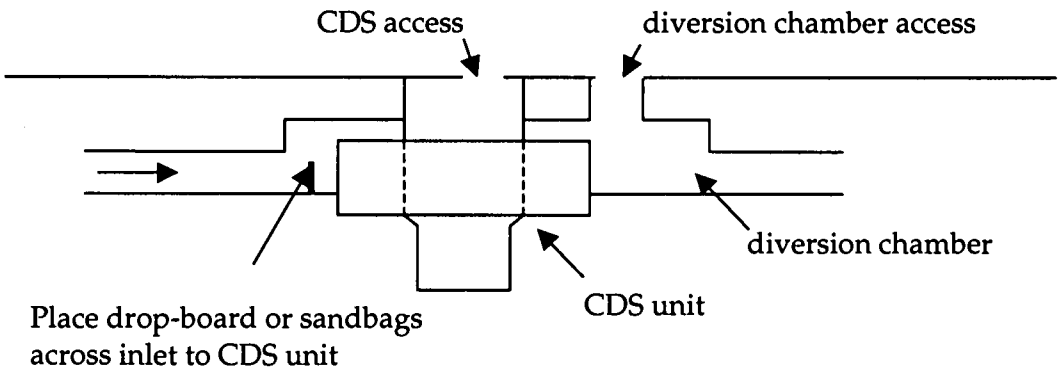
1.4 Suction Cleaning

The following is a recommended procedure for emptying the CDS unit using a truck-mounted suction unit (this procedure is shown in Figure 5.1)

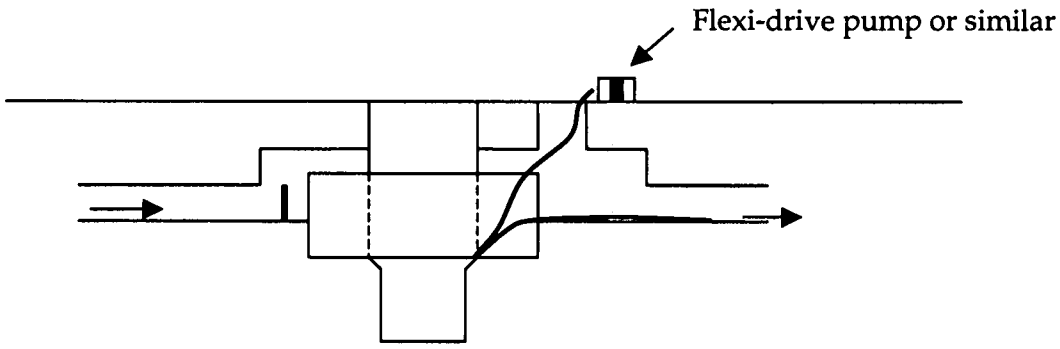
1.4.1	Stop inflow	The incoming flow can be blocked using a drop-board across the inlet or the appropriate inlet valve.
1.4.2	Remove debris by suction	Using a "Super sucker" type suction cleaner remove the debris from the sump.
1.4.3	Disposal of Pollutants	Record the quantity of pollutants removed from the CDS with a visual assessment of the breakdown by type: _____ % silt and sediment _____ % litter _____ % vegetation A note should be made of any unusual or large items, eg. oil, paint, rocks etc. Disposal of pollutant material is the responsibility of the owner at an approved tipping site, ie. a tip which is licensed by the Waste Authority in the relevant state. The free water removed can be discharged back into the CDS unit to minimise transportation and disposal costs. The material should be weighed if possible. Weight should be measured when the free water no longer drains out at the material. If this is not possible, an estimation of weight should be made.
1.4.4	Tidy Site	Tidy the site of any debris prior to leaving.
1.4.5	Complete and Forward Cleaning Report	Complete Cleaning Report (Appendix B) and forward to CDS owner. If there is any damage or non-functionality, complete Damage or Non-Functionality Report (Appendix C) and forward to the CDS Contact Person listed on the CDS Data Sheet.

Annually the CDS unit should be fully inspected inside and outside the screen to ensure no damage or algal growth or deposition of material has occurred. Any problems should be reported to the CDS owner and to CDS Technologies contact person.

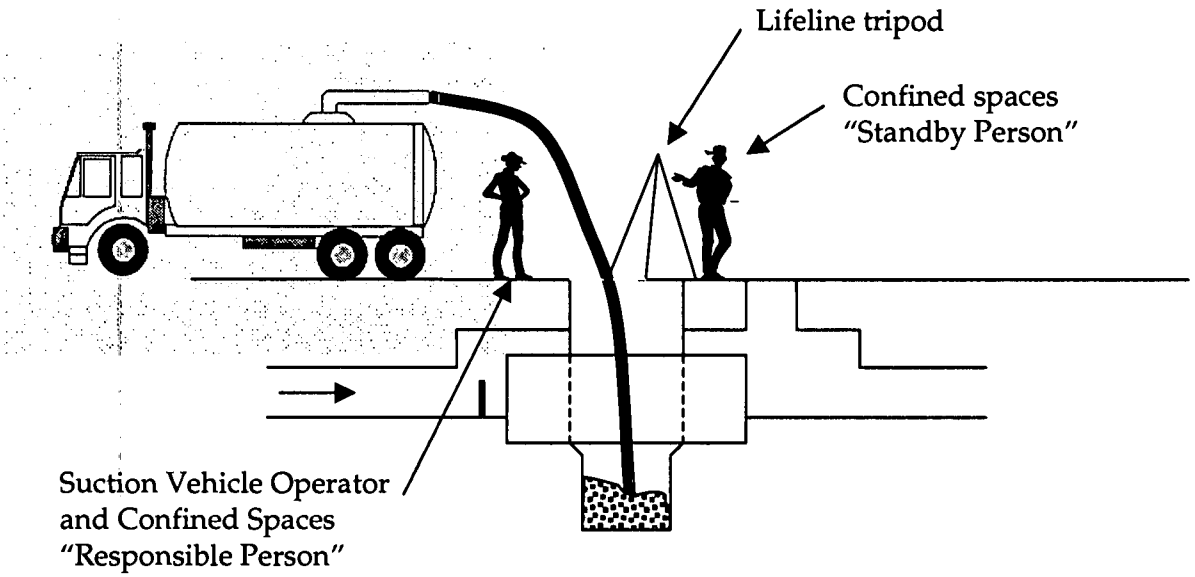
Step 1. Stop Inflow



Step 2. Pump down the separation chamber from the outside of the screen



Step 3. Remove debris by suction



NB: A person may be needed inside the CDS unit to guide the head of the suction hose.

All 3 staff in this method require Confined Spaces Training

1.5 Safety Regulations

1.5.1 The safety regulations applying in the State or Territory are to be strictly adhered to.

1.5.2 The party performing the cleaning is to be fully aware of all applicable safety regulations and ensure that all staff are adequately trained in safe working practices.

1.5.3 These safety regulations include but are not limited to:

1.5.3.1 Occupational Health and Safety Legislation

1.5.3.2 Confined Spaces Legislation

1.5.3.3 Motor Traffic Legislation

1.5.3.4 Scaffolding and Lifts Regulations

1.5.3.5 Health Regulations dealing with handling of hazardous substances

1.5.3.6 Hazardous Substances Legislation

1.5.3.7 Manual Handling Regulations

1.5.3.8 Plant Operating Instructions

1.5.3.9 Traffic and Pedestrian Safety Standards.

1.5.4 Adequate insurance's should be carried to cover Public Liability and Worker Injury.

1.6 Environmental Responsibility

1.6.1 CDS Technologies is committed to improving the environment with its products. It is essential therefore that the process of cleaning the CDS is performed in a manner, which is environmentally responsible. Simply, there must not be any waste left on the site or anything other than the treated water discharged into the environment. The waste must be disposed of in a best practice manner with regard to environmental legislation.

1.6.2 The party performing the cleaning must be aware of all environmental legislation applicable to these operations and ensure that all employees are trained in work practices complying with the legislation.

1.6.3 This legislation includes but is not limited to:

1.6.3.1 Local Government Regulations

1.6.3.2 Clean Waters Act

1.6.3.3 Waste Disposal Regulations

1.6.3.4 Litter Regulations

1.7 Documentation

There are only 3 documents generated by the inspection and cleaning of the CDS.

1.7.1 Inspection Report

Appendix A to be completed for each inspection and copy forwarded to CDS owner.

1.7.2 Cleaning Report

Appendix B is to be completed for each clean and forwarded to CDS owner.

1.7.3 Damage or Non-Functionality Report

Appendix C is to be completed upon observance of any damage or extraordinary occurrence affecting the normal operation of the CDS. Examples of these are:

1.7.3.1.1 damaged screen

1.7.3.1.2 damaged child protection bars

1.7.3.1.3 damaged lids

1.7.3.1.4 screen blockage

1.7.3.1.5 repeated inlet blockage, and such like.

This report to be faxed to CDS Technologies on 03-5977-0302. CDS Technologies will discuss with the CDS owner any remedial action required.

1.7.4 CDS Data Sheet

Appendix D - This contains relevant information about each CDS and includes contact phone numbers for CDS Contact Personnel including after hours numbers.

1.8 Maintenance

1.8.1 Inspections

1.8.1.1 Six monthly inspections are required to verify the integrity of the site and equipment. The performance of the screening level sensors and pump operation can be verified from the data retrieved from the last overflow event.

1.8.1.2 Examination of the internal equipment necessitates entry into the separation chamber and the sump. The unit may be emptied using an eduction truck or the sump pump. Alternatively, the inspection may be scheduled to follow the next overflow event without the final fill activity.

1.8.1.3 Access to the chambers is by extending ladder, care being taken not to contact the screen. Access to the chambers is by authorised persons only, with equipment approved for the duty.

1.8.2 Screens

1.8.2.1 Accidental Damage

The screens should be inspected for accidental damage in the form of sharp dents etc. These can be located by 'feel' and checked for depth with a template. Screens with damage to a depth of 4 mm must be replaced.

1.8.2.2 Coatings Damage

The screens should be inspected for loss of coating due to wear. If this failure occurs, it will become evident in the first instance adjacent to the inlet.

1.8.3 Pump

1.8.3.1 The pump is equipped with electronic monitoring of the motor and the oil chamber. Inspection is required only to verify that the pump remains correctly aligned to the pedestal and the bolts are secure to the concrete.

1.8.3.2 The discharge pipe is fitted with a check valve located in the sump. This valve can be checked by operating the pump for one minute and observing the quantity of the back flow.

1.8.3.3 The pump should be lifted to the ground for any dismantling procedure.

1.8.4 Spray Head

1.8.4.1 Examine the spray head for loose fixings. Rotate the head by hand and check for free movement.

1.8.4.2 Operate the solenoid valve and examine the spray pattern against the screen. Ensure that the spray covers all the screen area.

1.8.4.3 Monitor the water meter to verify flow rate.

2 Operation and Maintenance Requirement

2.1 The Installed Equipment

2.1.1 The installation is in accordance with the drawings and the specification and is capable of operating in accordance with the CDS principles outlined in SECTION 1 with the addition of ancillary equipment necessary to perform in the SSO application.

2.1.2 The special equipment to adapt the CDS unit to a SSO comprises an underflow/sump pump, a wash/fill system and an electrical control and communications panel.

2.1.3 The underflow/sump pump is a submersible pump, which removes concentrated sewage particles to the sewer at a rate, which is proportional to the inflow. It also empties the chamber of residual waste at the end of an event as part of the cleaning cycle.

2.1.4 The wash/fill system is a fresh water supply through a control valve and spray head arranged to rinse the screen after an overflow event and to refill the chamber in readiness for the next event.

2.1.5 The control and communications panel contains the electronic equipment to monitor the level sensors within the structures, compute the flow and control the underflow and wash cycles. The telemetry equipment is compatible with the BSC SCADA system.

2.2 Intervention in the Event of Equipment Malfunction

2.2.1 The CDS unit and associated equipment has been designed to the highest standards to minimise the risk of malfunction in operation. In the event of equipment failure during an event, rectification work in the chamber is not necessary or advised. The unit will operate for an extended period, depending on the solids loading, without any ancillary equipment operation. Repairs in the cubicle may be performed with the panel isolated during the event but works in the chamber may be delayed until the event is ended.

2.3 Manufacturers Information

2.3.1 Manufacturers information is contained in the following sections:

2.3.1.1 Level probe – Appendix E
2.3.1.2 Control Panel – Appendix F
2.3.1.3 Under flow/sump Pump – Appendix G

2.4 Maintenance

2.4.1 Planned Process Maintenance

For planned process maintenance refer to 'Routine Inspection' section 1.3 and subsequent cleaning procedures in Sections 1.4 to 1.7

2.4.2 Planned Equipment Maintenance

For planned equipment maintenance refer to the manufacturers information in Section 2.3

Inspection Form

Date: _____

Cleaning Contractor Company: _____

Phone No: _____ Fax No: _____

Inspection Person: _____

Unit Identification: _____

Percent cover of floatables on surface: _____

State of the screen (if visible): _____

Depth from base to lid: _____

Depth of accumulated solids: _____

Percent full: _____

Comments: _____

_____

_____

_____

Signed: _____

The report is to be faxed to the CDS owner.

Any damage or non-functionality of the CDS unit should be reported on a Damage or Non-functionality Report (Appendix C) to CDS Pty Ltd.

CDS Clean Out Report

Date: _____

Cleaning Contractor Company: _____

Phone No: _____ Fax No: _____

Contact Person: _____

Unit Identification: _____

Address: _____

_____

Method of Cleaning: _____

Time Taken: _____

Volume or mass of removed material: _____

Breakdown of material: _____% silt and sand

_____% litter

_____% vegetation

Comments: _____

_____

_____

_____

Signed: _____

This report is to be faxed to the CDS owner.

Any damage or non-functionality of the CDS unit should be reported on a Damage or Non-functionality Report Appendix C to CDS Pty Ltd.

Damage or Non-functionality Report

Date: _____

Unit Identification: _____

Address: _____

_____

Company doing inspection/cleaning: _____

Contact Person: _____

Phone: _____ Fax: _____

Nature of damage or problem: _____

_____

_____

_____

_____

Signed: _____

This report is to be faxed to CDS Pty Ltd on 03 5977 0305.

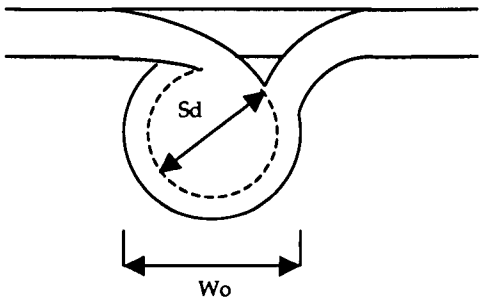
Appendix D
4BRI-06

CDS Unit Data Sheet

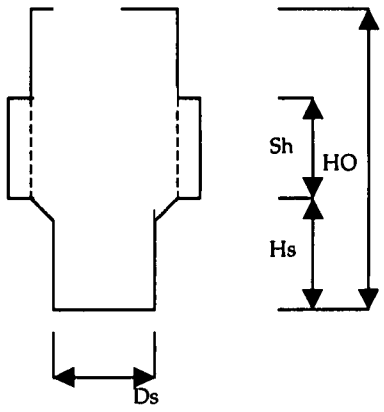
Name:		Unit Name:	
Address:		Unit No:	
		Unit Address:	
Contact Person:		Site:	
Phone:		Truck Instruction:	
Fax:		Keys:	
Mobile:		Lid Type:	
CDS Rep:		Lid Size:	
Phone:		Emptying Method(s):	
After Hours:		Date Operational:	

Technical Data

Screen diameter	(Sd)	=	m
Screen height	(Sh)	=	m
Over all height	(H0)	=	m
Over all width	(Wo)	=	m
Sump diameter	(Ds)	=	m
Sump Height	(Hs)	=	m
Sump total volume	(Vt)	=	m^3
Unit weight of solid material	(γ)	=	t/m^3
Estimate weight of full basket		=	



Depth from Lid to Pollution	Volume m^3	Weight kg	Percent Full
Screen			> 100
Sump Top			100
			90
			80
			70
			60
			50
			40
			30
			20
			10
Base =	0.00	0.00	Base of sump



Level Probe

The following manufacturers information relates to the Hawk level probes and controllers.

The level probes LS#1, LS#2 and LS#4 are installed in a horizontal plane with a deflector. This arrangement allows the probe to operate with minimum head room and is all in accordance with the manufacturers requirements.

LS #1 LS #2 LS #4 SPEC 1 of 3

PRINCIPLE OF OPERATION

The Hawk LP30 is an ultrasonic level transmitter that is powered by a 2-wire, 4-20 mA DC loop. The 4-20 mA loop is an industry standard control line for most PLC's and Distributive Control Systems. The LP30 is available in an integral configuration (transducer and electronics in an integrated housing) and a remote configuration (bracket mountable electronics separate from flange mountable transducers).

The transmitter draws less than 4 mA of current from the supply and emits a sound pulse from the transducer toward the measured product. This sound pulse is reflected from the surface to be measured back to the transducer where the signal, or ECHO, is processed by the transmitter. This pulse is generated every three seconds, regardless of current output by the transmitter. The time between pulse and echo reception is processed using the speed of sound (corrected for the ambient temperature of the application) to calculate the distance measured. Temperature compensation is critical to maintain accuracy since the variation is usually 0.10% of distance per degree Fahrenheit change 0.17% per degree C—seasonal changes can produce wide temperature variations.

The high sampling rates of the LP30 transmitter produces greater resolution on rapidly changing process measurement applications. After every echo is processed, the display is updated to read feet or meters of space or material and the corresponding output is proportionally updated.

Upon initial application the transmitter will open a 'window' over the entire span and gradually increase the gain of the amplifier until an echo is received. It will then perform a validation sequence and close the window around the level. The transmitter will maintain the window over the echo and ignore signals in front of and behind the valid level. This reduces the chance of false level readings. Periodic interruptions, such as agitators, can be ignored in the validation sequence if proper mounting is used.

The transmitter also employs dynamic gain control. The transmitter will automatically adjust its gain level to maintain the echo at a predetermined strength. This will allow the amplifier to track the level when intermittent disturbances such as steam or dust occur in the application.

FEATURES

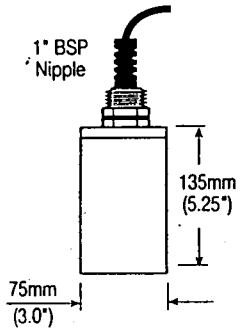
- Optional Hart Protocol Digital Communications
- Low-cost
- 2-wire loop-powered, 12V to 30Vdc supply
- 4-20mA analog output, proportional
- -6°C to 60°C (20°F to 140°F) operating temperature range electronics - *See table for transducer temperatures*
- Available in remote mounting for high temperature service
- Eight digit alphanumeric display
- Non-intrusive, high-impact enclosure (sealing IP67) NEMA 4x
- Easy calibration and installation
- Chemically resistant (acids, alkalis, hydrocarbons, oils, fats, detergents, etc.)
- Auto-compensation for temperature, steam, dust condensation, rain, wind, etc.
- Battery and solar panel capability for remote locations (12V - 250ohm)
- Agitator discrimination
- Operating performance diagnostics
- Transducer and electronics in same housing (Integral version)

PART NUMBER	FACING	*BLANKING ZONE	TEMPERATURE RANGE @ OPSIG	RATING
Transducer with Integral Electronics				
LP30-I-6	Teflon	300mm (1.0 ft)	-6° to 60°C (20° to 140°F)	IP67 Class 1 Zone"0" NEMA 4X
Remote Amplifier for Transducers (Listed Below)				
LP30-R	Valox		-6° to 60°C (20° to 140°F)	IP67 NEMA 4X
Transducers for Remote Amplifier (Listed Above)				
TD30-06	Teflon with PVC Body	300mm (1.0 ft)	-20° to 80°C (-4° to 176°F)	IP67 Class 1 Zone "1"
TD30-26	Teflon with 316 SS Body	300mm (1.0 ft)	-20° to 80°C (-4° to 176°F)	IP67 Class 1 Zone "1"

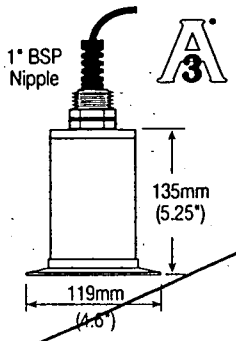
Note: *Maximum separation distance for remote units is 15m (50 ft).* ***Note:*** *3A sanitary approved model available.*
Note: *Integral LP30 units available for Intrinsically Safe (Class 1 Zone 0) areas. Consult factory for ordering information.*
** Blanking and range are affected by adverse conditions. If possible always increase the blanking zone by 50% and decrease the range according to the Enviormental conditions. Consult the factory for further application support.*

DIMENSIONS

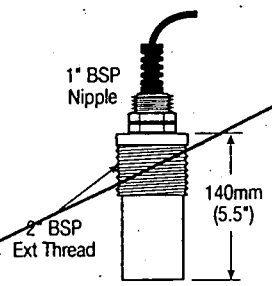
Remote Transducer TD30-06T



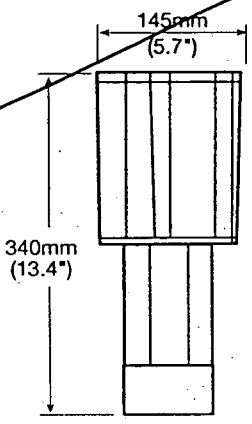
Tri Clover 3-A Sanitary Flange TD30-06S3A-T



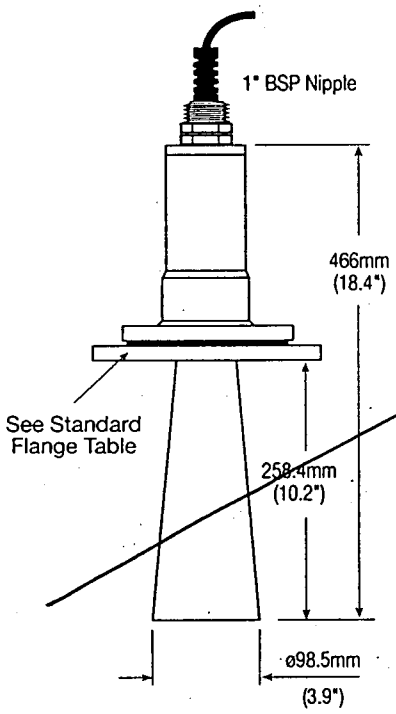
Remote Transducer 2" BSP TD30-44-B



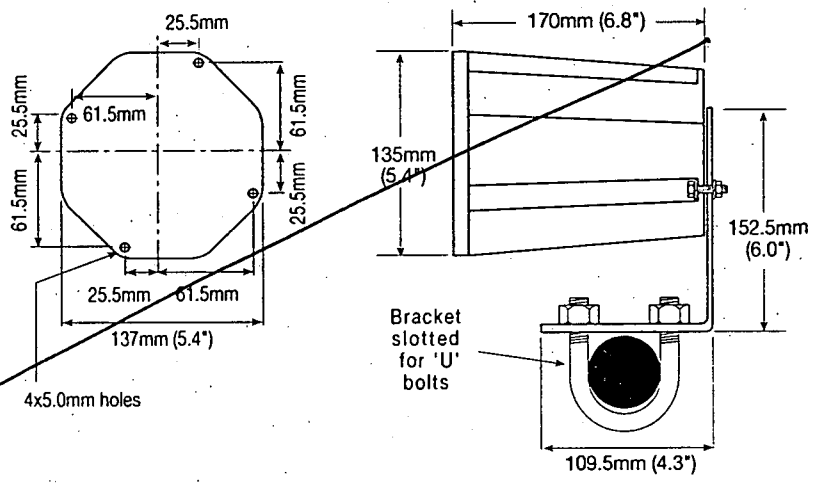
Integral Transmitter/Transducer LP30-I-6



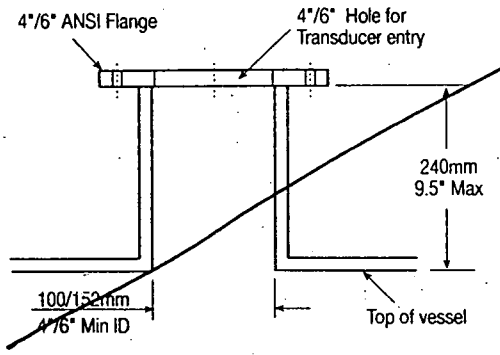
Remote Transducer TD30-06FCA6



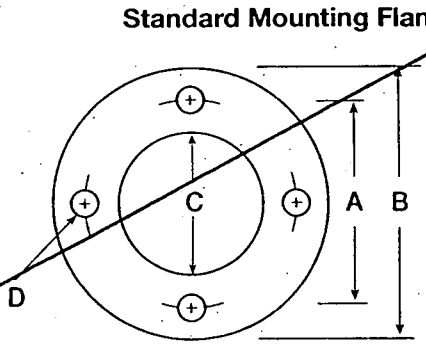
Remote Transmitter with Mounting Bracket



TD20-06FCA6 & TD30-06FCA6 4"/6" Nozzle Mounting



Standard Mounting Flange



FLANGE TYPE:
A = ANSI Flange
D = DIN Flange
J = JIS Flange
Others Available

STANDARD ANSI/DIN FLANGE DIMENSIONS

FLANGE TYPE	A (PCD) mm	A (PCD) in	B (OD) mm	B (OD) in	C (ID) mm	C (ID) in	D (Hole) mm	D (Hole) in
FCA4	190.5	7.5	228	9.0	100	4	19	0.75
FCD4	180	7.0	220	8.7	100	4	18	0.7
FCJ4	175	6.9	210	8.4	100	4	15	0.6
FCA6	241	9.5	279.5	11.0	150	6	22	0.85
FCD6	240	9.4	285	11.2	150	6	22	0.85
FCJ6	240	9.4	280	11.0	150	6	19	0.75

Note: Other flange sizes available.

LS# 1
LS# 2
LS# 4

SPEC 2 of 3

SPECIFICATIONS

Frequency
- 30 kHz

Input Voltage
- 12V to 30Vdc

Input Supply Current
- 4.0mA to 20.0mA

Source
- 2-wire, Loop Power

Maximum Load
- 750 ohms @ 24Vdc, 250 ohms @ 12Vdc

Blanking Distance
- See table inside

Measuring Range
- Max. range 9.999m (33 ft)

Resolution
- 1mm (0.04 inch)

Electronic Accuracy
- +0.25% of measuring range

Operating Temperature Electronics
- Max. continuous = 60°C (140°F)
  Min. continuous = -6°C (20°F)
  ** For higher temperatures consult the factory*

Transducer/Amplifier Separation
- 15m (50 ft)

Operating Pressure
- Max. 30 P.S.I. (2 Bar)

Beam Angle
- 6.0° (can be reduced using optional focalizers)

Analog Output
- 4-20 mA (max. 750 ohms) proportional @ 24Vdc
  4-20 mA (max. 250 ohms) proportional @ 12Vdc

Display
- 8 digit alpha/numeric (meters, feet)

Memory
- Non-Volatile (No Battery Back-up)

Enclosure Sealing
- IP67 (NEMA 4X)

Enclosure Materials
- Valox P.B.T. (High Chemical/Impact Resistance) or optional Lexan clear cover 'Valox' and 'Lexan' are registered trademarks of the General Electric Company

Cable Entry
- IP68 cable gland/5-10mm O.D. (7/8" entry hole)

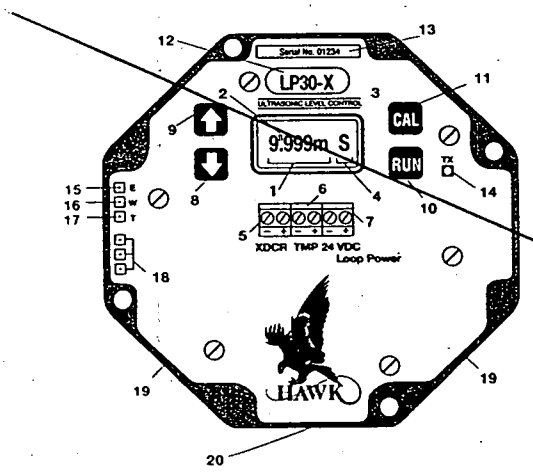
Mounting
- Flange (ANSI, DIN, JIS) Bracket

Cable
- 2-wire shielded cable

Weight
- Typical Integral unit: 3kg
  Remote Amplifier: 1kg
  Transducer: 2kg

Approvals
- Meets 3-A sanitary specifications
- Intrinsic safe model available
- CE Approved
- FM APPROVED

TRANSMITTER DESCRIPTION



1. Eight character Alphanumeric Liquid crystal display.
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3. Choice of display of engineering units in Meters, Feet or Percent.
4. Operating - Space, Material or Percent. Diagnostic - Gain Level.
5. Transducer connections (XCDR). (See wiring detail drawing)
6. Temperature compensator connections (TMP) for remote unit only- Integral unit has compensator built into transducer.
7. Current loop connection. (See specifications for min. and max. voltages and resistance loads)
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12. Model Number.
13. Serial Number.
14. Transmit pulse indicator (red).
15. Scope connection for the echo trace. (See scope settings for signal type and settings)
16. Scope connection for the window trace.(See scope settings for signal type and connections)
17. Trigger output. It may be required under noisy electrical conditions.
18. Common - Scope connection for leads. Do not ground.
19. Conduit Entry
20. Conduit Entry - international version (M16). U.S. version 7/8".

LS#1 LS#2 LS#4 SPEC 3of3

LS # 3 SPEC 1 of 3

PRINCIPLE OF OPERATION

The Hawk LP20 is an ultrasonic level transmitter that is powered by a 2-wire, 4-20 mA DC loop. The 4-20 mA loop is an industry standard control line for most PLC's and Distributive Control Systems. The LP20 is available in an integral configuration (transducer and electronics in an integrated housing) and a remote configuration (bracket mountable electronics separate from flange mountable transducers).

The transmitter draws less than 4 mA of current from the supply and emits a sound pulse from the transducer toward the measured product. This sound pulse is reflected from the surface to be measured back to the transducer where the signal, or ECHO, is processed by the transmitter. This pulse is generated every three seconds, regardless of current output by the transmitter. The time between pulse and echo reception is processed using the speed of sound (corrected for the ambient temperature of the application) to calculate the distance measured. Temperature compensation is critical to maintain accuracy since the variation is usually 0.10% of distance per degree Fahrenheit change 0.17% per degree C—seasonal changes can produce wide temperature variations.

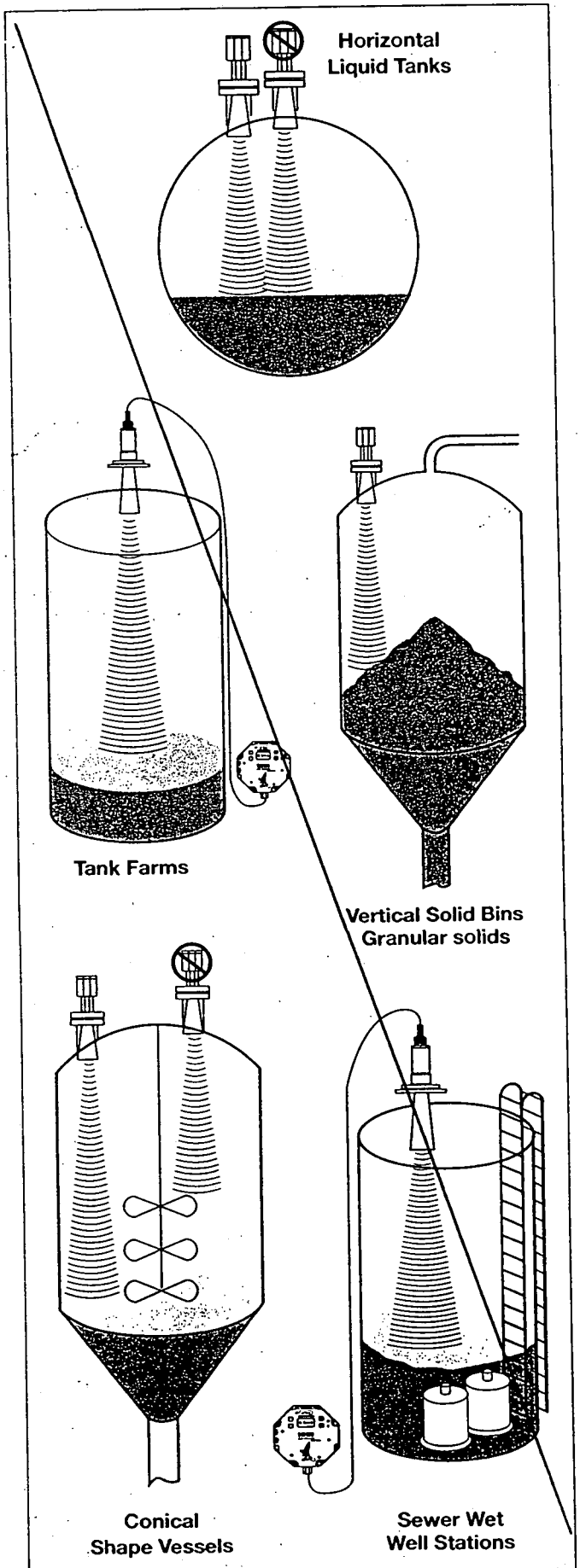
The high sampling rates of the LP20 transmitter produces greater resolution on rapidly changing process measurement applications. After every echo is processed, the display is updated to read feet or meters of space or material and the corresponding output is proportionally updated.

Upon initial application the transmitter will open a 'window' over the entire span and gradually increase the gain of the amplifier until an echo is received. It will then perform a validation sequence and close the window around the level. The transmitter will maintain the window over the echo and ignore signals in front of and behind the valid level. This reduces the chance of false level readings. Periodic interruptions, such as agitators, can be ignored in the validation sequence if proper mounting is used.

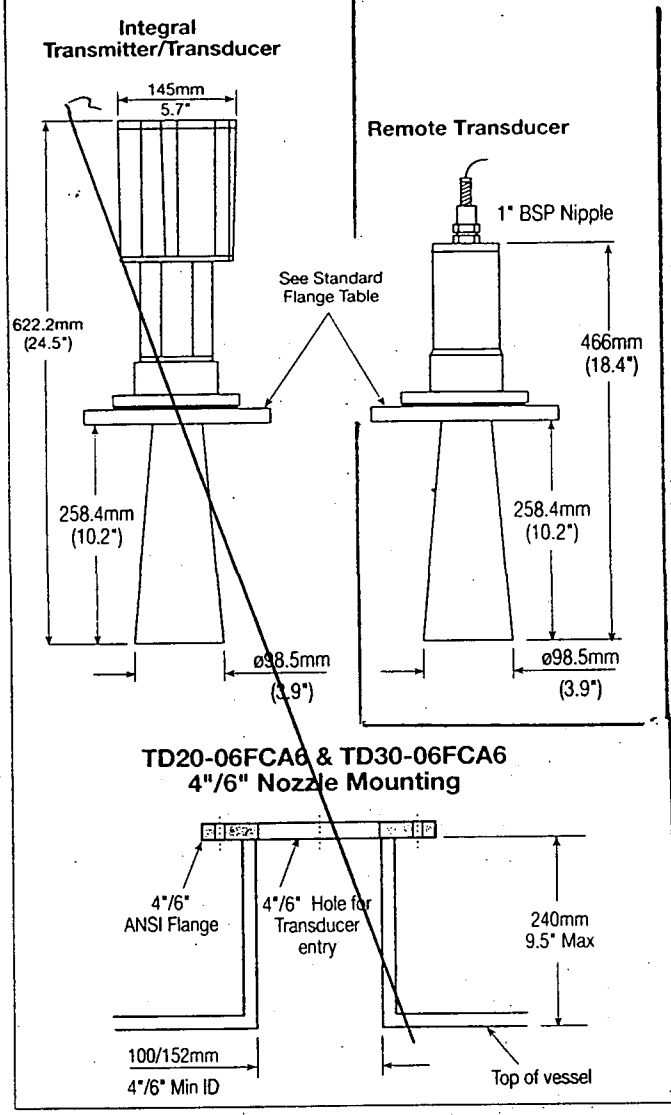
The transmitter also employs dynamic gain control. The transmitter will automatically adjust its gain level to maintain the echo at a predetermined strength. This will allow the amplifier to track the level when intermittent disturbances such as steam or dust occur in the application.

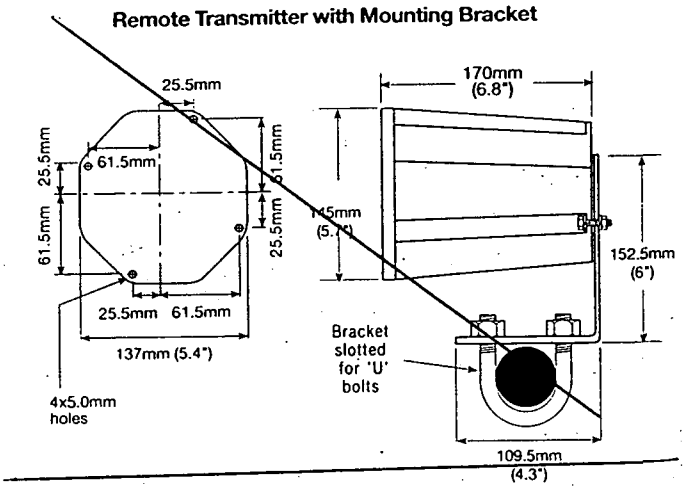
FEATURES

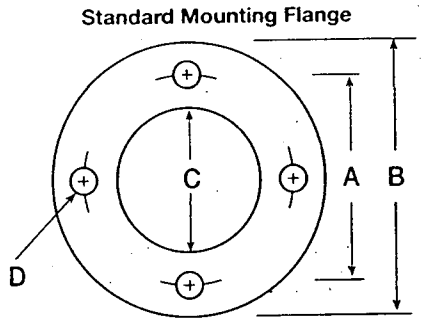
- Optional Hart Protocol Digital Communications
- Low-cost
- 2-wire loop-powered, 12 V to 30 Vdc supply
- 4-20 mA analog output, proportional
- -6°C to 60°C (20°F to140°F) operating temperature range electronics - *See table for transducer temperatures*
- Available in remote mounting for high temperature service
- Eight digit alphanumeric display
- Non-intrusive, high-impact enclosure (sealing IP67) NEMA 4x
- Easy calibration and installation
- Chemically resistant (acids, alkalis, hydrocarbons, oils, fats, detergents, etc.)
- Auto-compensation for temperature, steam, dust condensation, rain, wind, etc.
- Battery and solar panel capability for remote locations (12 V - 250 ohm)
- Agitator discrimination
- Operating performance diagnostics
- Transducer and electronics in same housing (Integral housing)



DIMENSIONS







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FCJ4	175	6.9	210	8.4	100	4	15	0.6
FCA6	241	9.5	279.5	11.0	150	6	22	0.85
FCD6	240	9.4	285	11.2	150	6	22	0.85
FCJ6	240	9.4	280	11.0	150	6	19	0.75

Note: Other flange sizes available.

PART NUMBER	FACING	*BLANKING ZONE	TEMPERATURE RANGE @ OPSIG	RATING
Transducer with Integral Electronics				
LP20-I-6	Teflon	400mm (1.4 ft)	-6° to 60°C (20° to 140°F)	IP67 Class 1 Zone"0" NEMA 4X
Remote Amplifier for Transducers (Listed Below)				
LP20-R			-6° to 60°C (20° to 140°F)	IP67 NEMA 4X
Transducers for Remote Amplifier (Listed Above)				
TD20-06	Teflon with PVC Body	400mm (1.4 ft)	-20° to 70°C (-4° to 160°F)	IP67 Class 1 Zone "1"
TD20-03	Titanium with PVC Body	1mtr (3.3 ft)	-20° to 175°C (-4° to 350°F)	IP67 Class 1 Zone "1"
TD20-23	Titanium with 316 SS Body	1mtr (3.3 ft)	-20° to 175°C (-4° to 350°F)	IP67 Class 1 Zone "1"
TD20-26	Teflon with 316 SS Body	400mm (1.4 ft)	-20° to 70°C (-4° to 160°F)	IP67 Class 1 Zone "1"

Note: *Maximum separation distance for remote units is 15m (50 ft).* ***Note:*** *3A sanitary approved model available.*
Note: *Integral LP20 units available for Intrinsically Safe (Class 1 Zone 0) areas. Consult factory for ordering information.*

* *Blanking and range are affected by adverse conditions. If possible always increase the blanking zone by 50% and decrease the range according to the Enviormental conditions. Consult the factory for further application support.*

LS #3 SPEC 2 of 3

SPECIFICATIONS

Frequency
- 20kHz

Input Voltage
- 12V to 30Vdc

Input Supply Current
- 4.0mA to 20.0 mA

Source
- 2-wire, Loop Power

Maximum Load
- 750ohms @ 24Vdc, 250ohms @ 12Vdc

Blanking Distance
- See table inside

Measuring Range
- Max. range 15m (50 ft)

Resolution
- 2mm (0.08 in)

Electronic Accuracy
- +0.25% of measuring range

Amplifier Operating Temperature
- Max. continuous = 60°C (140°F)
  Min. continuous = -6°C (20°F)
  ** For higher temperatures consult the factory*

Transducer/Amplifier Separation
- 15m (50 ft)

Operating Pressure
- Max. 30 P.S.I. (2 Bar)

Beam Angle
- 6.0°

Analog Output
- 4-20 mA (max. 750 ohms) proportional @ 24Vdc
  4-20 mA (max. 250 ohms) proportional @ 12Vdc

Display
- 8 digit alpha/numeric (meters, feet)

Memory
- Non-Volatile (No Battery Back-up)

Enclosure Sealing
- IP67 (NEMA 4X)

Enclosure Materials
- Valox P.B.T. (High Chemical/Impact Resistance) or optional Lexan clear cover 'Valox' and 'Lexan' are registered trademarks of the General Electric Company

Cable Entry
- IP68 cable gland/5-10 mm O.D. (7/8" entry hole)

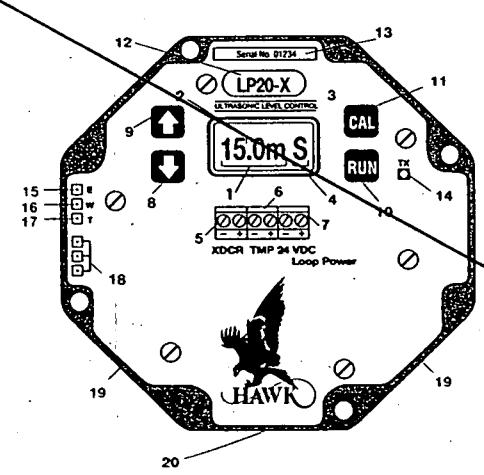
Mounting
- Flange (ANSI, DIN, JIS) Bracket

Cable
- 2-wire shielded cable

Weight
- Typical Integral unit: 6kg
  Amplifier unit: 1kg
  Transducer: 5kg

Approvals
- Meets 3-A sanitary specifications
- Intrinsic safe model available
- CE Approved
- FM APPROVED

TRANSMITTER DESCRIPTION



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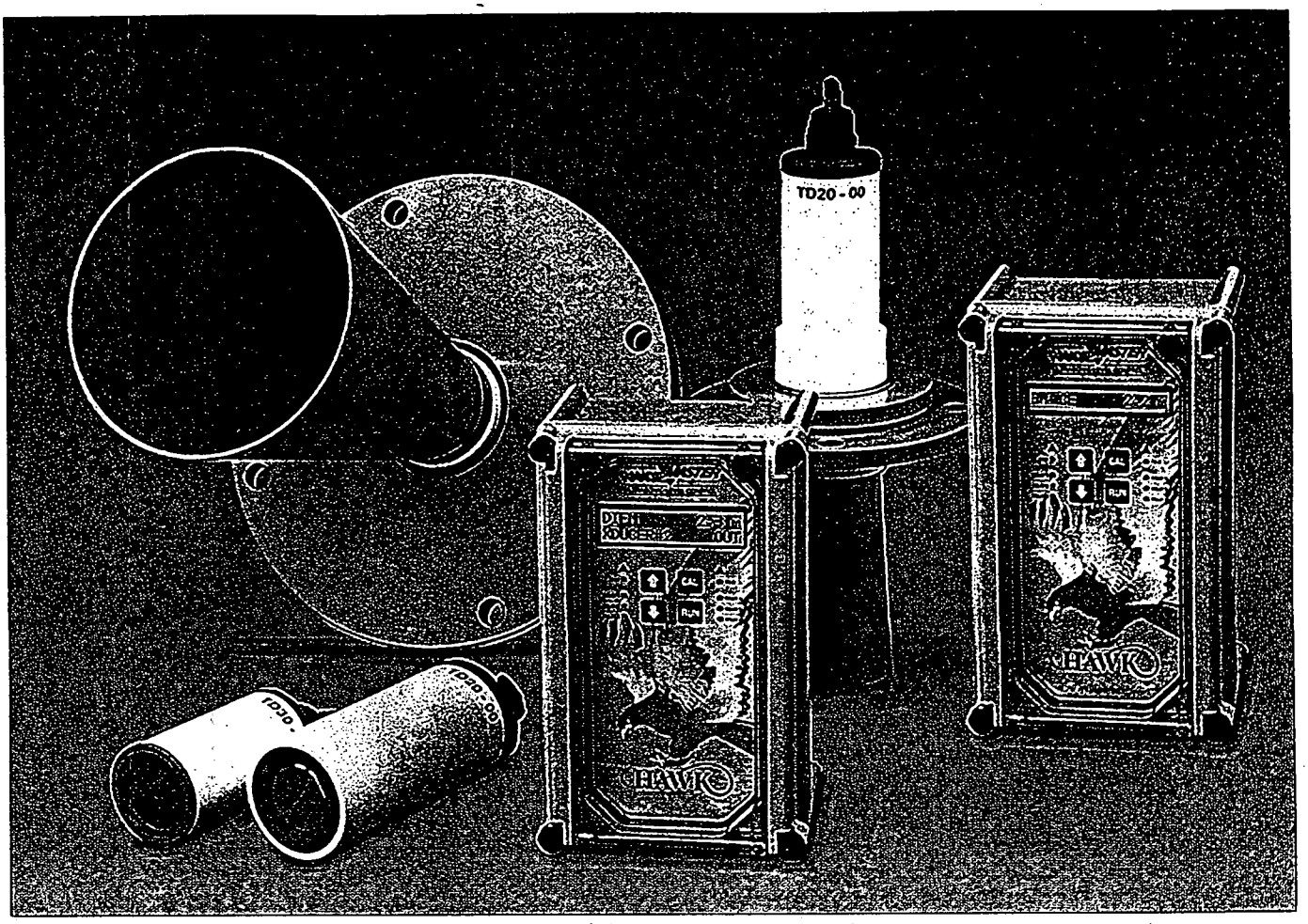
LS #3 SPEC 3 of 3

RANGEMASTER

HAWK



ULTRASONIC LEVEL MEASURING

RMA-10

Single or Dual Transducer Versions

Solid/Liquid Level

10, 20 & 30 KHz Systems

FUNCTION

Continuous level measurement of liquids and solid materials to a maximum range of 15 metres (45 ft).

TYPICAL USES

- Continuous level measurement of sumps, storage vessels and pneumatically-fed silos.
- Profile monitoring of conveyors.
- Control of multiple sump pumps for the sewage industry

PRIMARY AREAS OF APPLICATION

LIQUIDS:

- Food - Corn syrup, chocolate, fructose, soybean oil...
- Paper - Pulp, lime med, starch slurry, tall oil...
- Mining - Acid, slurry, water, caustics, chemicals...
- Power - Lime slurry, make-up water, fly ash slurry...
- Chemicals - Slurries, resins, effluent, chemicals...

SOLIDS:

- Mining - Copper, coal, lime, potash, iron ore, gypsum...
- Paper - Pulp, wood chip, fly ash, bark, wood dust...
- Power - Coal, lime, gypsum, fly ash, water treatment...
- Food - Corn, wheat, sugar, fish meal, soybeans, flour...
- Plastics - Polypropylene, ethylene, PVC, polyethylene...

CE Approved

SAA Class 1 Zone 1
SAA DIP T IP66/IP67 Class II
(Dust Ignition Proof)

AUSTRALIAN DESIGNED & MANUFACTURED

PATENTS PENDING

1 of 5

PRINCIPAL OF OPERATION

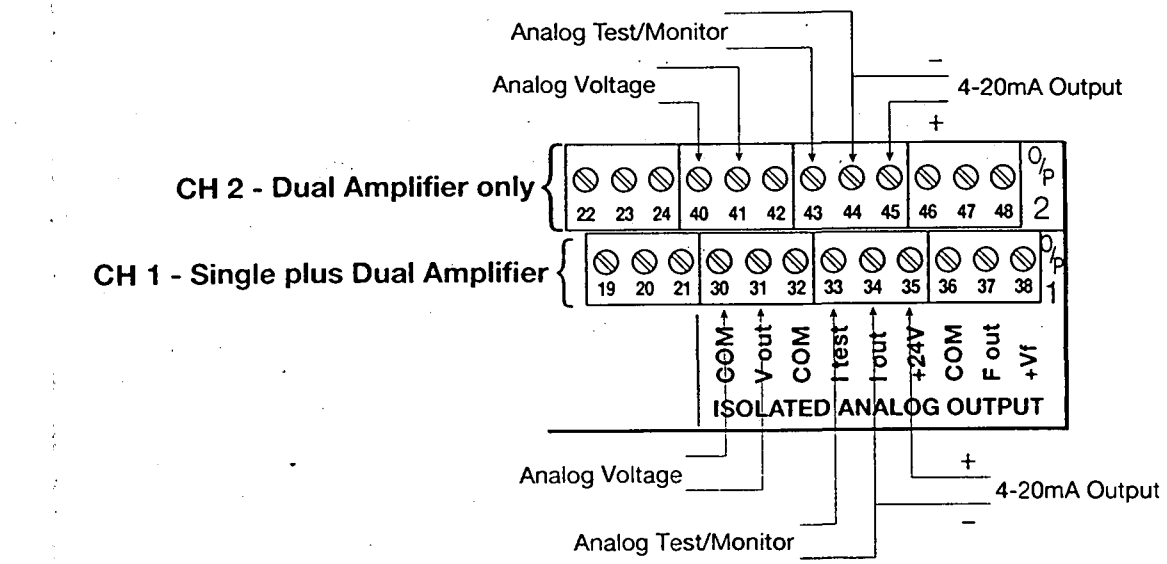
- The ultrasonic unit emits a series of ultrasonic pulses. The frequency of the emitted pulse is selected by the user at initial application of power.
- The transducer options are 10KHz, 20KHz or 30KHz.
- The chosen transducer will determine the selected frequency.
- On receipt of an acceptable signal, the software confirms the echo position, and then optimizes the gain on the receiver to ensure accurate level monitoring.
- To compensate for changing bin conditions, the software adopts pre-selected signal recovery and monitoring settings.
- These factory settings are based on years of experience working in acoustically-difficult application. They typically allow echo monitoring without any on-site adjustment.
- The continuous outputs and switch outputs are updated once a new echo position is confirmed.
- The switching relays may be used inside or outside the adjusted span of the system.

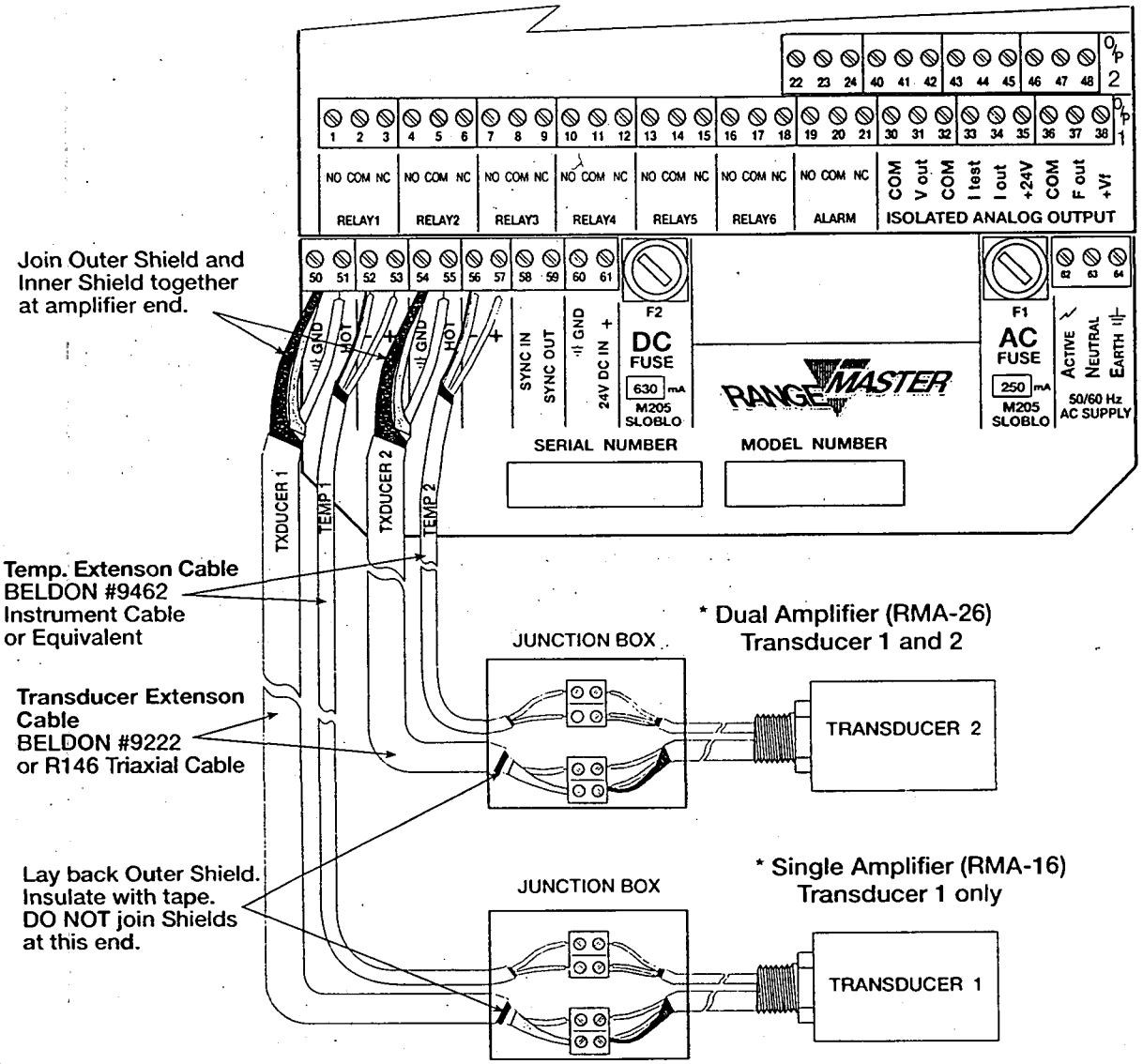
Transducer	Clean Air Distance	Blanking Zone	Beam Diameter
30KHz	12 metres 40 Feet	<300mm <12 Inches	7.50 Degrees
20KHz	20 metres 66 Feet	<600mm <24 Inches	8.00 Degrees
10KHz	75 metres 246 Feet	<990mm <39 Inches	6.00 Degrees
5 KHz	150 metres 492 Feet	<1.2m <48 Inches	7.50 Degrees

FEATURES

- Dual input amplifiers — two silos can be monitored from one amplifier.
- Frequency optimization to suit the application.
- Automatic power and sensitivity control to suit conditions.
- Wide range of signal conditioning options.
- Capability of monitoring powders, solids and liquids under the most difficult filling and emptying conditions.
- Wide range of tracking and recovery schedules (algorithms, procedures, etc.)
- Manual echo selection for difficult applications.
- Alpha-numeric display for easier programming and monitoring.
- Real-time display of gain levels, power level, frequency and signal-to-noise ratio.
- Flexible, multi-point scaling of display/outputs.
- Fail-safe alarm.
- Choice of transducers, dependent upon environment, range and physical dimensions.
- Temperature compensation.
- Up to 6 set point relays.
- Battery-free, non-volitile memory.
- Access codes to prevent unauthorized program changes.
- The analog outputs can be inverted, are galvanically and optionally isolated, and may be programmed anywhere between the maximum range and the blanking distance.
- Standard Outputs: current, voltage.
- Dual version may be programmed for average of difference output.
- Relays maybe distance or temperature dependant.

RANGEMASTER SINGLE/DUAL AMPLIFIERS (Connection Diagrams)





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SPECIFICATIONS

Supply Voltage Options

Nominal	Absolute Limits	
115Vac	97-132Vac	50/60Hz
240Vac	204-265Vac	50/60Hz
24Vdc	20-28Vdc	

Consumption Max. 18VA

Fail-Safe Relay
- 1 SPDT relay 10 Amp, 240Vac resistive
- 2 SPDT relay 10 Amp, 240Vac resistive (Dual)

LED Indicators
- Pulse transmission indicator (red)
- Fail-safe relay indicator (green)
- Level alarm indicators (red)

Display
- 16 (32) character dot matrix LCD

Temperature Range
- Amplifier -40°C to 60°C (-40°F to 140°F).
- Transducer (PVC): -40°C to 80°C (-40°F to 176°F)
- High temperature transducer 225°C (460°F)

Temperature Compensation
- Optional Sensor: TS-20 (refer below)
- Internal temperature compensator available, add 'T' to part number of transducer

Temperature Limits - Flange/Cone
- UPVC 70°C
- CPVC 110°C
- Polyproplene 100°C
- KYNAR 150°C
- Polyurethene 80°C
- Carbon Fibre 225°C

Temperature Limits - Facing Material
- Polyolfin/Elastome 80°C
- Polyolfin/Epoxy 80°C
- Titanium 120/225°C
- Teflon 80°C
- Gylon 80°C

Material of body, can in nearly every instance be P.V.C.

Volumetric Conversion
- Scaleable outputs
- Display units (tons, kgs., lbs., etc.)

Transducer/Amplifier Separation
- 185 meters (600 feet) maximum

Resolution
- 0.1% of range

Accuracy
- 0.2% of range

Enclosure
- UL and CSA listed NEMA 4X
- IP67 to AS1939
- Clear cover with hinged door
- Ultra-violet resistant
- Impact resistant polyester
- Coaxial cable RG-62U (metal conduit required)
- Triaxial cable 9222 (recommended - no conduit required)

Outputs (Isolated)
- A: Current 0/4mA to 20mA (<750ohm)
- B: Voltage 0Vdc to 10Vdc (<50mA)
- Outputs maybe inverted
- Optically and galvanically isolated

SELECTION OF TRANSDUCERS

Simple guidelines on Performance

PROCESS CONDITIONS	DISTANCE 12mts	24mts	72mts
Clean Liquids Under 40°C	30 KHz	20 KHz	10 KHz
Clean Liquid-High Temp. 40°C+	20 KHz	10 KHz	5 KHz
Clean Liquid-Light Foam	20 KHz	10 KHz	5 KHz
Clean Liquid-Heavy Foam	10 KHz	10 KHz	5 KHz
Clean Liquid-Light Steam	20 KHz	10 KHz	5 KHz
Clean Liquid-Heavy Steam	10 KHz	10 KHz	5 KHz
Clean Liquid-Condensation High	20 KHz	10 KHz	5 KHz
Slurry Liquid-Buildup	20 KHz	10 KHz	5 KHz
Slurry Liquid-Buildup-HighTemp.	10 KHz	10 KHz	5 KHz
Solids-Clean No Dust	20 KHz	10 KHz	10 KHz
Solids-Light Dust	20 KHz	10 KHz	10 KHz
Solids Pneumatic Fed	10 KHz	10 KHz	5 KHz
Solids-Dense phase Fed	10 KHz	10 KHz	5 KHz
Solids-Material Falls Thru Beam	10 KHz	10 KHz	5 KHz
Solids-High Temp. 70°C+	10 KHz	10 KHz	10 KHz
Powders-Gravity Fed	10 KHz	10 KHz	5 KHz
Powders-Pneumatic Fed	10 KHz	5 KHz	5 KHz
Powders-Dense phase Fed	10 KHz	5 KHz	5 KHz

If you are unsure, always use the next lower frequency transducer and select the appropriate frequency on the amplifier.

Please check with the factory for longer distances.

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PART NUMBERING

RANGEMASTER TRANSMITTER

(Sample).....RMA 10 - 1 6 - 115

MODEL
RMA - Rangemaster Air

SOFTWARE DISTANCE
10 = 15m
20 = 32m
100 = 100m

TRANSDUCER INPUTS
(1) = Single
(2) = Dual

ALARM RELAYS
(6) Programmable
*Note: 1 fail-safe relay per input standard

INPUT VOLTAGE
115 VAC
220 VAC
240 VAC
(24 VDC standard on all units)

TRANSDUCER

(Sample).....TD10 - 0 0 FCA10T - 0

TRANSDUCER FREQUENCY
(10) 10 KHz
(20) 20 KHz
(30) 30 KHz

HOUSING MATERIAL
(0) U.P.V.C.
(2) Stainless Steel
(4) Polypropylene
(5) KYNAR (P.V.D.F.)

FACING MATERIAL
(0) Polyolfin
(3) Titanium
(6) Teflon
(7) Gylon

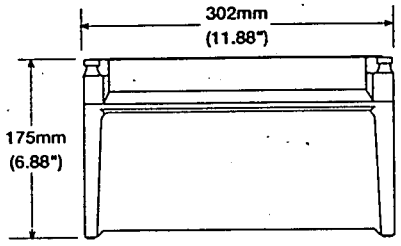
MOUNTING ACCESSORIES
(F) Flange
(C) Focalizer Cone
(A) ANSI
(D) DIN
(J) JIS
(10) Flange/Focaliser Cone Size-mm (in.)
(T) Temperature Compensator Internal

FLANGE & CONE MATERIAL
(0) U.P.V.C.
(2) Stainless Steel
(3) C.P.C.V.
(4) Polypropylene
(5) KYNAR (P.V.D.F.)
(6) Teflon
(7) Carbon Fibre
(8) Polyurethene

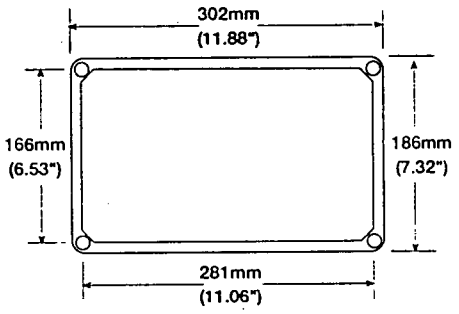
SELECTION EXAMPLES

Acids, Caustics, etc: High temp.	TD30-06FCA4T-4	Liquid ~ 10m(32ft)
Liquids, Slurry (175°C)	TD20-43FCA8T-7	Liquid ~ 15m(50ft)
High temp. (225°C)	TD10-43FCA10T-7	Liquid ~ 50m(165ft)
High temp. (225°C)	TD10-43FCA10T-7	Solids ~ 35m(115ft)

MOUNTING INFORMATION



Mounting holes 5mm / 0.197" Dia. (4 places)



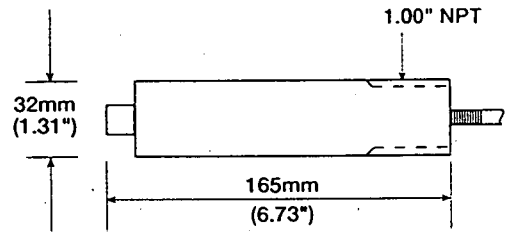
OPTIONS

Optional Temperature Sensor TS-20

Housing Size: 1" x 4" (25mm x 100mm) long.

Temperature Range: -40°C to 120°C (-40°F to 270°F)

Cable: Similar to Type 9462 Belden. Used to compensate for speed of sound variation with temperature change.



Hawk Measurement Systems
13 Ceylon Street
Nunawading 3131 Victoria Australia

Telephone: +61 (0)3 9894 2144
Facsimile: +61 (0)3 9894 2226

INTERNET: http://www.hawklevel.com
E-mail Address: hawkaus@c031.aone.net.au

Represented by:

ADDITIONAL PRODUCT WARRANTY AND APPLICATION GUARANTEES UPON REQUEST.
TECHNICAL DATA SUBJECT TO CHANGE WITHOUT NOTICE.

HA9/97

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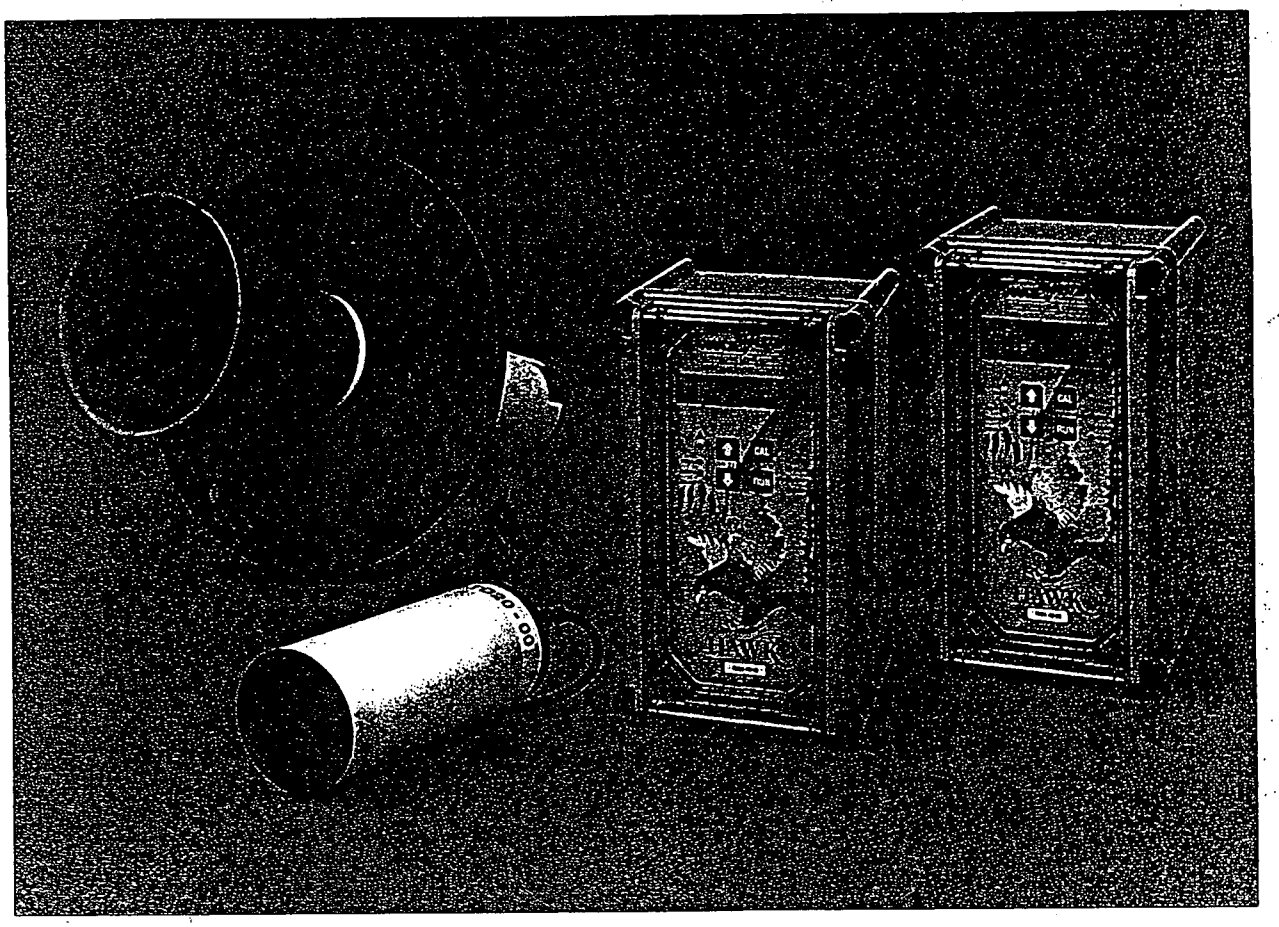
RANGE MASTER
SERIES



Range Master Ultrasonic Level Transmitter

Series 500

Installation and Operating Instructions

HAWK
Measurement Systems

INTRODUCTION

PROPRIETARY NOTICE

The information contained in this publication is derived in part from proprietary and patent data. This information has been prepared for the express purpose of assisting operating and maintenance personnel in the efficient use of the instrument described herein.

Publication of this information does not convey any rights to use or reproduce it, or to use for any purpose other than in connection with the installation, operation and maintenance of the equipment described herein.

WARNING

This instrument contains electronic components that are susceptible to damage by static electricity. Proper ***handling procedures*** must be observed during the removal, installation, or handling or internal circuit boards or devices.

* *Handling Procedure:*

1. Power to unit must be removed.
2. Personnel must be grounded, via wrist strap or other safe, suitable means, before any printed circuit board or other internal device is installed, removed or adjusted.
3. Printed circuit boards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in a protective container for transport, storage, or return to factory.

• *Comments:*

This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.) Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

CONTENTS

PRINCIPLE of OPERATION

The ultrasonic unit emits a series of ultrasonic pulses. The frequency of the Transducer pulse is selected by the user at initial application of power.

The Transducer options are 10kHz, 20kHz 30kHz or 5kHz.

On receipt of an acceptable signal, the software confirms the echo position, then optimises the Gain on the receiver to ensure accurate level monitoring.

When bin conditions change, the software adopts pre-selected signal recovery and monitoring settings.

These factory settings are based on years of experience in acoustically difficult applications. They typically allow echo monitoring without any on site adjustment.

The continuous outputs and switch outputs are updated once a new echo position is confirmed.

The switching relays may be used inside or outside the adjusted span of the system.

INSTALLATION SPECIFICATIONS

AMPLIFIER

Please note that the following specifications must be adhered to or warranty will be null and void.

1. Do not mount the amplifier in direct sunlight.
2. When using a sun shield, make sure it is adequately sized to cover the unit in all seasons. See page 45
3. Do not mount in high vibration areas such as hand rails or rotating plant. Consider using rubber absorption mounts in light vibration areas.
4. Do not exceed maximum or minimum temperature limits - **-20°C to +60°C (-4°F to +140°F).**
5. Do not mount near sources of high E.M.F., large current carrying cables, motor starters of S.C.R. variable speed drives.
6. Check that the power supply is within the specified limits.
7. Remove amplifier board before drilling access entry holes for conduits, etc.

Damage due to misuse or abuse does not constitute a warranty replacement.

TRANSDUCER

Mount the Transducer at least at the minimum blanking distance recommended above the highest level position in the bin, tank, silo etc. These are typical distances only. If possible use the conservative distances or greater. Please note that the blanking distances may vary with temperature. If temperature is high use blanking distances nominated as conservative.

TRANSDUCER	FREQUENCY	BLANKING DISTANCE (Metres)		
		MINIMUM	*NOMINAL	CONSERVATIVE
TD-30	30kHz	0.25	0.3	0.4
TD-20	20kHz	0.3	0.4	0.5
TD-10	10kHz	0.7	1.0	1.2
TD-05	5kHz	1.0	1.2	1.5

** Always use the nominated conservitive values wherever possible.*

1. Ensure Transducer is mounted away from the infeed point, and as near to perpendicular to the product surface as practicable.
2. If using **nipple** mounting do not over tighten the locknuts or have mounting bracket closer than 6mm **from rear** of Transducer.
3. If using **flange** mount:
   i) Use a rubber or neoprene gasket and rubber washers.
4. If the cable is to be extended, it is necessary to use the correct specified cable for the transducer and the temperature sensor.

INSTALLATION SPECIFICATIONS cont'd

BLANKING DISTANCE vs FACING MATERIAL

The blanking distance is the closest return distance an echo from a product may be accepted relative to the Transducer face. If the product goes closer the likelihood of the return echo being accepted as a valid level is diminished. The echo can become immersed in the transmit pulse of the system and consequently can not be identified.

The blanking distance is a variable. This distance is influenced by the gain of the amplifier. It the gain is high the blanking is extended. If the gain is low, the blanking is diminished. The gain of the amplifier automatically adjusts for the differing accustic reflectivity of various surfaces and environments.

The RangeMaster has automatic blanking depending upon the gain value.

Digitising of the transmit pulse minimises the potential problems described above.

The Transducer type gives the basic blanking distance. The blanking distances are influenced by gain. The facing material influences the gain value. When installing the Transducers it is always best to be conservative in the 100% material level and leave sufficient space to ensure under no conditions will the return echo enter this blanking zone.

It is important to note that as the level increases, the echo naturally will become bigger. This larger return echo will ensure the gain automatically is reduced as is the blanking required.

If necessary you can lift the Transducer to give the space required for correct operation. Always try and stay within the guide lines to give the very best performance of the system.

If in doubt - be conservative on these distances.

INSTALLATION SPECIFICATIONS cont'd

MOUNTING the TRANSDUCER

The mounting of the Transducer is CRUCIAL to proper operation of the RangeMaster.

The positioning of the Transducer, in general, can be determined by taking the distance from the vessel wall to the infeed and then placing the mounting flange 1/3 of this distance from the wall and 2/3 of the distance from the infeed. This is a general rule. If you are unsure where the optimum mounting location on your vessel is, please contact your local **Hawk** representative. This is an **important** step for optimum performance of the unit.

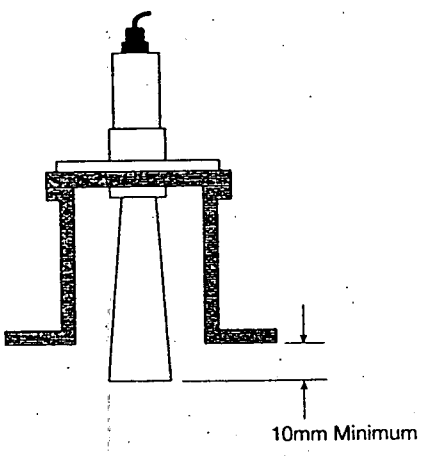
The Transducer must be mounted correctly and have adequate line-of-site to the product being measured. A **Focaliser Cone** should be used on the Transducer to better focus the return echo energy. The horn attached to the Transducer must protrude into the vessel by a minimum of 2" (50mm). If the Transducer needs to be positioned above the roof line of the tank, it is necessary to use an appropriate sized standhorn. These standhorns are a special size and shape. (Please see pages 39 - 40).

When mounting the Transducer on top of the vessel, use a nozzle and flange. The height of the nozzle should allow the horn to protrude into the vessel.

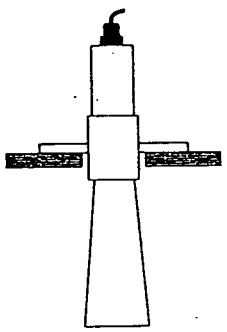
Use common sense in the mounting. A clear line of sight is preferred. A few minutes taken to correctly mount the unit will ensure optimum performance.

The drawing below should help in this matter.

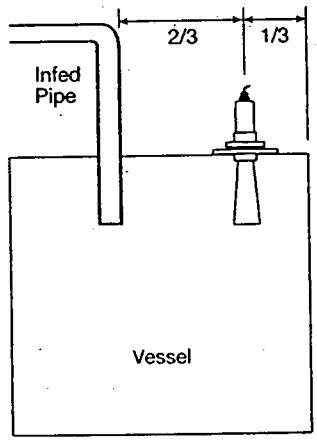
Nozzle Mount



Flush Mount



Mounting Position



(see page 3 for blanking distance recommendations)

SPECIFICATIONS

AMPLIFIER RANGE

RMHA125/400	0 - 125m (375 ft)
RMA100/240	0 - 100m (240 ft)
RMA 20/80	0 - 30m (90 ft)
RMA 10/40	0 - 15m (45 ft)

TRANSDUCER FREQUENCY

TD30	30kHz
TD20	20kHz
TD10	10kHz
TD5	5kHz

ACCURACY

0.2% of Full Range

RESOLUTION

0.1% of Range

DISPLAY

Single 16 Character Alpha Numeric LCD
Dual 32 Character Alpha Numeric LCD
Adjustable Viewing Angle

MEMORY

All parameters stored in non volatile EEPROM. Data retained for 10 years without power.

OPERATING TEMPERATURE

Amplifier	-20° to 60°C (-4° to 140°F)
Transducer	-20° to 80°C (-40° to 176°F)

Max for special transducer 225°C

ANALOG OUTPUT CURRENT

Nominal range (adjustable)
ØmA - 20mA
4mA - 20mA
Voltage Level 7 - 32Vdc
Over Voltage Protected
Reverse Polarity Protected
Maximum Load: 750 Ohms @ 24Vdc
Connection - Current Drive or Modulating
Optically Isolated to 3000V Continuous

SUPPLY VOLTAGE

110Vac	50/60Hz	+/- 15%
240Vac	50/60Hz	+/- 15%
24Vdc		+/- 15%

POWER CONSUMPTION

Max 18VA on ac power
Max 1 amp on 24Vdc

LEVEL ALARM RELAYS

S.P.D.T. 10 amp/280Vac

RMA-16	6 x SPDT (Single)
RMA-26	6 x SPDT (Dual)

Relay contacts must be protected by fuses with appropriate characteristics.

FUSE PROTECTION

250mA - 110Vac/240Vac
630mA - 24Vdc

FAILSAFE RELAY

1 x S.P.D.T	10Amp/280Vac Single
2 x S.P.D.T.	10Amp/280Vac Dual

ENCLOSURE (Amplifier)

IP67 (NEMA 4X)1(UL Approved)
Width Height Depth
186mm x 302mm x 175mm
- Polyester F.R.P.

ENCLOSURE (Transducer)

IP68

SPECIFICATION cont'd

TRANSDUCER

HOUSING MATER1AL:

(1) U.P.V.C.
(2) Stainless Steel.
(4) Polypropylene
(5) KYNAR (P.V.D.F)

FACE MATERIAL:

(0) Polyolefin/Elastomer
(3) Titanium
(6) Teflon
(7) Gylon

FLANGE MOUNTING:

Ansi, JIS, DIN, others available.
(See Drawings page 40.)

NIPPLE MOUNTING:

1.00 N.P.T. BSP.
Other sizes available.
Consult representative / factory.

CABLING

To extend the Transducer cable use only:

(a) R-146 Tri-axial Cable (first preference).
(b) Belden 9222 Tri-axial Cable (first preference).
(c) RG-62U Coaxial Cable (must be run in grounded metal conduit).

For alternative cable consult factory.

Maximum distance to amplifier is 185 metres.

Note: *Longer distances to amplifier are possible. Please consult the factory or your nearest Representative.*

Do not use other types of cable - even if your suppliers tell you it is 'requivalent' (it rarely is). If you can not locate any of the above cables, please contact your nearest representative or contact **Hawk.**

Note: *Wrong cable can seriously affect the ability of the unit to operate correctly.*

To extend the temperature sensor use:
Type 9462 Belden or similar.

CONNECTION COMMENTS

BEFORE POWER UP

After power connections are checked, ensure the Transducer cable is not reversed. Take special note of the termination to ensure there is correct connection from this cable to each connection point on the terminal strip.

Solder connections are recommended if there is extension cable used. Ensure the correct extension cable is used and it is wired correctly with special emphasis placed on the ground connections. The shields must not be connected at the junction box, only at the amplifier end. This gives an open circuit for the earth at the Transducer junction box and a short circuit at the amplifier end. The short circuit to ground in the cable ensures maximum signal interference rejection at the amplifier. Any noise which is induced in the cable is shunted to the amplifier ground and will minimise noise interference in the amplifier. Reversed shield/hot connection may damage the Transducer and certainly will create an extremely electrically noisy environment, especially if variable speed drive solenoids or starters are in the vicinity.

Please refer to page 37 for correct wiring and connection information.
It is *very* important to follow the specified wiring and connection instructions.

INSTALLATION

RANGEMASTER AMPLIFIER

The amplifier must be mounted correctly in the specified manner *See page 3.* If the unit is to be mounted in direct sunshine it is advisable to use a weather protector sun shield.

See Page 45 for an example of this.

OPERATIONAL CHECK BEFORE POWER UP

Ensure correct supply voltage is connected.

TRANSDUCER SELECTION AND MOUNTING

To achieve the best echo possible:

1. Mount the Transducer as close as possible to perpendicular to the product profile being measured.
2. Mount the Transducer out of the path of normal product flow.
   See notes page 41, 42, 43
   Always use common sense to look for the best position.
3. **Ensure the Transducer frequency selection in software corresponds to theTransducer used.** Transducer selection for the application is important. If in doubt use the next lower frequency transducer available to ensure best performance. The lower the frequency the better the performance in difficult applications. Your representative should be able to guide you on the frequency selection.

30kHz	Liquids/simple solids
20kHz	Agitated liquids/dust free solids
10kHz	Steam/foaming liquids/dusty solids/pneumatic filling
5kHz	Steam/foaming liquids/dusty solids, powders etc

Distance is also important

TRANSDUCER	DISTANCE	* BLANKING ZONE		
		Minimum	Nominal	Maximum
TD-30	10m	0.25m	0.3m	0.4m
TD-20	20m	0.3m	0.4m	0.5m
TD-10	75m	0.7m	1.0m	1.2m
TD-05	125m	1.0m	1.2m	1.5m

** Typical values only, use the largest blanking zone which is practical*

INSTALLATION cont'd

LIQUIDS:

Mount the Transducer as perpendicular to the liquid surface as possible.
DO NOT mount the Transducer near an inflow pipe. If an agitator is present, make sure the position for the Transducer has the minimum interference from the agitator blades.

SOLIDS (Powder, ore, etc):

Mount the Transducer towards the draw point of the vessel. A position 2/3 of radius from the vessel infeed and the outer wall is advisable. It is better to be a little closer to the wall than the infeed if the wall is smooth.

TRANSDUCER SELECTION and MOUNTING

The important part of Transducer selection lies in the correct operational frequency. In general, the lower the frequency, the further the unit is capable of operating. Hence, if you have very dusty application you should use Low Frequency Transducers e.g. 10kHz or 5kHz.

The long wavelength of these low frequencies allows the sound to travel through the environment with minimal losses of energy. This simple characteristic of our Transducers will give far greater reliability in dusty conditions than normally could be expected.

When the unit is installed, it is simple to check the performance of the unit and the security of operation via the diagnostics on the front panel. The Signal to Noise value gives this important information. The larger the value the better the performance.

Marginal but acceptable performance would see a Signal to Noise of about 5%. Lower than this value may require a lower frequency Transducer to give a better response.

See page 33 for the diagnostics information.

ENTERING DATA

All software adjustments are achieved via the four PUSHBUTTONS on the front panel of the RangeMaster amplifier.

(A) Increments Display (Increase)

(B) Scrolls option within the parameter selection (Forward direction)

(A) Decrements Display (Decrease).

(B) Scrolls variables of parameter selection (Reverse direction).

(A) Calibrate pushbutton.

(B) Operating pushbutton in a momentary action steps parameter display individually.

(C) Holding pushbutton down scrolls parameter display continuously. When CAL is pressed, the selection is made.

(A) Run pushbutton - only used when selections are finished.

(B) Operating pushbutton will store the current selection place via CAL in memory, then check the validity of the selection and return to the normal operating RUN mode.

Press the CAL pushbutton while the unit is operating to program RangeMaster.

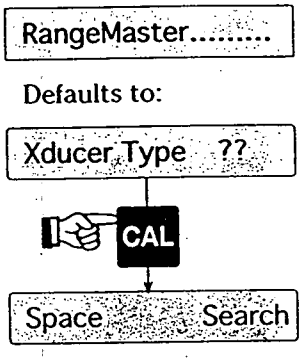
UP or DOWN	**Pushbuttons change options in a parameter. At the top level it selects the group.**
CAL	**Pushbutton accepts selection and moves onto the Next setting.**
RUN	**Pushbutton store all selection and returns to the operating mode.**

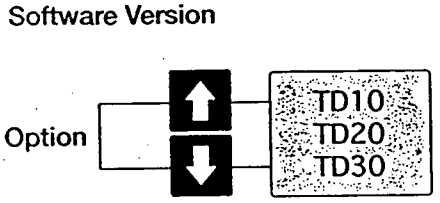
Use this method and the software tree to arrive at the different settings as dicussed in this manual.

SET-UP: Single Channel

SINGLE AMPLIFIER

The selection is identical to a Dual Unit, except there is no option for the second channel.





The unit will continue to SEARCH until a valid acceptable echo is detected. When detection occurs, the display will show the distance and the mA output (and relays if applicable) will update to the values dependant upon the SPAN of High and Low Level.

If a RMHA amplifier is used there is no selection of transducers. It automatically sets itself for optimum control at 5kHz.

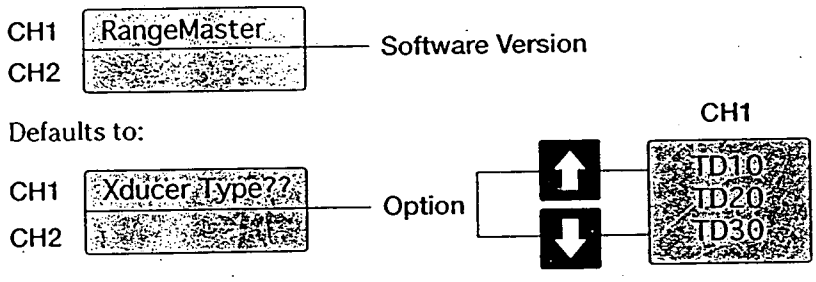
SET-UP: Dual Channel

DUAL AMPLIFIER

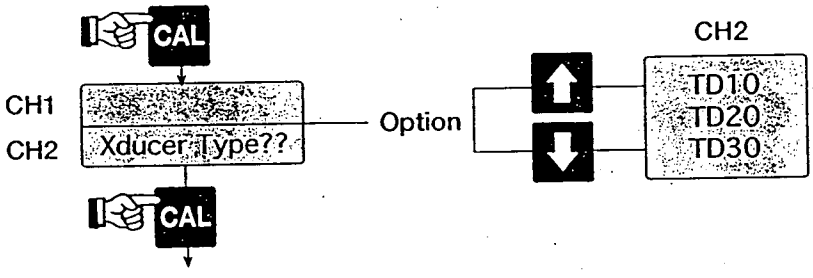
If the frequency of the Transducers has been previously selected, the amplifier will automatically go into a SEARCH mode.

If you have filled out the Application Specification sheet the unit should be pre-programmed for optimum control and the Transducers selection will already be entered.

If Transducers have not been selected, the following will be displayed:

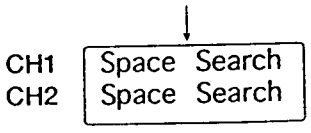


Once the transducer type is entered,



This then will initiate the SEARCH in both channels alternating between CH1 and CH2.

If no choice is made on CH 1 or CH2 and CAL or RUN is pressed this will automatically take out that transducer. TXDUCER OUT on the relevant channel will be displayed.

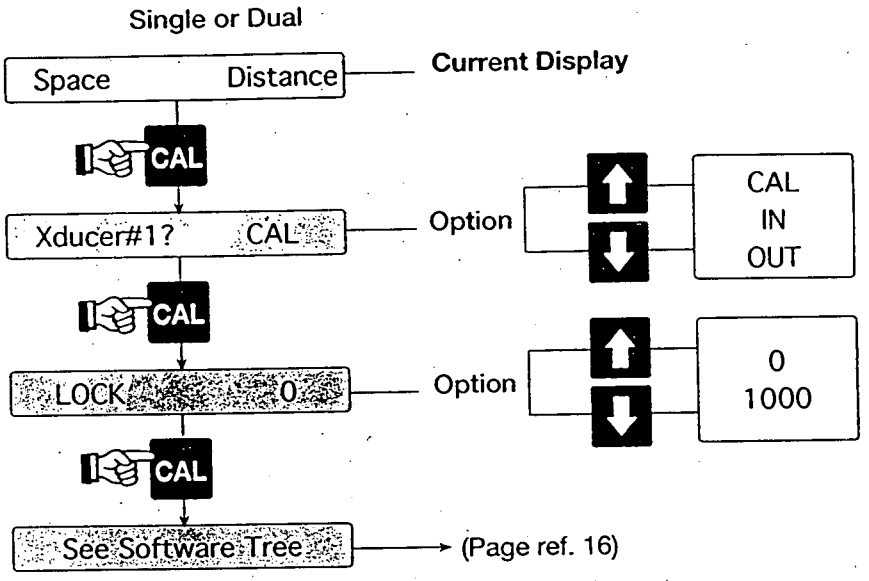


The red LED pulsing indicator will first show on CH1 then CH2. After the echo is located, the green light of each Channel should illuminate and the failsafe relay will be energised.

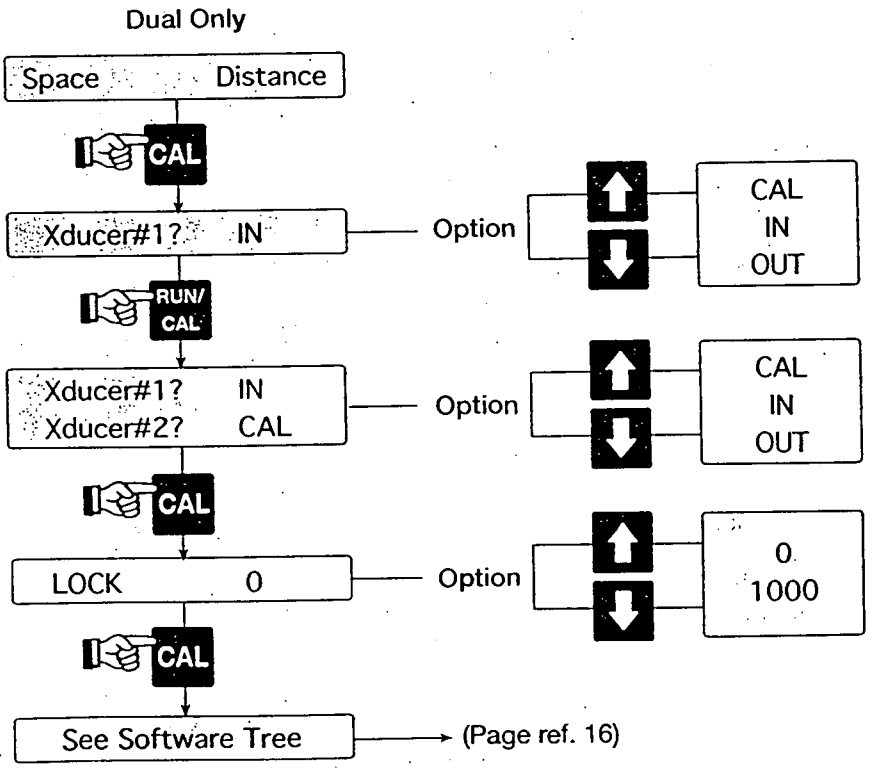
ACCESSING PARAMETERS

VERSION 500

CHANNEL 1:

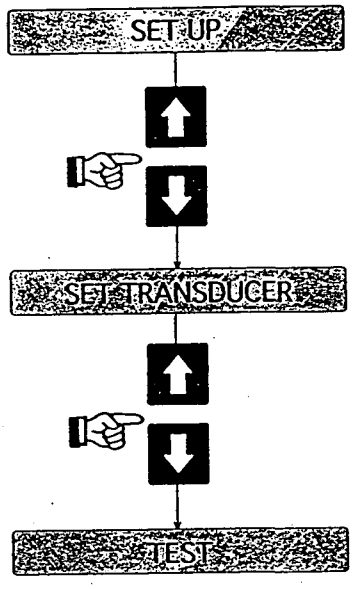


CHANNEL 2:



PARAMETERS ~ VERSION 500

PARAMETER HEADINGS

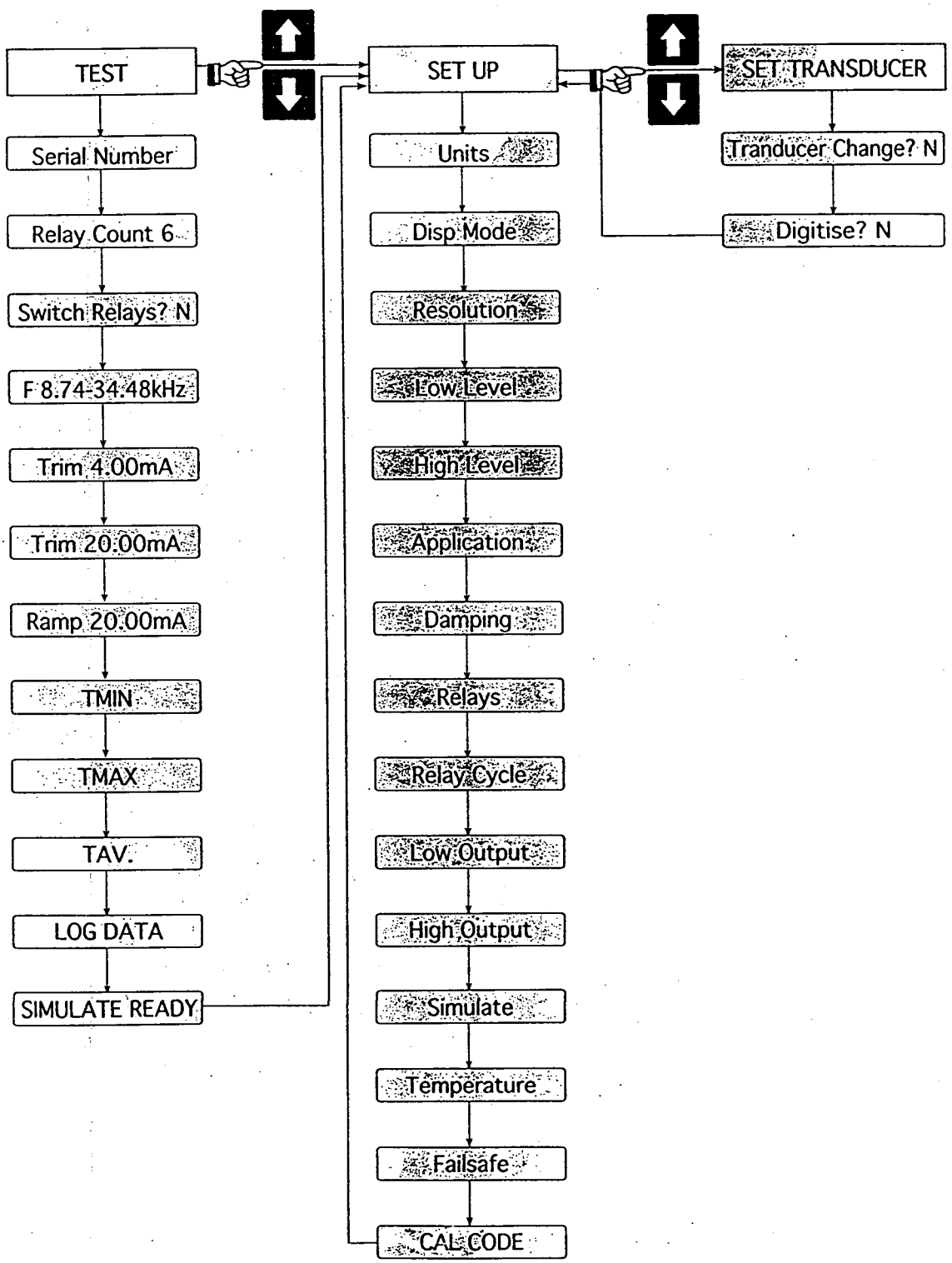


These headings are displayed using the UP/DOWN pushbuttons.

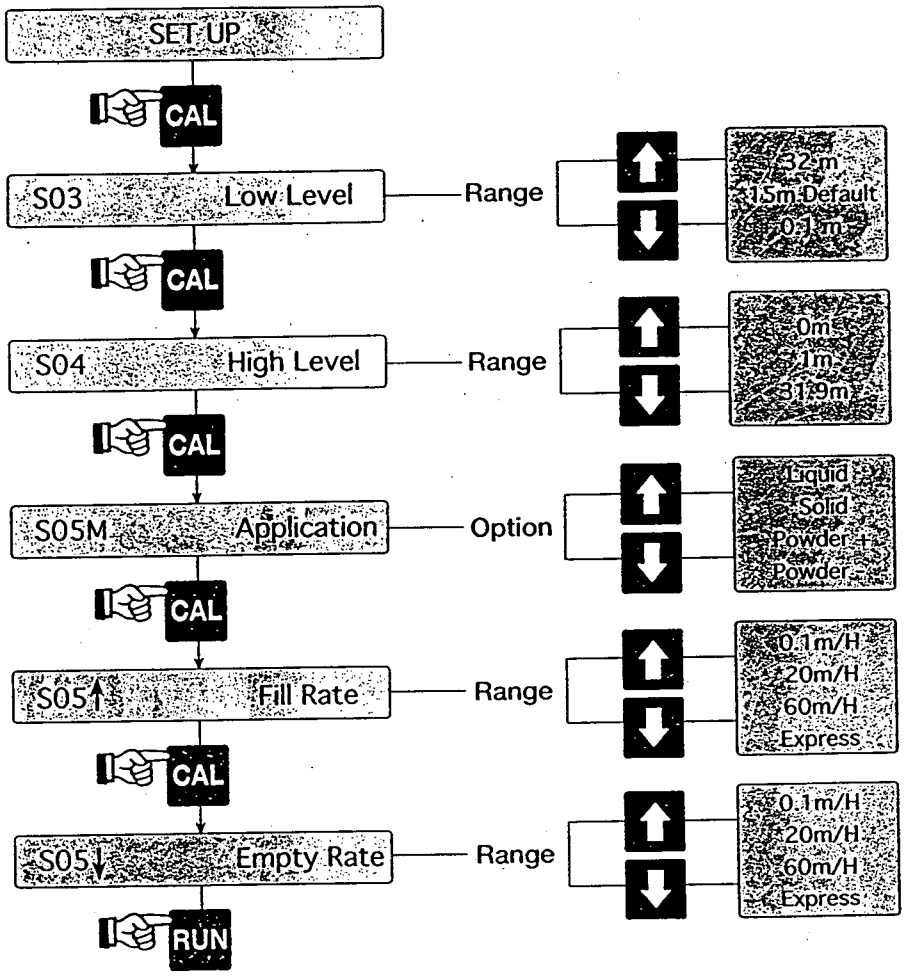
The flow chart and explanations follow for:

1. Set Up
2. Set Transducer
3. Test

SOFTWARE TREE OVERVIEW RANGEMASTER

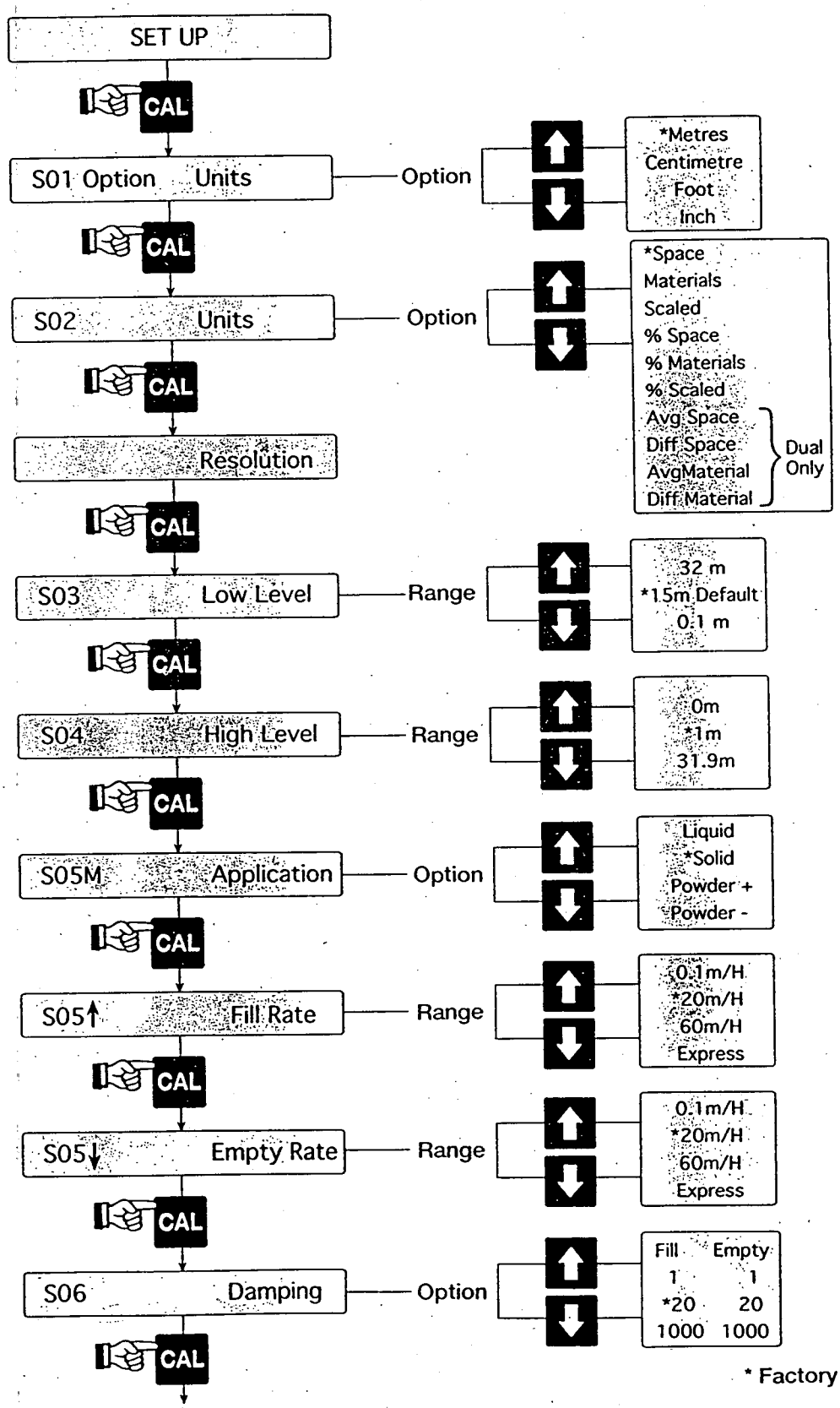


QUICK START ~ FLOW CHART

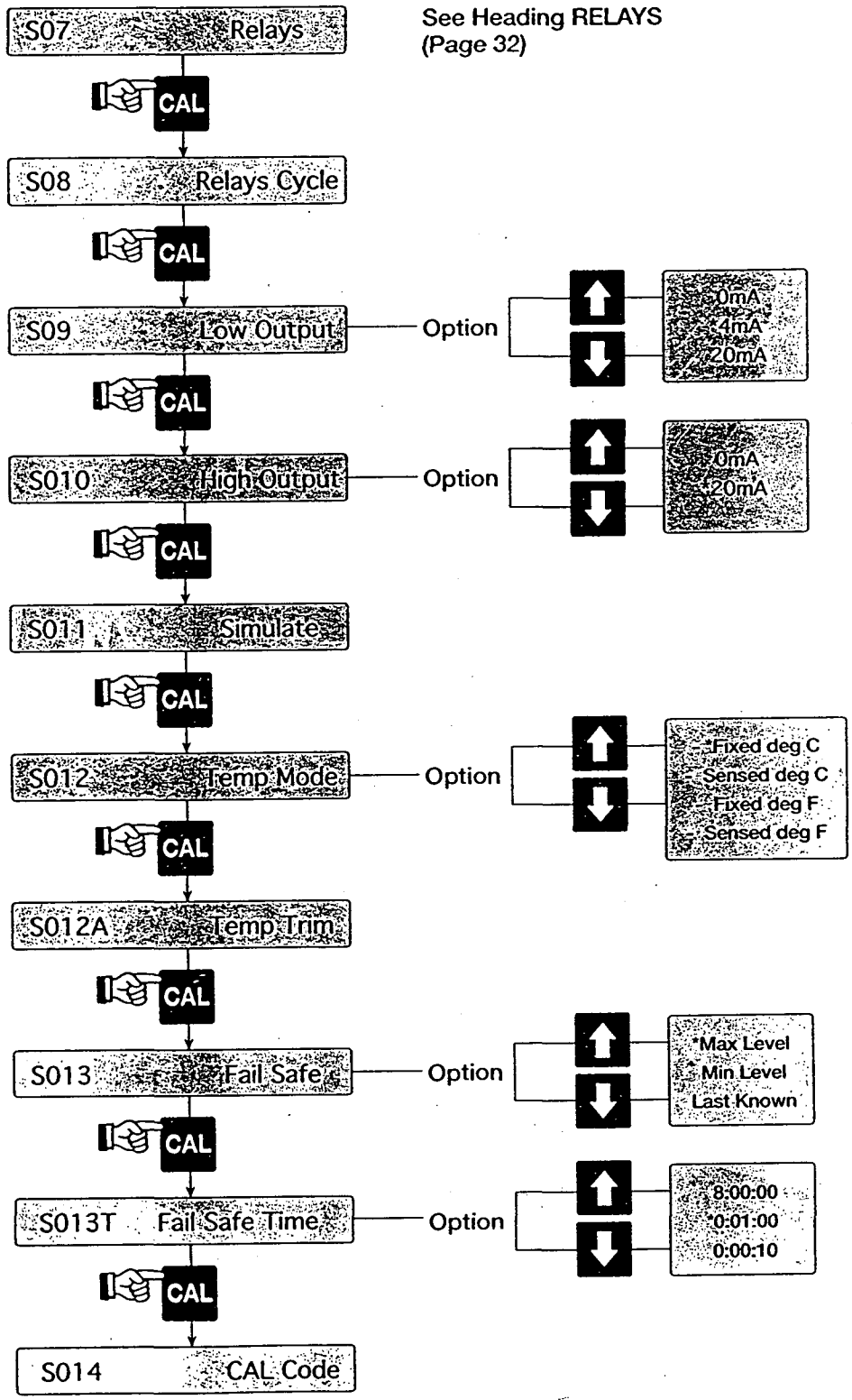


* Factory Default

SET-UP~ FLOW CHART



SET-UP ~ FLOW CHART cont'd



* Factory Default

SET-UP ~ DESCRIPTION

S01 UNITS

Choices: METRES, CENTIMETRES, FEET, INCHES.
These are the units indicated on the display

S02 DISP MODE

Choices: SPACE, MAT'L, SCALED, % SPACE, % MATERIAL, % SCALED FOR A SINGLE UNIT. A DUAL IN ADDITION HAS DIFF SPACE, DIFF MATERIAL, % DIFF SPACE, % DIFF MATERIAL.
Both space and material are displayed as distance or percentage, and scaled in the units chose. After the DISP MODE selection RESOLUTION is shown – adjust the resolution to establish the required number of decimal places on the display.

S03 LOW LEVEL

Set level corresponding to the position at the bottom of the span.
There should be a difference between EMPTY LEVEL and LOW LEVEL to ensure RangeMaster operates slightly past the bottom of the vessel.
This is the level corresponding to the lower analog out value.

S04 HIGH LEVEL

Set level corresponding to the position at the top of the span.
This is the level corresponding to the higher analog out value.

S05 APPLICATION

The user chooses the type of material that is to be monitored. The unit will default to appropriate signal control for the material chosen. Four different kinds of material are allowed for:

Liquids ~ applies to any liquid in any vessel - open or closed type.

Solids ~ applies to any solid material of any size from lump to fines.

Powders + ~ applies to powder where the solids heading has not produced the output required.
Typically larger granule powder.

Powders - - ~ applies to very fine powder, where Powders + has not produced the output required.
Typically, for very fine powders.

S05 FILL RATE

This is the fill rate in metres/min the level is expected to rise. It is better to have a 20-30% margin (faster) to ensure the unit will correctly follow the rate you enter. The rate is in metres/minute (or feet/minute).

S05 EMPTY RATE

This is the empty rate in metres/min the level is expected to fall. It is better to have a 20-30% margin (faster) to ensure the unit will correctly follow the rate you enter.

S06 DAMPING

Depending upon the speed of filling and emptying chosen, the damping may be set for faster reaction.

A larger number will give more damping than a smaller number. Hence use a low number e.g. 25 for fast fill and 100 for slow emptying. Fill 25 ⎍ 100 empty. This should be adjusted to a rate that follows the level as smoothly as possible. The formula is:

$$\text{STEP} = \frac{1}{1+k} \times (\text{Old level} - \text{New level})$$

'k' is the DAMPING factor

STEP is the change in distance at eachpulse, recalculated at each pulse.

SET-UP ~ DESCRIPTION cont'd

S07 RELAYS

With a dual amplifier, it is first necessary to assign each relay to a Transducer.

(A) ASSIGN THE RELAY TO AN OPERATING MODE.

This allows the user to define the relay operating mode.

1. **OFF - PROGRAMMED OFF** (Always de-energised).

2. **ENERGISED MODE** – The relay is normally energised. It is de-energised when the material level rises above LEVEL 1 and remains de-energised until the level falls below LEVEL 2.

   Note: *L1 and L2 are entered as distances from the Transducer face.*

3. **DE-ENERGISED MODE** – The relay is normally de-energised. It is energised when the material level rises above LEVEL 1 and remains energised until the level falls below LEVEL 2.

   Note: *L1 and L2 are entered as distances from the Transducer face.*

SET-UP ~ DESCRIPTION cont'd

S08 RELAY CYCLE

This function allows Relays number 5 and 6 to alternate their set points sequentially from one to the other.

Relay 5 will switch at its set point(s).

On the next pumping cycle Relay 5 will take Relay 6 settings and Relay 6 will take Relay 5 settings.

This will again alternate for the next pump cycle.

S09 LOW OUTPUT

This is the low span of the analogue output corresdponding to the low level of the vessel.

This can be set for ØmA or 4mA or alternatively, inversed to give 20mA output at low level output.

S10 HIGH OUTPUT

This is the high span of the analogue output corresdponding to the high level of the vessel.

This can be set at 20mA or alternatively, inversed to give a zero or 4mA output at high level output.

S11 SIMULATE

Range: EMPTY LEVEL to 0.0

By using the UP and DOWN pushbuttons, the RangeMaster will output according to the level displayed.

Left side indicates 'space from transducer'. Right side indicates the 'scaled display value'.

S012M TEMP MODE

Choices:

FIXED °C, SENSED °C,
FIXED °F, SENSED °F.

If a temperature probe is installed, use sensed.

If no temperature probe is fitted, adjust setting to temperature of application.

S12A TEMP TRIM

This is used to install in the amplifier the information relating to the air temperature within the vessel.

The options are fixed degree based upon not needing a temperature sensor and sensed degree based upon the use of an integral or remote temperature sensor.

The temperature change will cause a change in the speed of sound through air. This is 0.17% of the distance displayed per degrees C temperature change.

S13 FAILSAFE

S13M This is the level assigned to the unit which designates where the output will go in a failed condition.

This can be Min, Max or Last Known level.

S13T This is the given time taken before the unit gives a failsafe analogue output.

Adjustable from 0:00:10 to 08:00:00 hours.

S14 CAL CODE

If used, a number must be entered to gain access.

SCALING VESSEL SHAPE

Under Parameter **[S3] DISPLAY MODE** there are six selections.

SPACE MATERIAL SCALED % SPACE % LEVEL % SCALED

The scaled selection allows the RangeMaster unit to display the level as volume or mass in a selected unit.

(1) In a Dual unit there is also the following:

Differential Space
% Differenital Space
and
Differential Material
% Differential Material

Enter the **BASIC SETUP** branch of the software tree and use the **CAL** pushbutton to locate **S-2.**

Display shows:

S-2	DISP MODE

then

S-2	SPACE

(2) Using the UP and DOWN pushbuttons select SCALED.

Display shows:

S-2	SCALED

(3) Press CAL

Display shows:

RESOLUTION	1

Indicating a resolution of one unit.
Use the **UP** and **DOWN** pushbuttons to change the value.

Choices are: 1, 0.1, 0.01, 0.001

1 = no decimal point.

01 = 2 digits after the decimal point.

(4) Press the CAL pushbutton to accept the value. The display changes to:

ENG UNITS	K

Kgs, Tonnes, Litres, etc

Use the **UP** and **DOWN** pushbuttons to select the units required from the selection at the top of the page and press **CAL** to accept the units.

Displayshows:

100%FS	5000

(5) Indicating the value representing the Full Scale (amount of scaled product to fill the vessel) **followed by the units selected. Use the UP and DOWN pushbuttons to select the value needed.**

Adjustable from 0 to 10000

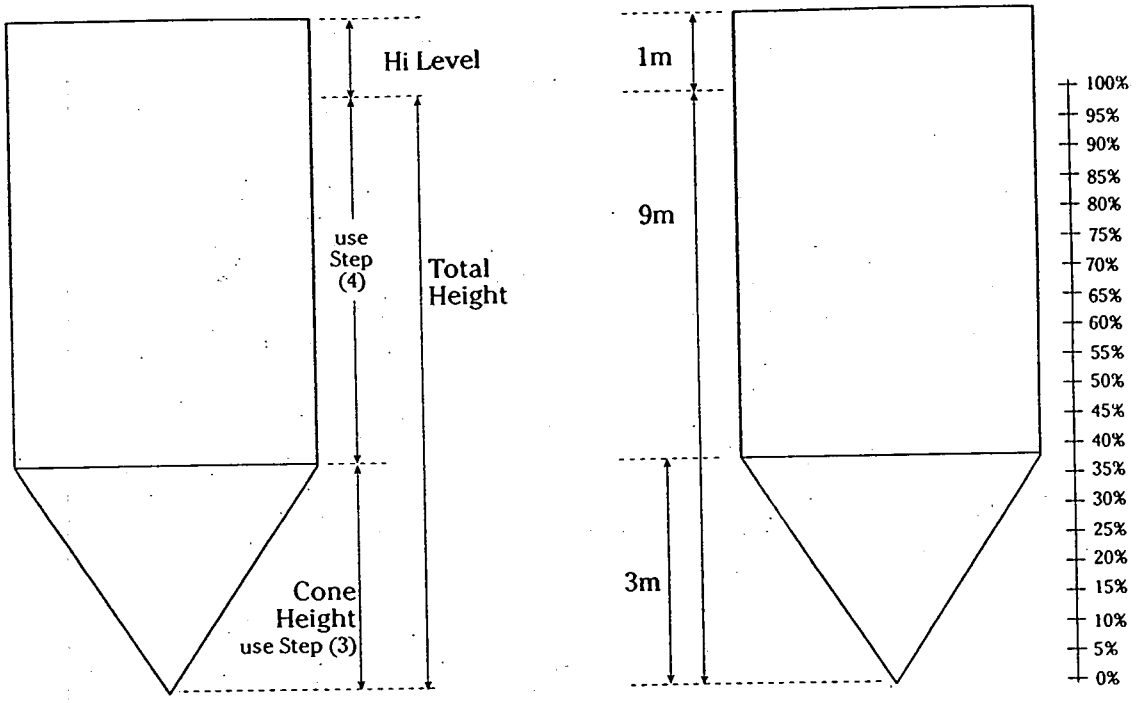
Press **CAL** display shows:

1	0.0>0.0

There are twenty one locations to store scaled values beginning at 0% of operating range and incrementing every 5% up to 100%. Both left and right values are adjustable. The left value represents the distance. The right value represents the scaled units. It is simply a matter of forming a table of values relating distance to scaled values and entering twenty one points. The positions lying between subsequent points are derived via linear interpolation. As usual press **UP** or **DOWN** pushbuttons to change values and **CAL** to accept them.

***Note:** Distance 0% to 100% is from Low Level to High Level.*

SCALING VESSEL SHAPE cont'd



Scaling data should be entered in percentage of distance and percentage of volume for all 21 points.

POINT	% DISTANCE	% VOLUME
1	0%	0%
2	5%	Calc. Volume %
3	10%	Calc. Volume %
4 to 20	15% to 95%	Calc. Volume %
21	100%	100%

Cylinder Volume = πr^2 x (Total Height - Cone Height)

Cone Volume = 1/3 πr^2 x Cone Height

Steps to calculate volume as percentage of distance are as follows: for point 2 in above table.

(1) Calculate distance by using **Total Height** x 5% (5% = percentage of height required.)

(2) **If the distance calculated in Step (1) – is less than or equal to Cone Height then use Step (3) – if the distance is greater than Cone Height then use Step (4).**

(3) Calculate the volume as percentage:

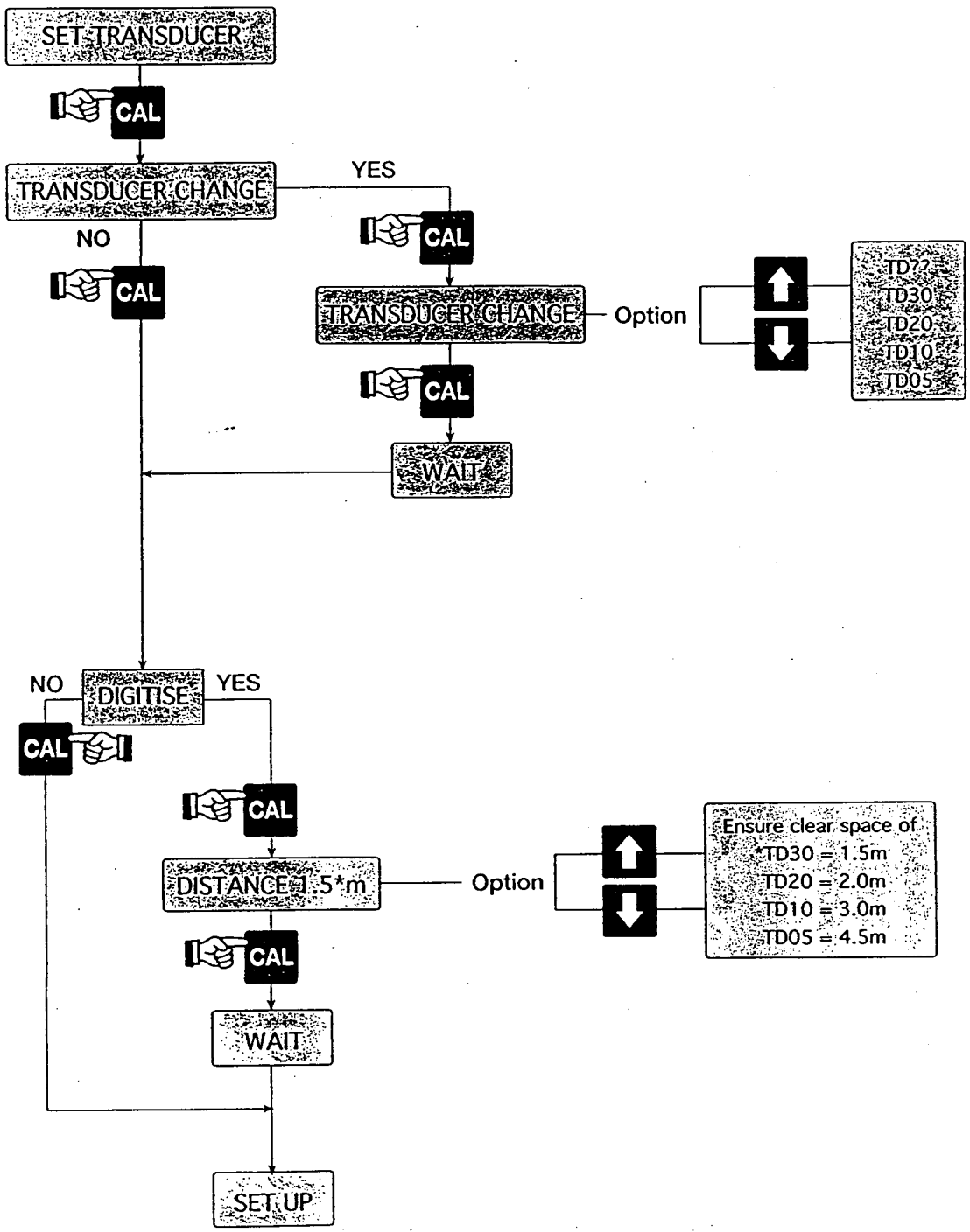
$$\frac{\textbf{Total Height} \times 5\% \times 1/3\ \pi r^2}{\text{Total Volume}} \times 100$$

(4) Calculate the volume as percentage:

$$\frac{(\textbf{Total Height} \times 5\% - \text{Cone Height}) \times 1/3\ \pi r^2 + \text{Cone Volume}}{\text{Total Volume}} \times 100$$

SET TRANSDUCER FLOW CHART ~ Series 500

SETTING TRANSDUCER ~ CODE O



SET TRANSDUCER DESCRIPTION

SET TRANSDUCER

Transducer Change. It is necessary to change the entered Transducer frequency if a different Transducer is connected to the amplifier.

Dual Amplifier may use a different Transducer on each input.

TRANSDUCER CHANGE? N

This allows for different Transducers to be changed after the initial unit has been installed.

You must change to Y (Yes) if another frequency Transducer is to be used.

DIGITISE

This is where a new ringdown profile is created. If there are doubts about the ringdown profile - or the output has jumped to the high level, it will be necessary to digitise the Transducer. Allow space and digitise to this value.

Typically:

TD05	4.0 m
TD10	3.0 m
TD20	2.0 m
TD30	1.0 m

You may digitise for distances up to 5.0 m. Then wind the right hand value to those shown above. Ringdown is designed to hide the transmit pulse to ensure it can not be seen by the firmware as a potential echo.

Note: *If you wish to* ***exceed*** *the specifications concerning the position of the 100% material level relative to the face of the Transducer, the Digitise option must be chosen. How close to the sensor face will depend upon the degree of difficulty and the Transducer chosen.*

If you get the level too close to the Transducer, the ouput and display may jump back from the first reflected echo to the second reflected echo.

The correct level echo could be lost in the transmit pulse. (If this occurs you must digitise the transmit pulse.)

The software will then not be able to see the transmit pulse hence the unit will not be capable of locking onto the high level incorrectly.

Digitising must be done with at least the distances from the Transducer face to the material level as shown above.

SCALING

FLOW - PARSHALL FLUME

Following table for calibration of RMA for flow measurement in Parshall flume.

The basic formula is $Q = KH^X$, where H is absolute head (i.e., not differential head), k is a flume constant and ^{X} is a flume constant approx 1.5.

Following table of % flow vs % head for exponents 1.5, 1.52 and 1.54.

%H	%Q1.5	%Q1.52	%Q1.54
0	0	0	0
5	1.12	1.05	0.99
10	3.16	3.02	2.88
15	5.81	5.60	5.38
20	8.94	8.66	8.39
25	12.50	12.16	11.83
30	16.43	16.04	15.66
35	20.71	20.28	19.85
40	25.30	24.84	24.39
45	30.19	29.71	29.24
50	35.36	34.87	34.39
55	40.79	40.30	39.83
60	46.48	46.00	45.54
65	52.40	52.00	51.51
70	58.57	58.15	57.74
75	64.96	64.58	64.21
80	71.55	71.24	70.92
85	78.37	78.11	77.86
90	85.38	85.20	85.02
95	92.59	92.50	92.40
100	100.00	100.00	100.00

H = % of head height

This table is based on 5% head increments, while for better accuracy the increments should be smaller at the higher head values.

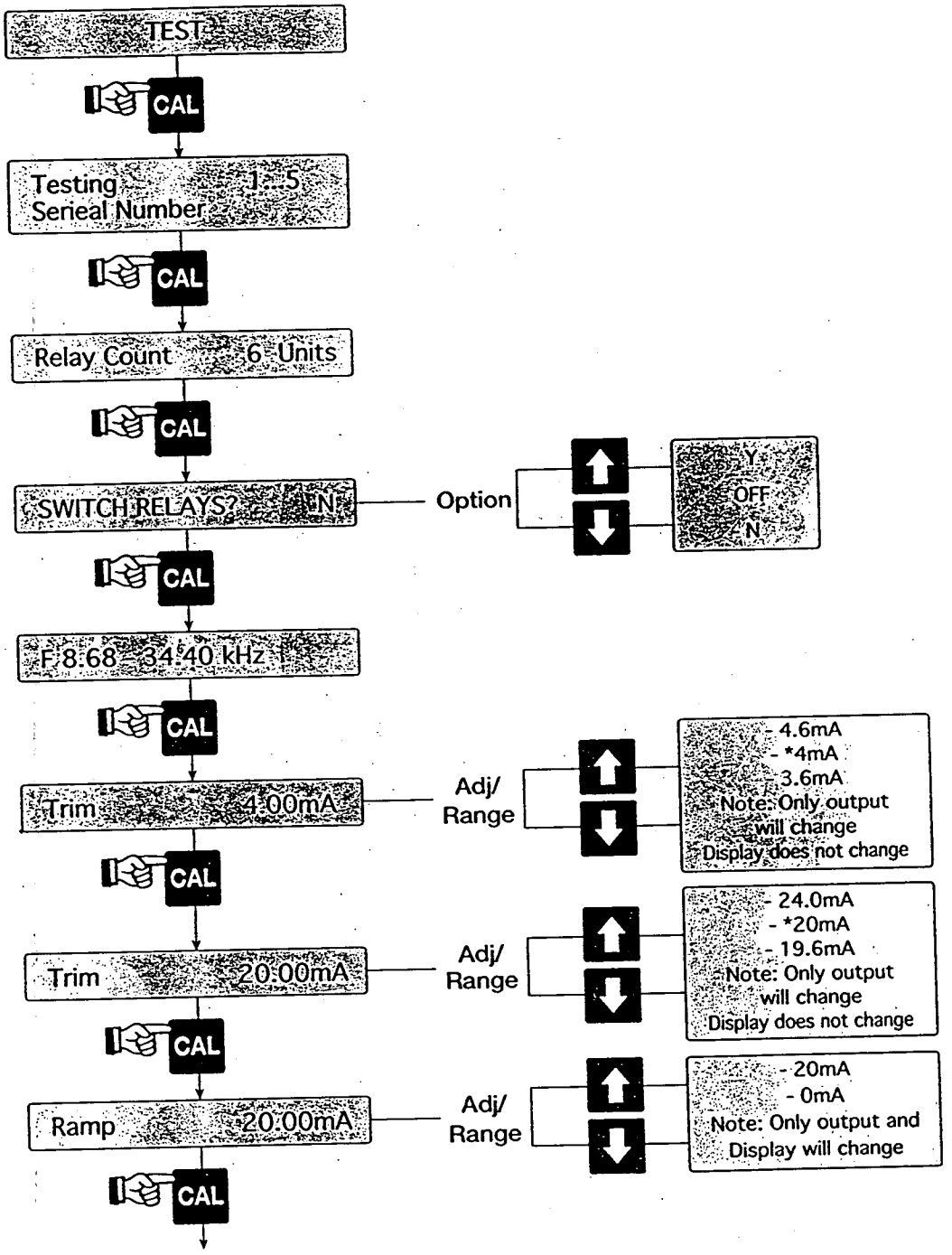
To setup the RMA select "SCALED" output, then select the desired engineering units. Enter the 100% full scale value. This defines the subsequent displayed values. Eg. if you select GPD and 100%FS = 1234 then in subsequent operation, the flow will be displayed as some fraction of 1234 GPD.

Note that 0% and 100% head should correspond respectively to the low level and high level. That is not essential, but if this is not the case then the % values would become more complicated and since the 4-20mA output is relative to the low level-high level span, it too would have to be reconfigured if it is required to indicate flow.

The exponents for Parshall flumes vary between 1.50 and 1.58 but are typically close to 1.50. Note that the effect of exponent accuracy is greater at the low flow end.

The flume specifications are necessary not only for checking the exponent, but also for determining the 100% full scale value. Some flume manufacturers do not provide the exponent value, but provide a table of flow vs head instead.

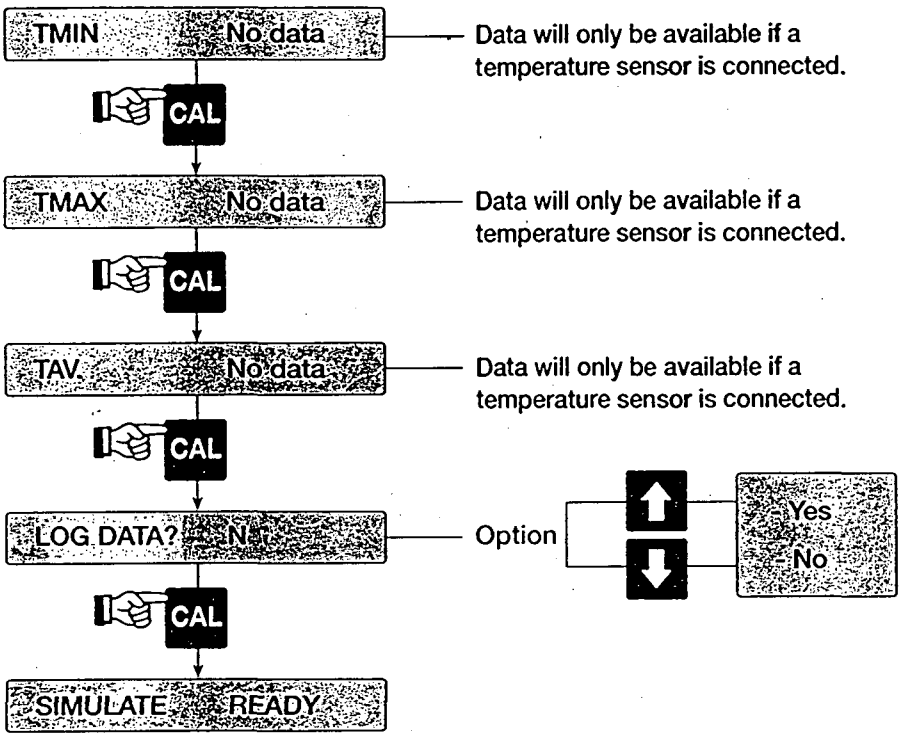
TEST FLOW CHART ~ Series 500



(Continued next page)

TEST FLOW CHART ~ Series 500

TEST continued from previous page



RINGING

LEVEL HANGING UP HIGH

If the RangeMaster seems to display a High reading, especially after the vessel attains a near empty state; the cause could be ringing.

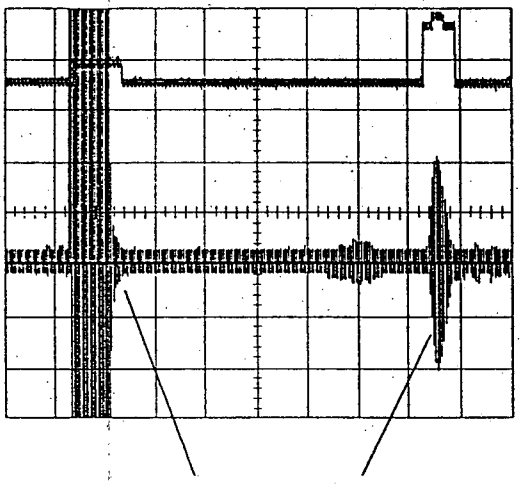
After the RangeMaster sends a pulse to the Transducer there is a definite time delay before the Transducer stops vibrating. This is termed Transducer ring down.

When the RangeMaster is powered up for the first time, the Transducer is pulsed several times, so that the ring down characteristics of the Transducer used can be stored.

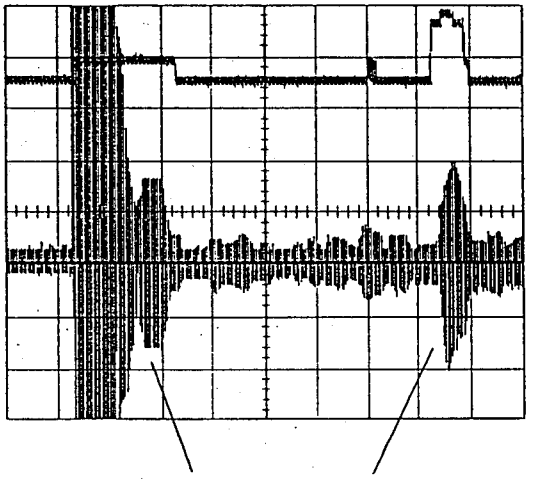
This data is used when the RangeMaster is in normal operation.

If conditions change significantly, or a high level switch is subsequently introduced, you will need to initiate a new digitising procedure.

Transducer mounted correctly



Transducer mounted incorrect



These diagrams are similar to the traces available on an oscilloscope via the pins on the logic circuit board.

Set the amplitude on approximately 200mV per division and the time base at approximately 5m^{S} per division. Monitor the pin marked ECHO.

As can be seen the ring down is completely different.

The resulting signal can appear to the RangeMaster as a valid echo.

This is more likely to happen when the level in the vessel is Low.

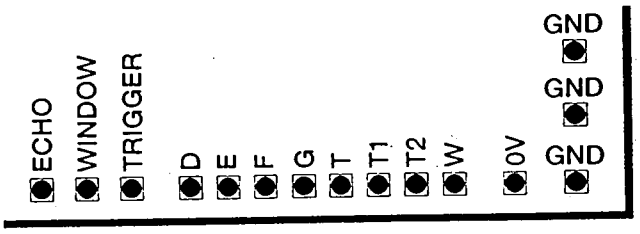
The resulting gain necessary is large enough to cause this ringing to appear as the valid echo.

THUS IT IS CRITICAL THAT THE TRANSDUCER IS MOUNTED IN SUCH A MANNER SO THAT THE EFFECTS OF ANY RINGING ARE MINIMISED.

Please observe recommendations on the pages referring to Transducer mounting.

CONNECTING an OSCILLOSCOPE

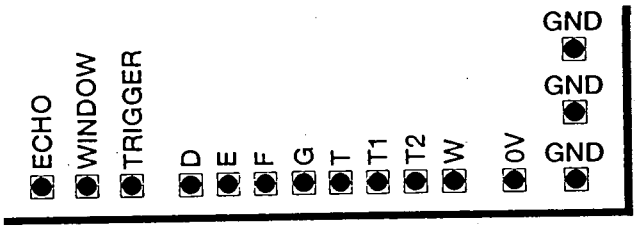
On the bottom right side corner of the logic circuit board are these test points.



Connect the Oscilloscope between ECHO and GND and use trigger if needed.

Voltage Level: 0.2V per Division.
Sweep Duration: 5 to 10mS per Division.

The operation of the RangeMaster can be observed with the aid of an oscilloscope. On the lower right corner of the logic circuit board are pins to facilitate the connection to an oscilloscope.

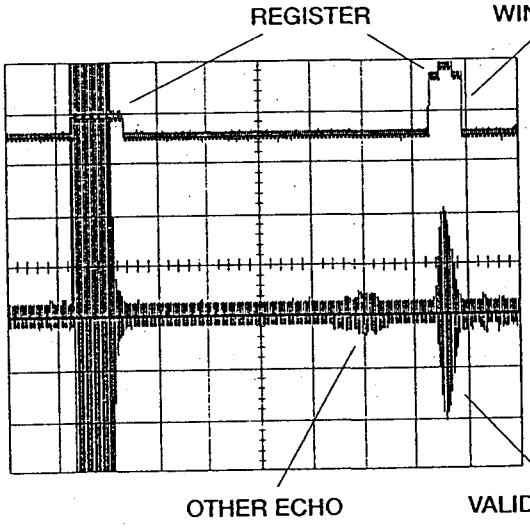


The two traces of the oscilloscope are connected to the WINDOW pin and the ECHO pin. The ground is connected to the GND pm. The trlgger isconnected to the TRIGGER pin.

A dual trace storage oscilloscope is recommended but not essential. A non storage oscilloscope can be used. The diagram below represents the two traces produced on the oscilloscope.

The top trace is the window trace. The window indicates the area of the vessel where the RangeMaster considers the correct level to be. For an echo to be considered it must have a value large enough to cause a register to form on the window trace.

to



Amplitude 2V per division.

Sweep time depends on the size of the vessel.

Amplitude 0.2V per division

ERROR DESCRIPTION

ERROR No:	DESCRIPTION:
000	System data corrupted (1) (unrecoverable)
001	System data corrupted (2) (may recover on reset)
002	System data corrupted (3) (may recover on reset)
010-019	Parameter data read error (recoverable on reset). 013 Parameters 014 High power map data 015 Low power map data
100	Keypad switch fault
101	Oscillator fault
102	Excess Noise/Receiver fault (may be temporary)
103	Transducer presence check failed
104	Temp sensor low impedance
105	Temp sensor high impedance
106	Excessive noise in binmap
110 -119	Data storage failure (may recover on reset). 110 Timing 111 Confirm 112 System parameters 113 Parameters 114 High power map data 115 Low power map data
120-121	Power supply fault (may be temporary). 120 At power-up 121 Power loss during critical operation (may cause corrupted data) 030 Low supply voltage 031 Low supply voltage - temporary
201	*See error 103*

For total RESET to factory parameters, hold both the UP and DOWN pushbuttons until the display blanks, then use the UP pushbutton to select RESET. At the RESET display, hold CAL until the appropriate set of parameters is displayed. Use the UP and DOWN pushbuttons to select FACTORY and accept this by pressing CAL. Resume operation by pressing the RUN pushbutton. If the FAULT display persists contact the nearest representative.

PROGRAMMING RELAY SWITCHING

The entered distances for relay control are always entered as space distances.

This is the distance from the face of the Transducer to the required switching positions.

The printed N.O., N.C. and COM terminals relate to the status of the relay in the de-energised mode. (i.e. the red light on the circuit board is off)

OPTION 1

Programming Relay for failsafe

R1 - EN LEVEL

L1 – 1.0m (3ft) L2 – 1.0m (3ft)

L1 = L2
No differential on relay switching

R1 - ENERGISED MODE
When the mode EN LEVEL is selected, the relay is normally energised.

The relay is de-energised when the material level rises above level L1 and remains de-energised until the level falls below the level L2.

If L1 = L2 the relay is de-energised above L1, L2 and energised below the L1, L2 entered distances.

R2 - DE-ENERGISED MODE
When the mode DE EN Level is selected the relay is normally de-energised.

When the material is above the selected level the relay is energised and will remain energised until the material falls below the selected switch position.

R2 - DE-EN LEVEL

L1 – 5.0m (15 ft) L2 – 5.0m (15 ft)

L1 = L2
No differential on relay switching

OPTION 2

Using the above example, but only one relay contact.

EN LEVEL

R1 L1 – 1.0m (3 ft) L2 – 5.0m (15 ft).

The differential on the relay is added to give the control required.

The relay will switch off (de-energise) when the level reaches 1.0m (3ft) of space.

It will stay deenergised until L2 limit 5.0m, (15 ft) is reached.

DIAGNOSTIC DISPLAY

For example, during RUN, the following could be displayed:

SPACE	10m

To identify the actual operational characteristics push the UP pushbutton. SPACE will be replaced with the dynamic display. The UP pushbutton changes the display. (On Dual Amplifiers the UP is for Transducer 1 the DOWN is for Transducer 2).

The displays available are:

VN	VERSION	Software version
nG	GAIN	Amplifier Gain in %
nS	S/N	Signal to noise Ratio on Echo, in %
nT	TEMPERATURE	Fixed or Varying
nF	FREQUENCY	Transducer Operating Frequency in kHz
nC	CYCLES	Pulse Width
nE	ECHO	Identifies instant largest echo
nQ	MOUNTING	Mounting quality
nN	NOISE	Noise Level

nG74 10m

Dynamic display showing amplifier gain on echo of 74%

- n low power
- N high power
- r low power recover
- R high power recover
- s low power search
- S high power search
- $\bar{n}$ first echo

Press the RUN pushbutton and the display returns to the selected display.

For example:

SPACE	10m

DIAGNOSTIC DISPLAY cont'd

GAIN

This is the percentage value the gain attains to identify the wanted echo.

S/N

This is the percentage value of gain left when the instantaneous level of noise is determined.

TEMP

This is the value of temperature entered if the unit is set for fixed degree C (degree F) or it is the actual value of temperature sensed at the position of the temperature sensor.

FREQUENCY

This is the frequency of the amplifier transmit pulse and receiver settings.
They must correspond to the Transducer frequency selected during initial Transducer selection.

CYCLES

This is the pulse width applied to the Transducer transmit pulse.
There are 2 separate factory entered values for each Transducer, which give more or less power - depending upon the application difficulty.

ECHO

This gives the instantaneous largest echo position after the software has made the factory set modifications to the echos received.
The distance displayed should be approximately that given in the space reading on the right hand side of the display.

MOUNTING

This gives the accoustic quality of the mounting and is designated by Q.

It is displayed as follows:

nQ1/0.4

n – normal mode low power

Q — mounting quality

1 — this is the number of bumps on the end of the transmit pulse – a number of less than 3 is reasonable. To get a lower number ensure the horn (if applicable) is protruding into the vessel and there are no switches, struts or supports near the face of the Transducer.

0.4 – this gives the inherent ringing, characteristic of the Transducer and varies with each Transducer frequency.

NOISE

The noise value **N** gives an indication of the combined effects of electrical and mechanical noise the Transducer/Amplifer system is exposed to.

TERMINAL CONNECTORS

POWER SUPPLY VOLTAGES

62	——	115 / 240 VAC
63	——	Neutral
64	——	Earth/System Ground

61	——	+ 24 Vdc
60	——	24 Vdc Common

TRANSDUCER & OPTIONAL TEMPERATURE SENSOR

TRANSDUCER

Ch1	Ch2	
51	55	—— Hot
50	54	—— Ground

TRIAXIAL: Belden 9222
200 metres (600feet) Maximum

TEMPERATURE SENSOR

Ch1	Ch2	
53	57	——+ VE
52	57	——- VE

TWISTED PAIR: Belden 8451/9462
200 metres (600 ft) Maximum

FAILSAFE RELAYS SCHEMATIC (GREEN LED'S)

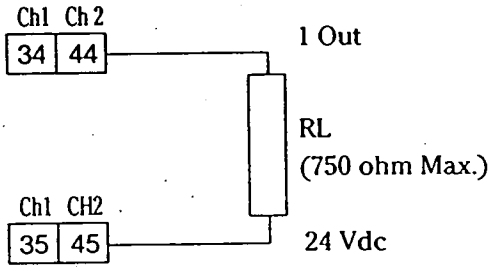
Ch1	Ch2	Normally Open Contact
19	22	
20	23	
21	24	Normally Closed Contact

CONTROL RELAYS SCHEMATIC (RED LED'S)

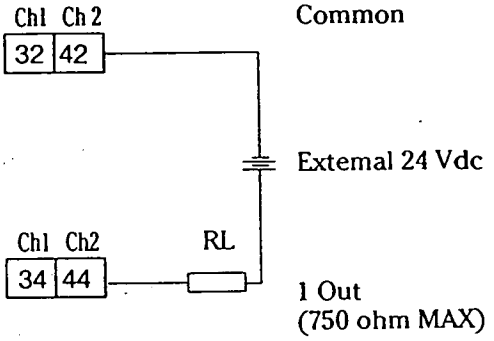
						Normally Open Contact
1	4	7	10	13	16	
2	5	8	11	14	17	
3	6	9	12	15	18	Normally Closed Contact

ISOLATED CURRENT LOOP

Hawk Powered Current Loop



Externally Powered Loop
(PLC, DCS Input Card)



VOLTAGE OUTPUTS

VOLTAGE

Ch1	Ch2	
31	41	—— + Voltage Out
30	40	—— - Voltage Out

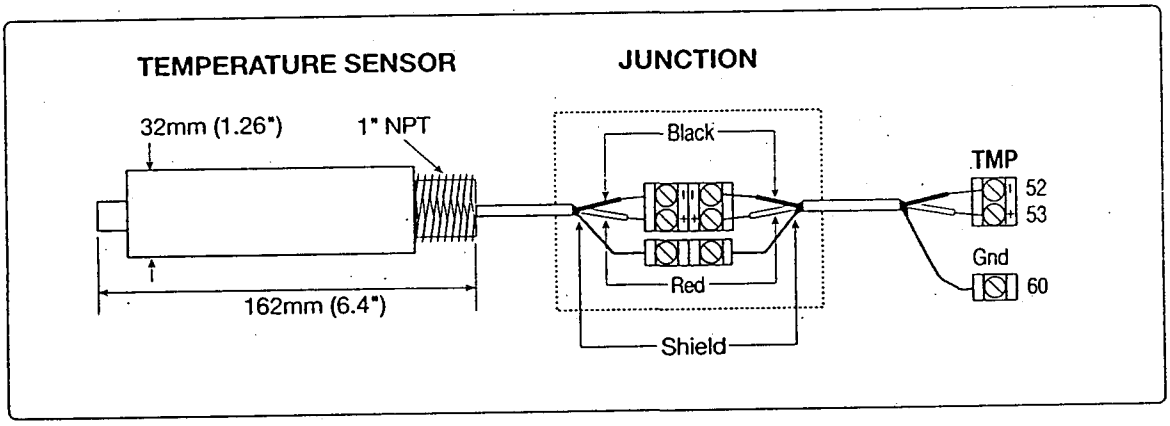
Note: *The first noted boxed number applies to the outputs for a Single input unit. The first noted boxed number also applies to Channel 1 on a Dual input unit. The second boxed number only applies to the second channel on that Dual input unit.*

WIRING

Mounting Instructions for Remote Temperature Sensor

1. The temperature sensor should be mounted in a location which represents the temperature fluctuations likely to occur between the transducer and the target.
2. To avoid false readings, mount the temperature sensor out of the direct sunlight.

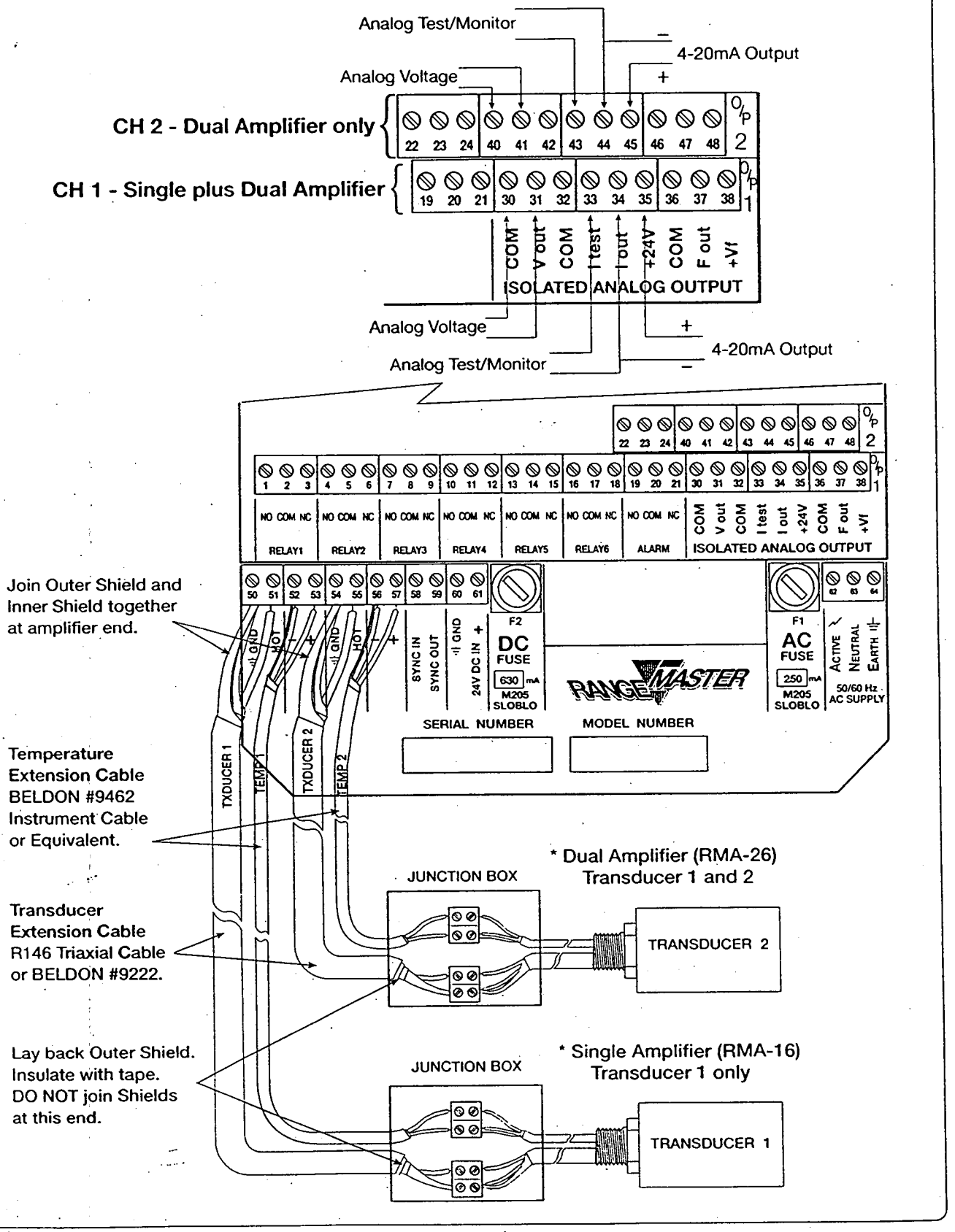
   Radiant heating can cause a differential temperature between air and sensor's measurement.
3. Temperature sensor cable can be run with the transducer cable in a grounded metal conduit.
4. If a temperature sensor is not used, the expected error due to temperature variations is 0.17% degree Celsius (0.10% degree Fahrenheit) over the operating range.
5. Temperature sensor wiring must be done in conjunction with approved conduit, boxes and fittings.



Response Time: 8 Minutes (maximum)
Temp Limits: -20° to 110°C (-4° to 230°F)
Maximum Cable Length: 10metre (30 ft.)
Extension to Cable: Belden Type 9462 or equivalent

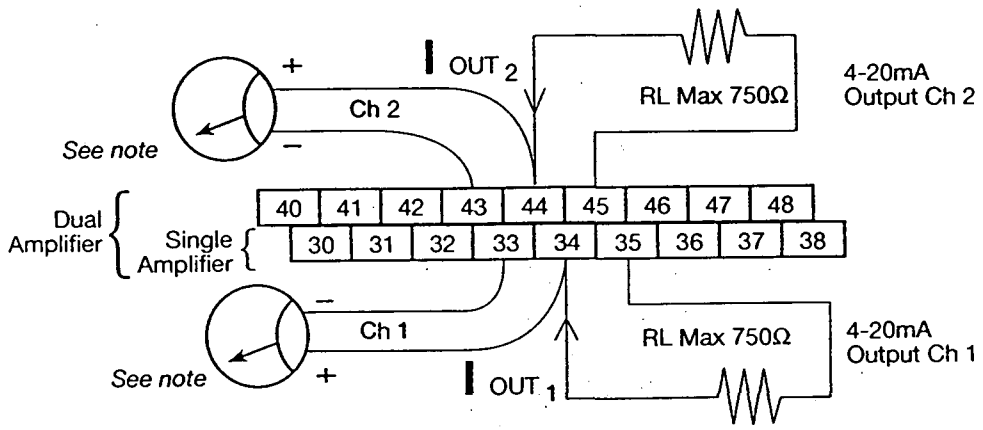
Note: Temperature Sensor can be run in the same conduit as the transducer cable.

WIRING cont'd



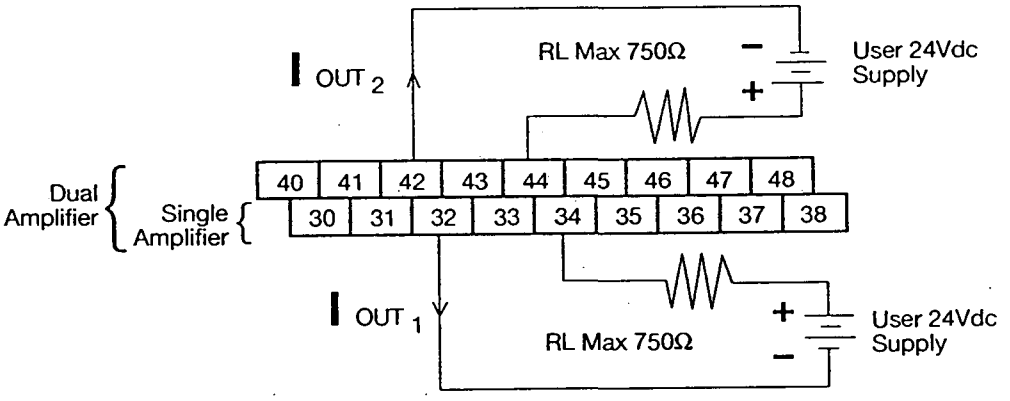
WIRING cont'd

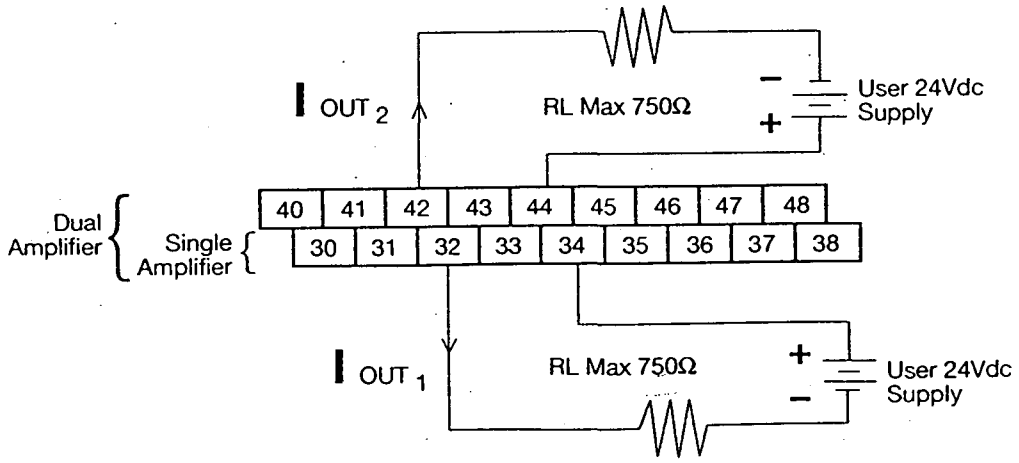
ISOLATING CURRENT OUTPUTS (Driving) ~ RMA Supply



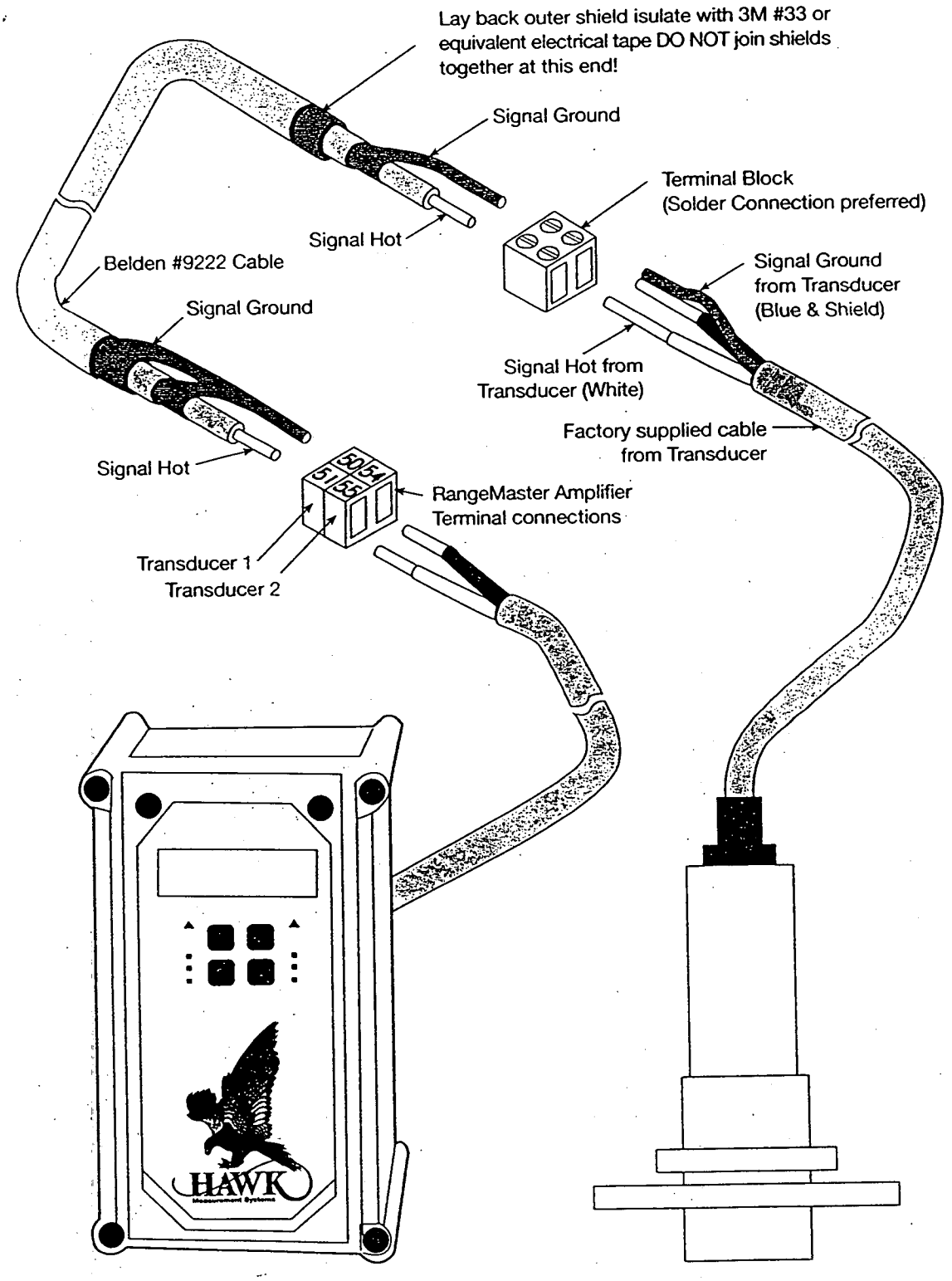
Note: *Circuit current tests points are only valid if current loop is operating.*
It is used to check the mA loop without interupting the loop connections. It is not used for driving mA out.
It is designed only for a mA meter to be connected.

ISOLATING CURRENT OUTPUTS (Modulating) ~ User Supply





WIRING cont'd

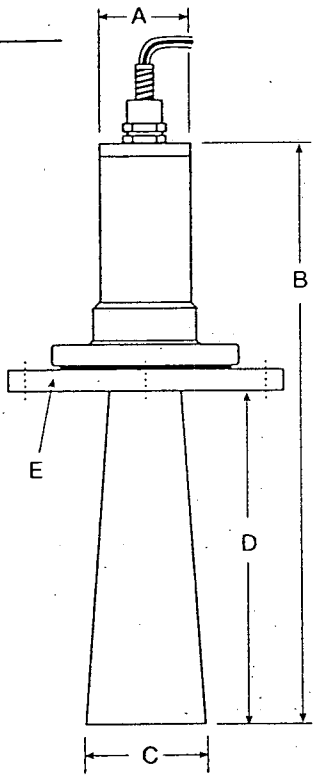


(For connection to amplifier see page 37)

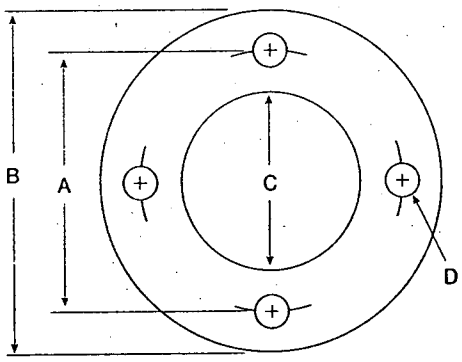
MOUNTING

REMOTE TRANSDUCER

REMOTE DIMENSIONS						
		A	B	C	D	E
TD30	C4 Cone	75mm 2.95in	416mm 16.37in	98.5mm 3.44in	267mm 10.50in	See Standard Flange Table
TD20	C4 Cone	75mm 2.95in	465mm 18.25in	98.5mm 3.44in	267mm 10.50in	
TD10	C10 Cone	88mm 3.50in	775mm 30.51in	235mm 9.25in	410mm 16.14in	



STANDARD MOUNT FLANGE



STANDARD ANSI/DIN/JIS FLANGE DIMENSIONS							
FLANGE TYPE	A (PCD) mm	A (PCD) in.	B (OD) mm	B (OD) in.	C (ID) mm	C (ID) in.	D HOLE
FCA4	190.5	7.5	228	9.0	100	4	19mm
FCD4	180	7.0	220	8.7	100	4	18mm
FCJ4	175	6.9	210	8.4	100	4	15mm
FCA6	241	9.5	279.5	11.0	150	6	22mm
FCD6	240	9.4	285	11.2	150	6	22mm
FCJ6	240	9.4	280	11.0	150	6	19mm
FCA8	298.5	11.8	343	13.5	200	8	22mm
FCD8	295	11.6	340	13.4	200	8	22mm
FCJ8	290	11.4	330	13.0	200	8	19mm
FCA10	362	14.3	406	16.0	250	10	25mm
FCD10	350	13.8	395	15.6	250	10	22mm
FCJ10	355	14.0	400	15.7	250	10	23mm

FLANGE TYPE

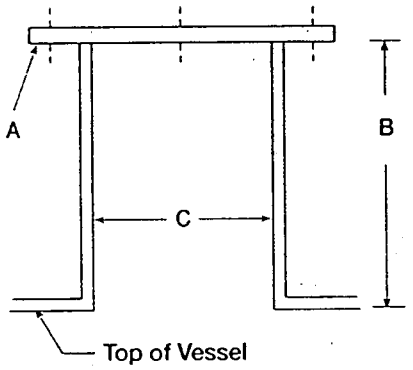
A = ANSI Flange
D = DIN Flange
J = JIS Flange
Others Available

FLANGE SIZE

4 = 100mm/4"
6 = 150mm/6"
8 = 200mm/8"
10 = 250mm/10"
Others Available

MOUNTING cont'd

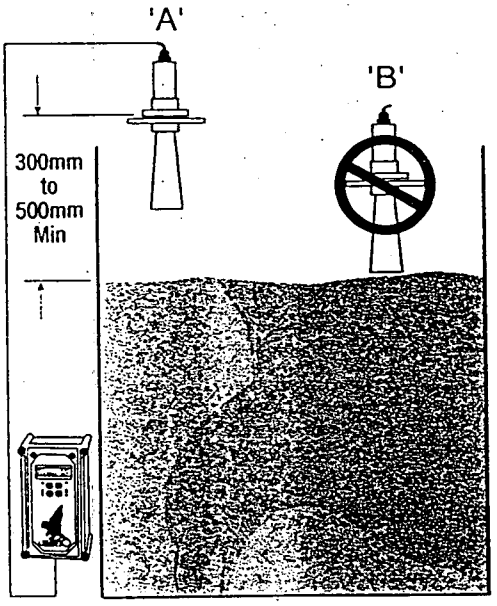
NOZZLE MOUTING



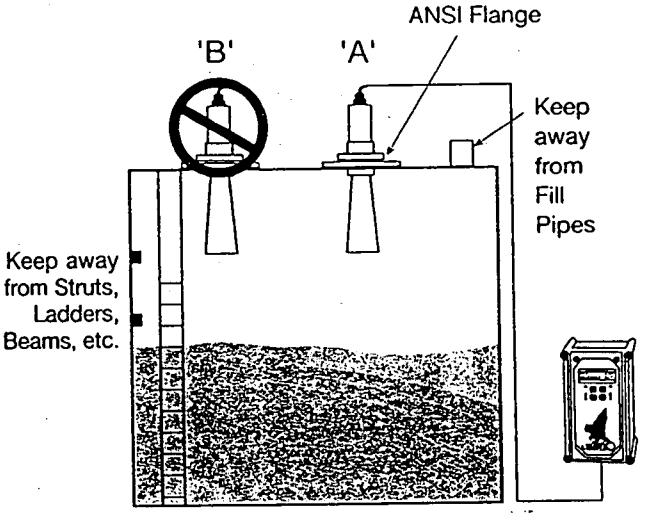
NOZZLE MOUNTING DIMENSIONS		
A	B	C
100mm (4in) DIN	240mm 9.44in	100mm 4.0in
150mm (6in) DIN	240mm 9.44in	150mm 6in
200mm (8in) DIN	300mm 11.8in	200mm 8in
250mm (10in) DIN	390mm 15.35in	250mm 10in
100mm (4in) ANSI	240mm 9.44in	100mm 4in
150mm (6in) ANSI	240mm 9.44in	152mm 6in
250mm (10in) ANSI	390mm 15.35in	254mm 10in

SUMP APPLICATIONS

'A' is mounted correctly



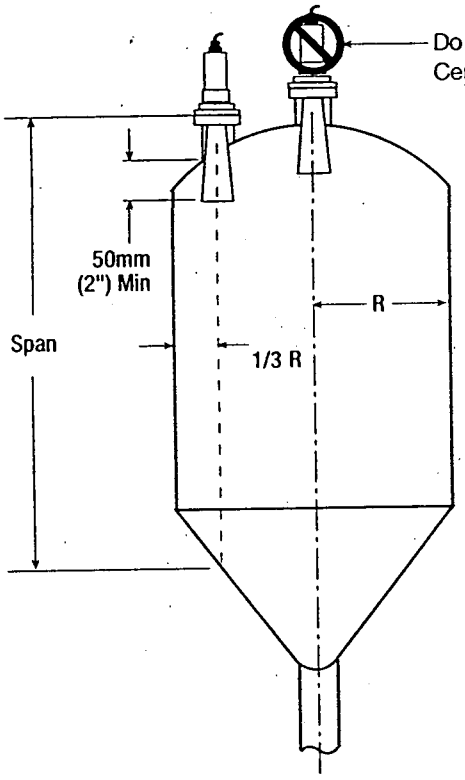
Mount the TD30 a Minimum of
300mm - 500mm above the highest level.
A larger distance gives more reliable results
when foam, steam, condensation are present.



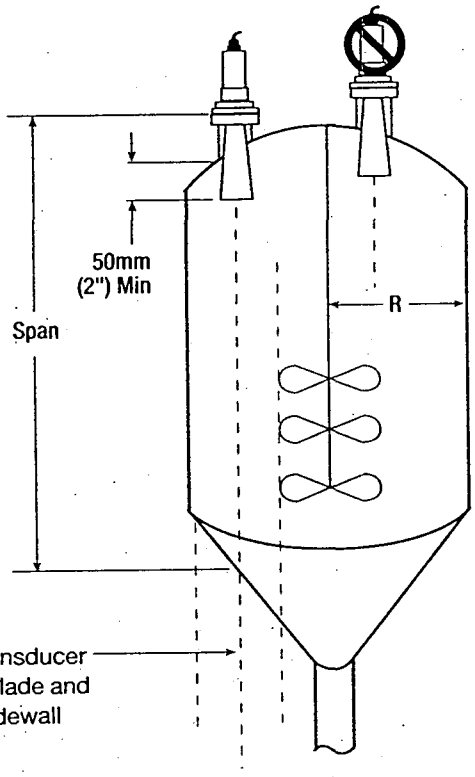
Mount the TD30 a Minimum of
300mm -500mm above the highest level.
Always use more if possible.
Use a nozzle to lift sensor position if required.
(see above)

MOUNTING cont'd

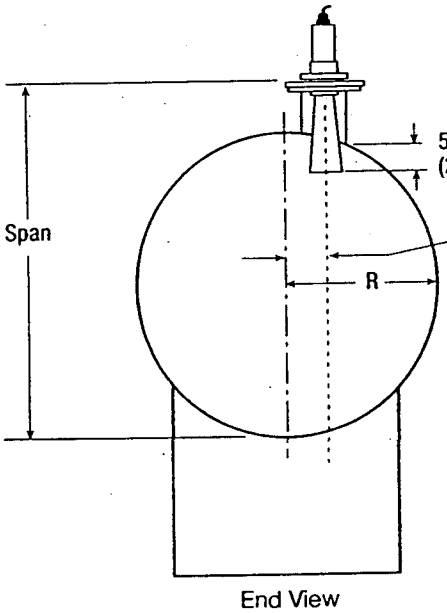
VERTICAL LIQUID TANK APPLICATIONS



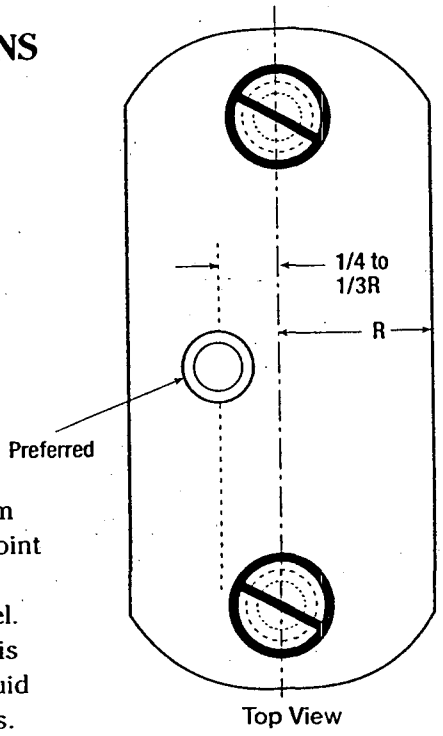
Span will be from Transducer Face to point directly below Transducer in Vessel



HORIZONTAL LIQUID TANK APPLICATIONS



Span will be from Trancducer Face to point directly below Transducer in Vessel. Ensure Transducer is perpendicular to liquid surface at all times.



MOUNTING cont'd

APPLICATION GUIDE

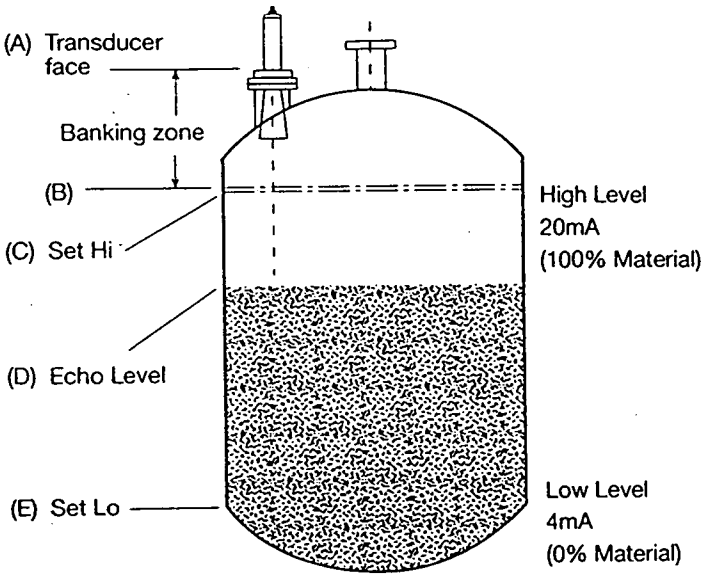
(A) Transducer Face – Mounting Flange

(B) End of Banking Zone - XDCR ***Will Not*** accurately Measure Level in this Area

(C) High Point of Measurable Span

(D) Material Level Returns an Echo to the Transmitter

(E) Low Point of Level Span



All setpoints are measured from 'A' the transducer face (SPACE).
Amount of MATERIAL is referance from 'E' (Set Lo).

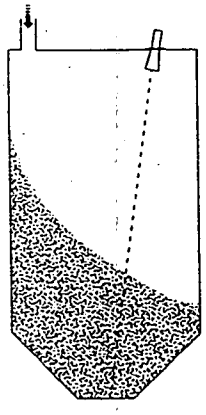
EXAMPLE:

Material = E - D, since distance E > D from transducer. 'Set Lo' is user defined in memory, 'D' is found by transmitter.

Note: High level must be behind blanking level.
See Section: Response Time for specific dimensions.

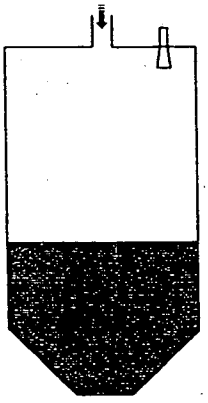
TRANSDUCER MOUNTING

SOLID (Granular)



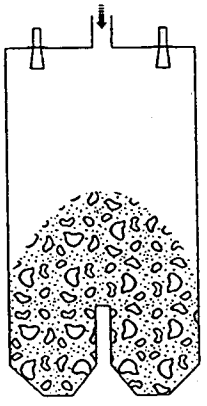
Aim transducer at point of outfeed.

LIQUID



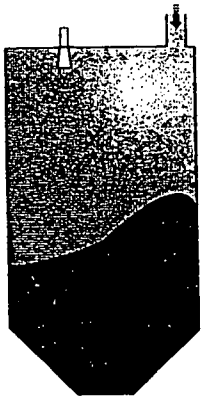
Transducer should be as perpendicular to product as practicable.

DUAL OUTFEED



Use two transducer and select Average mode on a dual amplifier.

POWDER



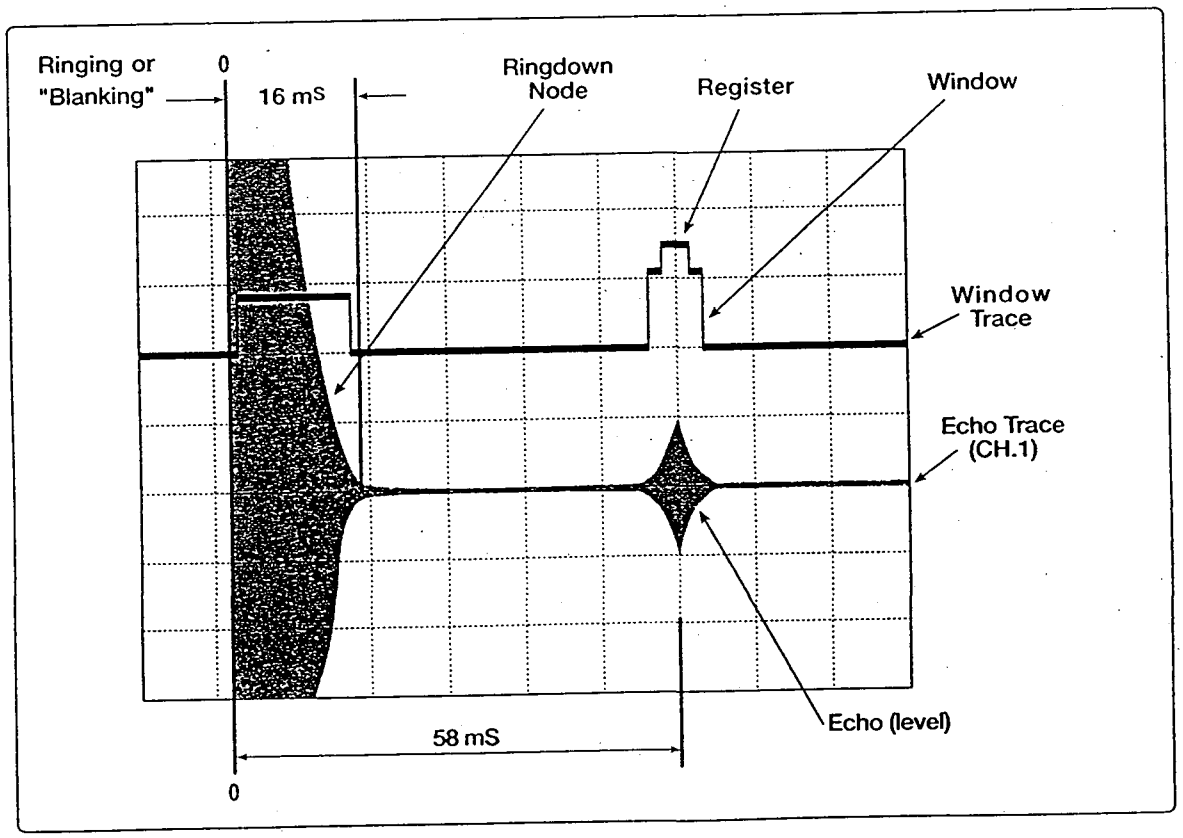
Mount away from infeed

In all applications the best mounting position will be a compromise between the reflection produced by the material and the position and aiming of the transducer.

TEKTRONIX 222 ~ Set-up

Setting Up the Tekronix 222 Digital Oscilloscope for the RangeMaster

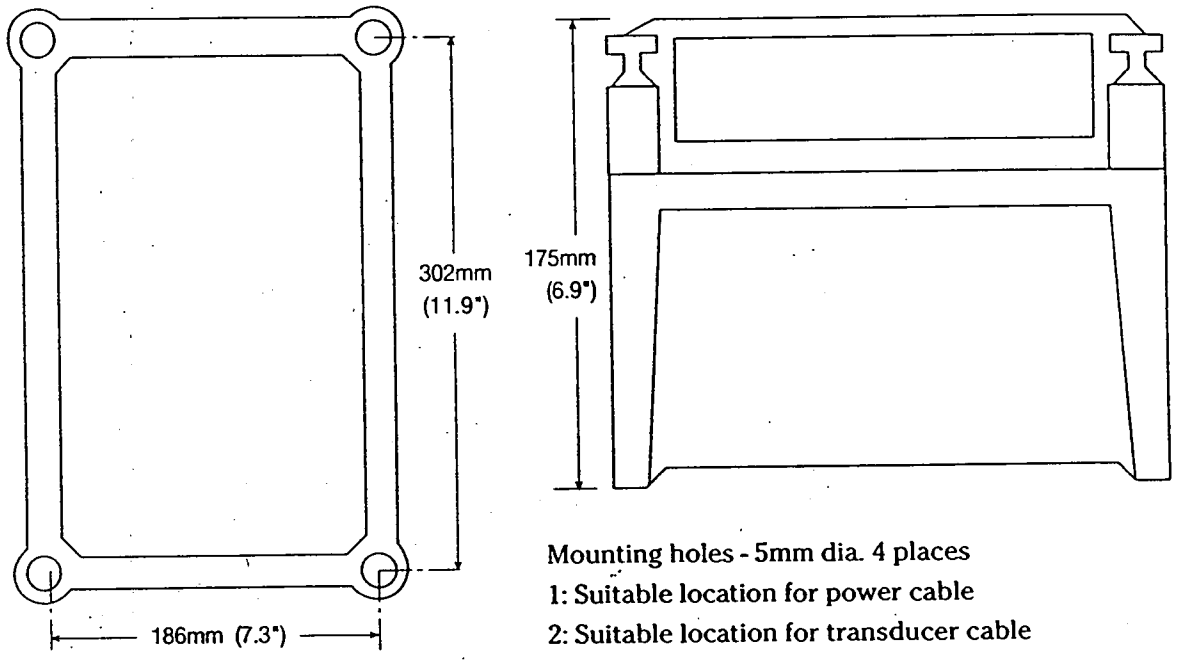
1. Set ***CH1*** to DC and use Volts/Div knob to adjust **CH1 = .5V**
2. Set ***CH2*** to ***DC*** and use Volts/Div knob to adjust **CH2 = 2V**
3. Press ***Mode*** and set mode to **NORM**
4. **Go to Button Panel on Top of the Scope**
5. Press ***ACQ*** button and ensure a box is placed on **ENV**
6. Press ***DISPL*** button and **Clear** all rectangles
7. Press ***AUX*** button and **Clear** all rectangles
8. Press ***TRIG POS*** button and place Rectangle on **POST**
10. Place ***CH1 Probe*** on the **ECHO** pin
11. Place ***CH2 Probe*** on the **Window** pin
12. Place each ***Channel Ground Clips*** to any of the **Common pins** on LP
13. **Start the Loop Unit to Pulsing**
14. Adjust ***Trigger Level*** knob between **1 -4v** until the green light pulses with the LP
15. Adjust ***Sec/Div*** knob between **2ms-10ms** depending on distance of level
16. Adjust Display by rotating the ***POS*** knob on the **Volts/Div** adjustment
17. Press the ***STORE*** button on top of the scope to **freeze pulses** on screen



SPEED OF SOUND = 5.8mS/m (1.77mS/ft)
ie: Blanking Zone = 16mS/1.77mS/ft = 9.0ft
Valid Echo = 58mS/1.77mS/ft = 32.8ft

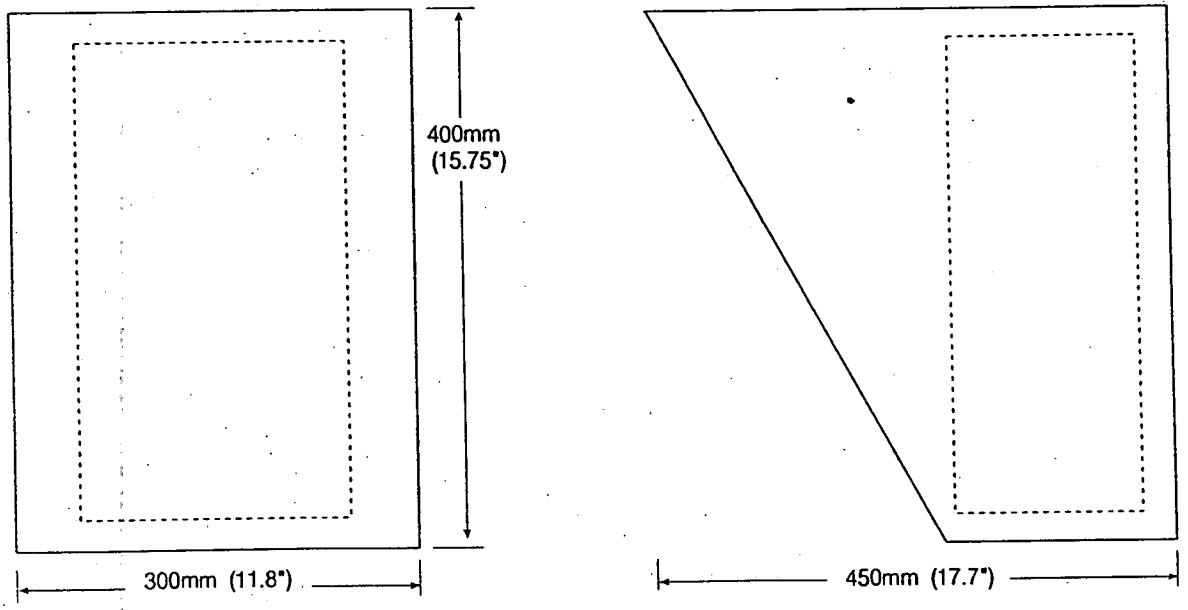
AMPLIFIER ENCLOSURE

MOUNTING



Mounting holes - 5mm dia. 4 places
1: Suitable location for power cable
2: Suitable location for transducer cable

SUN SHIELD



The RangeMaster Amplifier should be mounted in such a way so as to avoid direct sunlight. If mounted outside, the minimum protection must include a sun shield with the above minimum dimensions. Amplifier must face away from the direction of the sun.

HAWKLOG

INSTRUCTION MANUAL

INTRODUCTION

- ★ HAWKLOG enables RangeMaster information to be e-mailed all over the world.
- ★ Any problems or queries can be solved by long distance communication.
- ★ HAWKLOG will save time and money for all concerned.

CONTENTS

CONNECTING HAWKLOG

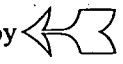
REQUIREMENTS

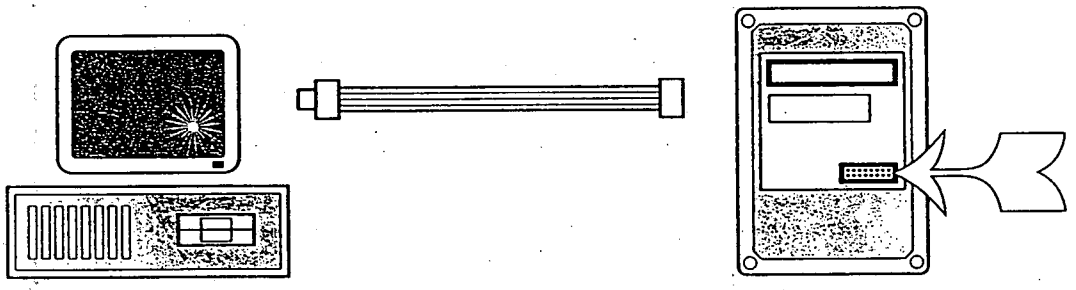
- 486 DX 33 or higher, Windows 3.1, Windows 95

INSTALLATION

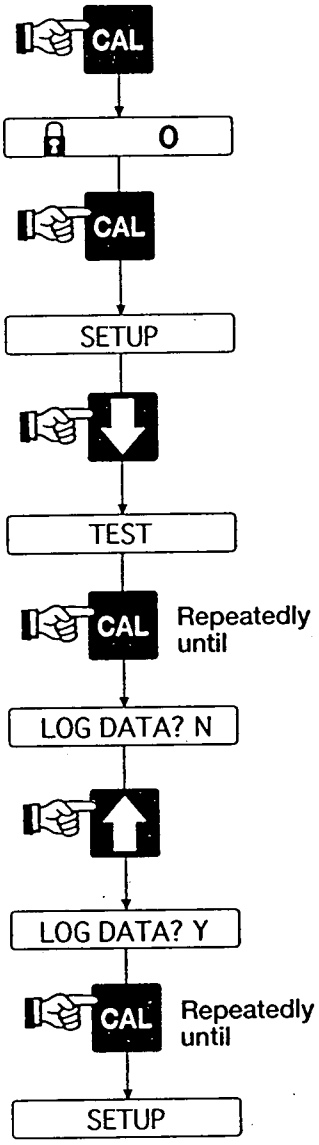
- Insert HAWKLOG into drive A or B
- From Windows program manager select Run
- Type a:\setup or b:\setup and press enter
- Follow instructions on screen

HOW TO CONNECT

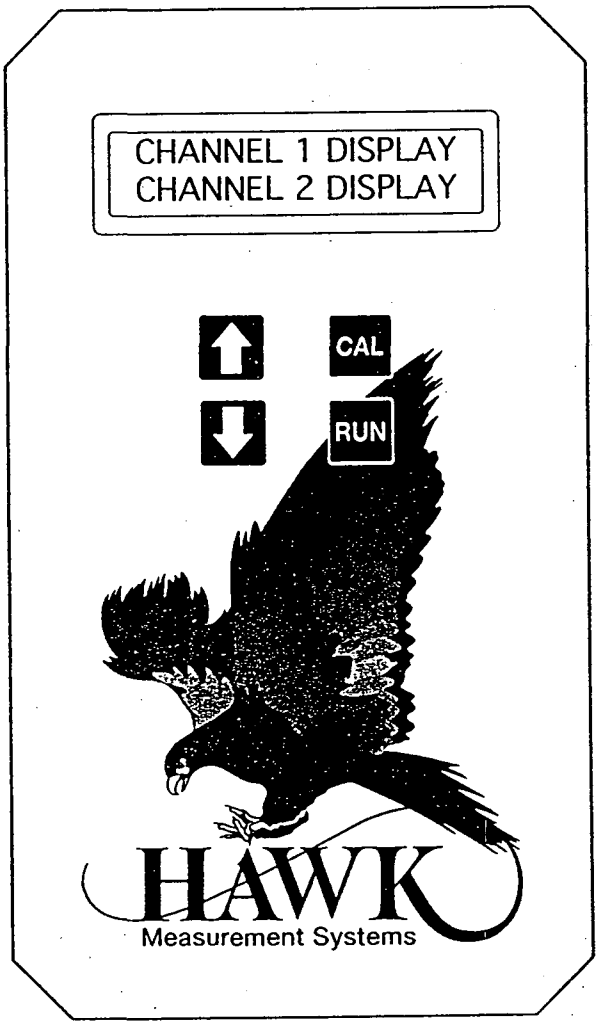
- Plug HAWK cable into a communication port on your PC (COM 1, COM 2)
- Remove display case from RangeMaster
- Connect other end of cable into RangeMaster shown by 



CONNECTING HAWKLOG



RANGEMASTER DISPLAY

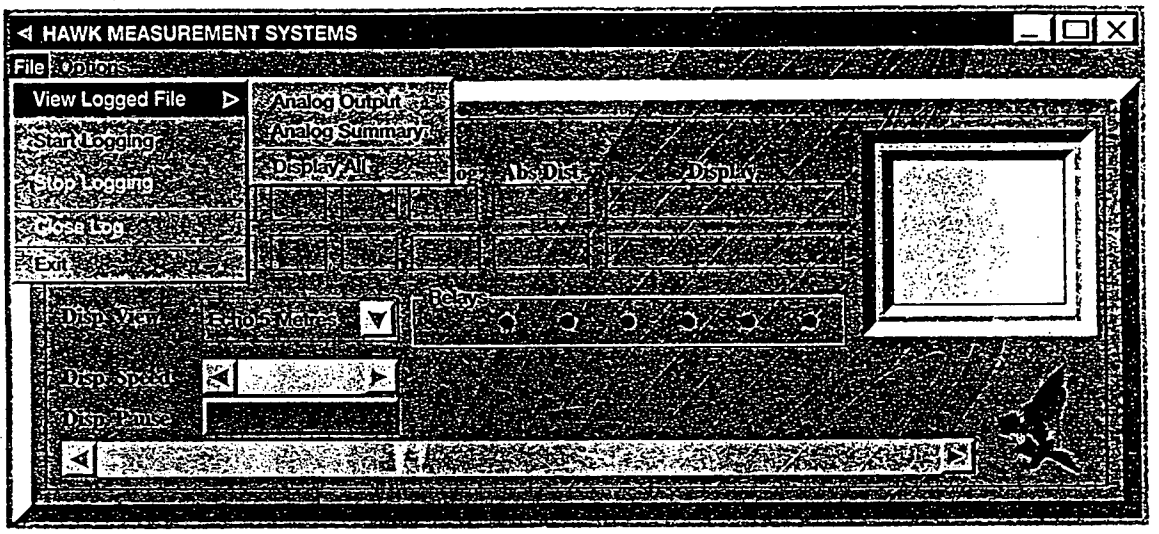


SOFTWARE

- Run program HAWKLOG
- Click "Options"
- Click "Setup" - change communication port according to the connected port on your PC
- Click "File"
- Click "Start Logging"
- If you choose to save data, click YES
- Follow instructions on screen carefully

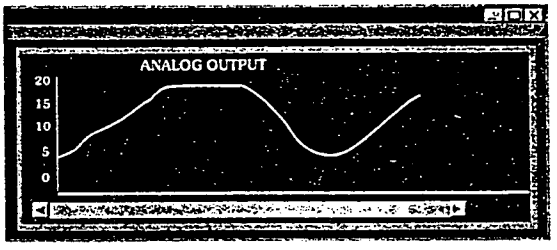
USING HAWKLOG

VIEWING LOGGED FILE

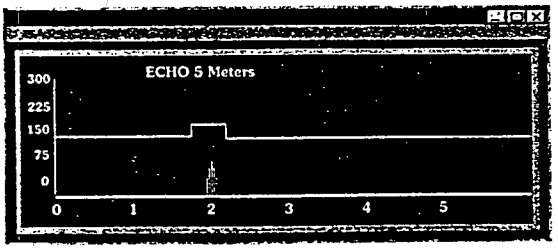


- Click "File"
- Click "View Logged File"
- Click either - analog output
  - analog summary
  - display all
- Choose a saved file

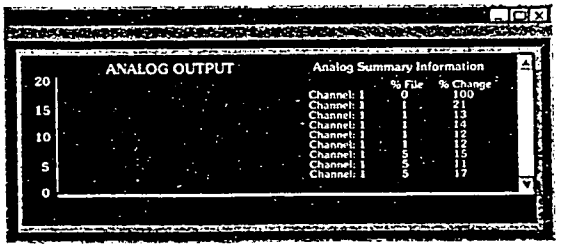
Actual Analog Output for duration of stored file



Actual stred Echos for duration of stored file

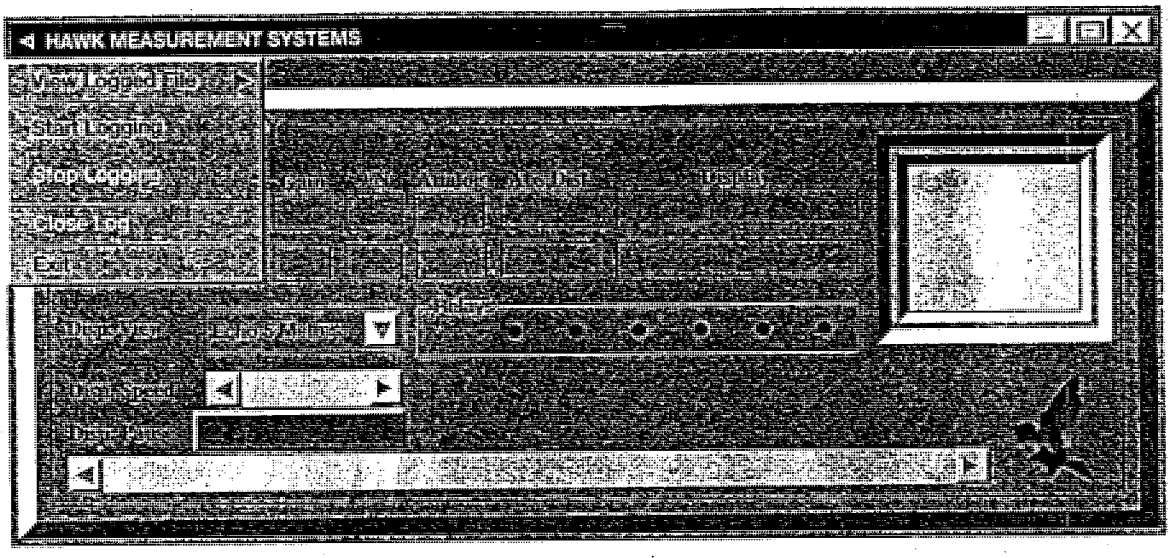


Actual Analog summary for duration of stored file



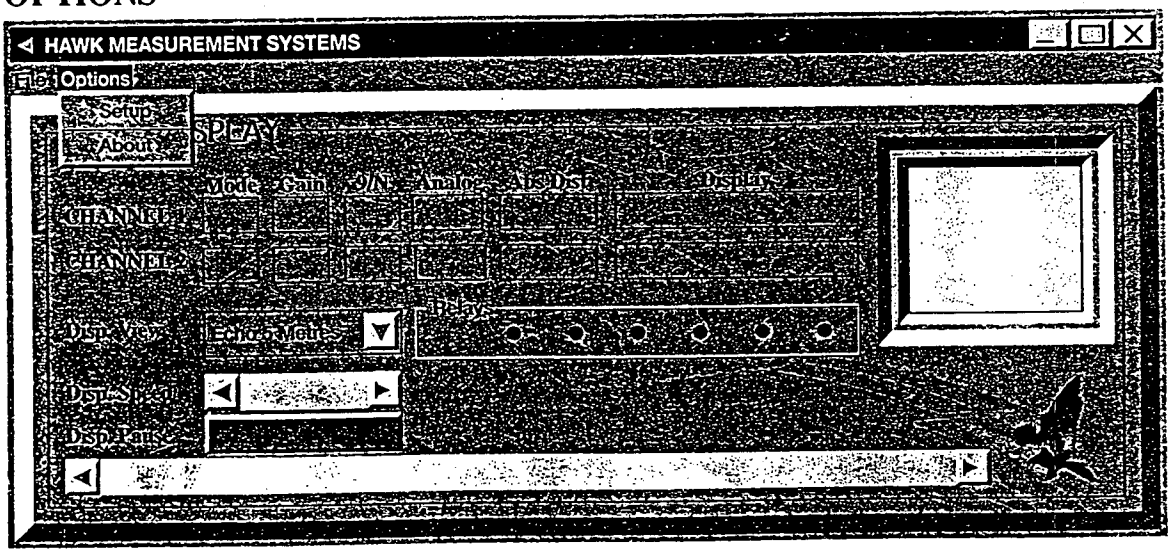
DISPLAY READOUTS

FILE



- **View Logged File:** analog output - *the analog reading only*
  analog summary - *the complete analog trend*
  display all - *show analog and echo readings*
- **Start Logging:** *create a new file*
- **Stop Logging:** *stop recording echo information*
- **Close Logging:** *close the open log*
- **Exit:** *exit the program*

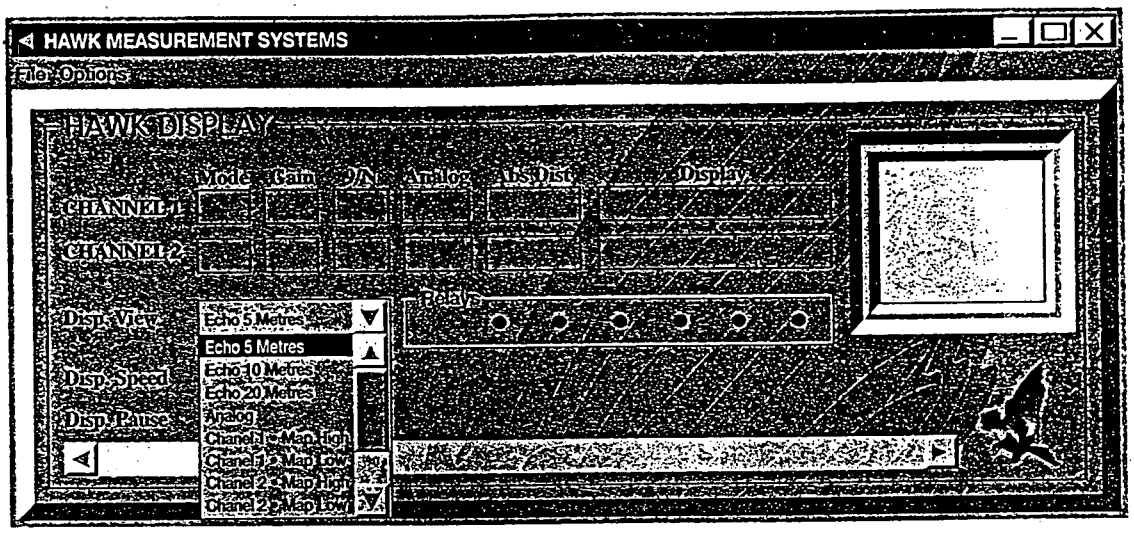
OPTIONS



- **Setup:** Communication Port - *computer connection point*
- **Analog Change %:** *damping of analog*
- **About:** *information regarding HAWK*

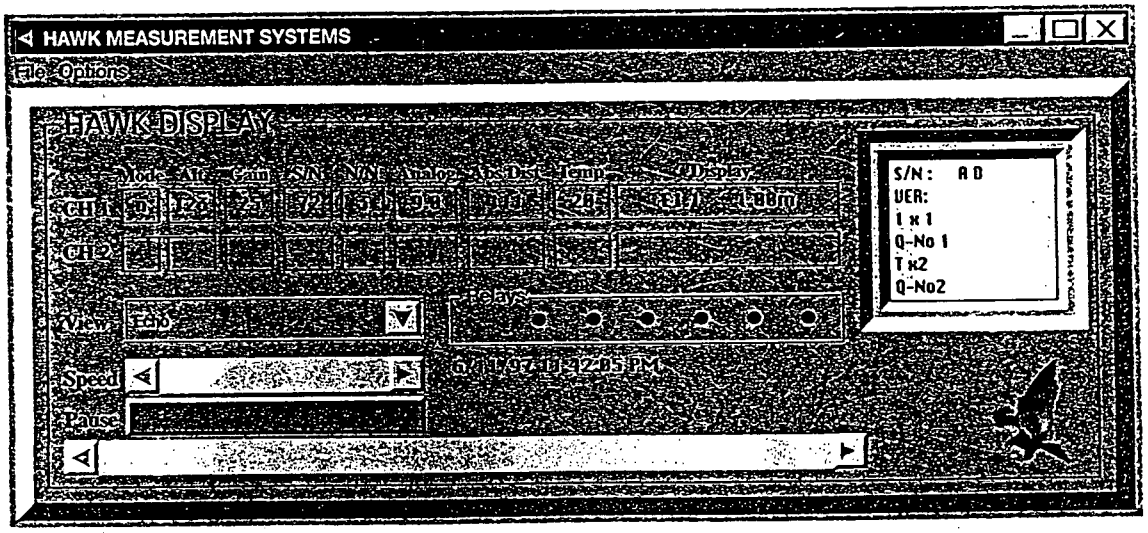
DISPLAY READOUTS cont'd

HAWK DISPLAY



- **Mode:** *operating situation of the unit (low power, high* power, *recovery).*
- **Gain:** *strength of the echo received (low gain = high signal return).*
- **S/N (Signal Noise):** *the remaining available gain.*
- **Analog:** *current output (mA).*
- **Abs. Dist:** *absolute distance between transducer and instant echo.*
- **Display:** *rangemaster display information.*

DISPLAY VIEW



- **Echo 5/10/20:** *echo range.*
- **Analog:** *current output (mA).*
- **Channel 1/2 Map High:** *stored map for high Power.*
- **Channel 1/2 Map Low:** *stored map for Low Power.*
- **Display Param CH 1/2:** the *current stored settings in the rangemaster.*
- **Disp Speed:** *view stored rangemaster information at a desired speed (only in View Logged File).*
- **Disp Pause:** *pause readings at any stage (only in View Logged File).*

DISPLAY READOUTS cont'd

E-MAIL ADDRESS

- hawkaus@c031.aone.net.aus

WHAT TO SEND

- Saved files of Hawklog
- Details etc.
  - what is the application?
  - where is the problem located on the file?
  - what do you perceive to be the problem?

HAWK
Measurement Systems

WARRANTY

Hawk control products will be replaced, put in good operating condition, or the purchase price refunded, at the option of Hawk, free of charges except transportation, if defective in their manufacture, labeling, packaging, or shipping, and if notice of said defect is received by Hawk within one year from the date of shipment. The cost of such replacement, repair or refund or purchase price shall be the exclusive remedy for any breach of warranty, and Hawk shall not be liable to any person for consequential damages for injury or commercial loss resulting from any breach of any warranty. Hawk makes no warranty of fitness for a particular purpose, and makes no other warranty, express or implied, including implied warranty arising from course of dealing or usage of trade.

PART NUMBERING

RANGEMASTER TRANSMITTER

(Sample)..... **RMA 10 - 1 6 - 115**

MODEL
- RMA RangeMaster Air
- RMHA RangeMaster Hi Power Air (5KHz)

SOFTWARE DISTANCE
- 10 15m
- 20 32m
- 100 100m
- 125 125m (5KHz Only)

TRANSDUCER INPUTS
- 1 Single
- 2 Dual

INPUT VOLTAGE
- 115Vac
- 220Vac
- 240Vac
- (24Vdc standard all units)

ALARM RELAYS
- 6 Programmable
- *Note: 1 fail-safe relay per input standard

Note: The single amplifier is recommended for the most difficult applications due to its higher power capability when compared to the dual version. This applies to RMHA only.

TRANSDUCER

(Sample)..... **TD20 - 0 6 FCA6T - 0**

TRANSDUCER FREQUENCY
- 05 5 KHz
- 10 10 KHz
- 20 20 KHz
- 30 30 KHz

HOUSING MATERIAL
- 0 U.P.V.C.
- 2 Stainless Steel
- 4 Polypropylene
- 5 KYNAR (P.V.D.F.)

FACING MATERIAL
- 0 Polyolfin/Elastomer
- 3 Titanium
- 6 Teflon
- 7 Gylon
- 9 Teflon/Titanium

FLANGE & CONE MATERIAL
- 0 U.P.V.C.
- 2 *Stainless Steel
- 4 Polypropylene
- 5 KYNAR (P.V.D.F.)
- 6 Teflon
- 7 Carbon Fibre
- 8 Polyurethene

*Available in 20,30khz only

MOUNTING ACCESSORIES
- F Flange
- C Focalizer Cone
- A ANSI
- D DIN
- J JIS
- 6 Flange/Focalizer Size (in.)
- T Temperature Compensator

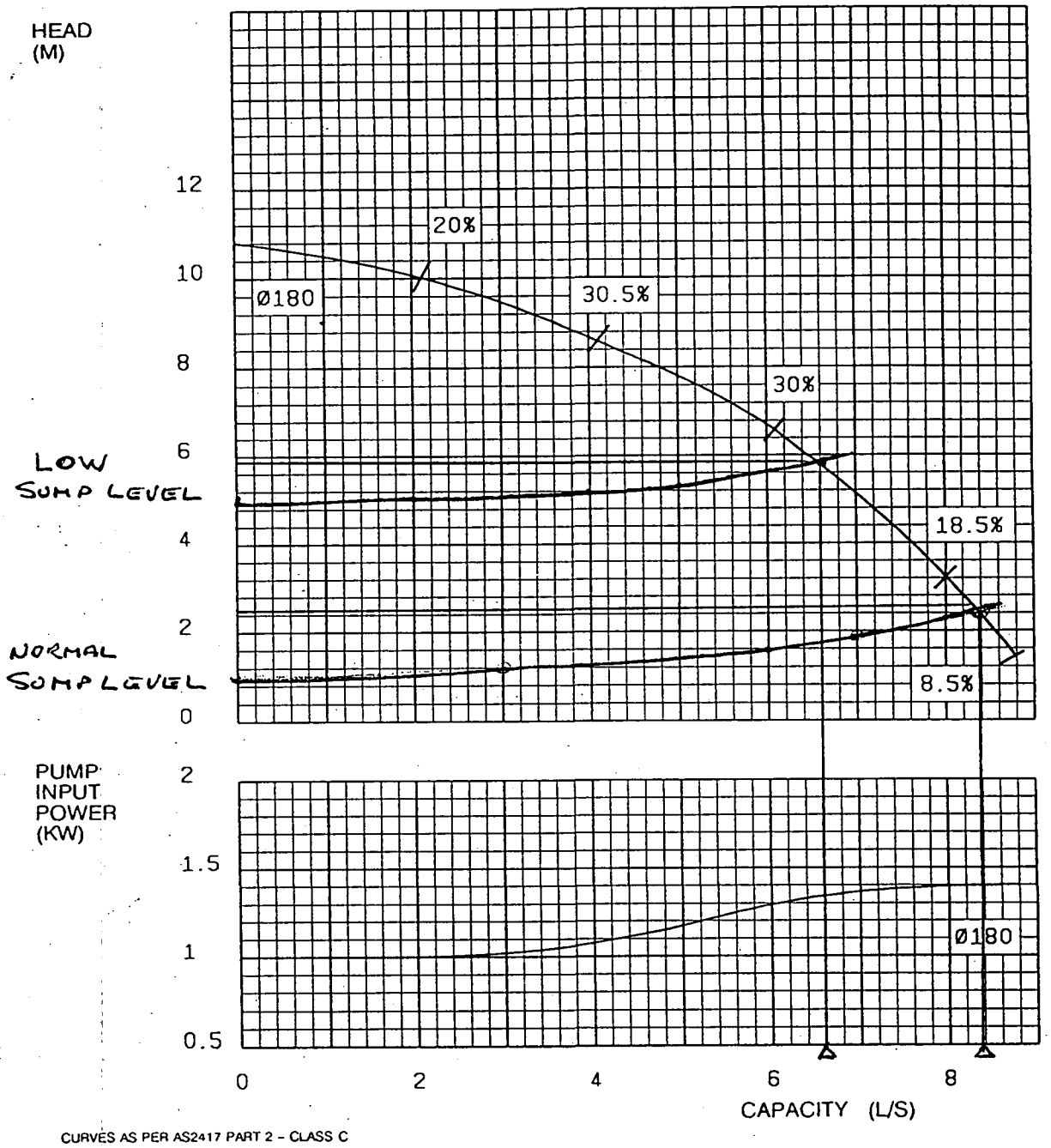
Hawk Measurement Systems
15-17 Maurice Court
Nunawading 3131 Victoria Australia

Telephone: 61 3 9873 4750
Facsimile: 61 3 9873 4538

INTERNET: http://www.hawklevel.com
E-mail Address: hawkaus@c031.aone.net.au

KSB
KSB Ajax Pumps Pty. Ltd.

MODEL : S75–280	IMP. TYPE: SHREDDER	SPEED: 1450 RPM NOMINAL
CURVE NO.: 5270	ISSUE DATE: JAN 97	FREE PASSAGE: 3 MM



CURVES AS PER AS2417 PART 2 - CLASS C

MOTOR RATING IN KW	IMPELLER Ø IN MM	MOTOR FRAMESIZE	FLC IN AMPS
1.5	180	150 FR	3.2

MOTOR RATING IN KW	IMPELLER Ø IN MM	MOTOR FRAMESIZE	FLC IN AMPS

Due to our policy of constant research and development product specifications may change without notice.

KSB AJAX PUMPS PTY LTD

FORRERS WORKS

All members of the KSB Ajax Pumps Works staff are pleased to have been part of the team who produced your unit. Every effort is made by us to ensure the product you have purchased is finished to the highest standard.

Our Ref:\Model\150T300A

PROJECT DETAILS

Pump Model: S75-280 TLC
Motor: 1.5 KW 4 Pole
Project Drawings: N/A
Pump Serial Number: F51252

PERFORMANCE DETAIL

Duty: L/s @ M
Pump Efficiency: N/A
Motor Efficiency: N/A
KWH/KL: N/A

SPECIAL CONSTRUCTION DETAILS

Cable Length: 15 MTRS
Thermistors Fitted: YES
Water Sensor Fitted: NO
Cable Connection: STAR

CLIENT

Customer: CDS TECHNOLOGIES
Project: N/A
Pump Station: N/A
Contract Number: N/A

FOR AFTER SALES AND SERVICE CONTACT YOUR LOCAL KSB AJAX PUMPS BRANCH:

HEAD OFFICE & EXPORT
27 Indwe Street
TOTTENHAM VIC 3012

Ph 03 9314 0611
Fax 03 9314 7435

NEW SOUTH WALES
28 Skinner Avenue
RIVERWOOD NSW 2210

Ph. 02 9584 2099
Fax. 02 9584 2111

QUEENSLAND
1 Carberry Street
EBBW VALE QLD 4305

Ph. 07 3282 1766
Fax 07 3816 0225

SOUTH AUSTRALIA
226 Richmond Road
MARLESTON SA 5033

Ph. 08 8234 0066
Fax 08 8443 5411

WESTERN AUSTRALIA
Unit 2
30-32 Vinnicombe Drive
CANNING VALE WA 6165

Ph 09 9455 7900
Fax 09 9455 7800

NEW ZEALAND
Unit 5
110 Mays Road
PENROSE AUCKLAND NEW ZEALAND

Ph 64 9 634 4020
Fax 64 9 634 6282

TABLE OF CONTENTS

1.0 TECHNICAL DATA

1.1 PUMP TECHNICAL DATA

1.1.1 DESCRIPTION

Pump Manufacturer:	KSB AJAX PUMPS FORRERS PUMP WORKS

1.1.2 PUMP DRAWINGS

Sectional Arrangement:	REFER APPENDICES 12.1
Dimension Drawing:	REFER APPENDICES 12.6

1.1.3 PUMP WEIGHT

Pump Components Weight:	REFER APPENDICES 12.6

1.1.4 MOTOR TECHNICAL DATA

1.1.5 DESCRIPTION

Motor Manufacturer:	KSB AJAX PUMPS FORRERS PUMP WORKS

1.1.6 MOTOR PERFORMANCE DETAILS & MOTOR HARDWARE DETAILS

REFER APPENDICES 12.7 (MOTOR TECHNICAL DATA)

Motor Weight:	REFER APPENDICES 12.7 (MOTOR TECHNICAL DATA)

1.1.7 MOTOR DRAWINGS

Sectional Arrangement:	REFER APPENDICES 12.1
Mechanical Seal:	REFER APPENDICES 12.1
Wiring Diagram:	REFER APPENDICES 12.8

1.2 PUMP IDENTIFICATION

To ensure the correct procedure is followed when working on equipment and ordering spares it is essential you identify equipment correctly.

Pump units are fitted with an identification similar to:

KSB AJAX PUMPS PTY LTD

SUBMERSIBLE INDUCTION MOTOR (AS1359) AND PUMP

CONTRACT NO. [ ] SEAL NO. [ ]

PUMP TYPE [ ] MOTOR [ ]

VOLTS 3 PHASE HERTZ [ ] AMPS

RATING S1 INSUL F DESIGN [ ] CONN [ ]

KW [ ] RPM [ ] L/SEC [ ] HEAD [ ] M

MADE IN AUSTRALIA 199[ ] FORRERS PUMP WORKS

DETAILS ARE:

Contract Number - filled in with clients contract number if known.

Serial Number - special serial number for this unit. This number must be quoted to ensure correct spares are supplied.

Pump Type - details specific pump model.

Motor - this nominates the motor frame size. This allows the client to follow correct procedure in the following manual eg. FR203 refers to a motor with a stator diameter nominally 203mm.

Volts - indicates correct operating volts.

Hertz - indicates correct operating frequency.

Amps - indicates motor full load current.

Design - indicates motor design capability.
eg. N - normal starting.
NY - able to be star delta started.

CONN - indicates cable connection.
Y - star connected.
"DEL" OR Δ - delta connected.
⌓ - open delta connected (2 sets power leads)

KW - rated kilowatts of motor.

RPM - speed of motor.

L/Sec - flow in litres per second where a specific duty is nominated.

Head - head in metres where a specific duty head in nominated.

Year of manufacture is also noted.

As well as the above the pump has a direction of rotation tag on the pump volute which has specific pump serial number stamped on it.

If the unit is a stock standard pump unit it will also be fitted with a single plate stamped with a part number for that unit. Quoting this number will also ensure correct spares are supplied.

2.0 PRINCIPLES OF OPERATION

2.1 PUMP DESCRIPTION

This pump unit is a submersible, wet well, sewage pump close coupled to a submersible motor. The non clog impeller is double shrouded non-clog design with open passages to minimise the possibility of blockages while pumping sewage. The impeller and pump case are fitted with replaceable wear rings on the suction side of the impeller to maximise the life of the major components. The impeller is mounted directly onto the motor shaft via a key and positively locked by means of a lock nut. The impeller is balanced at the factory before dispatch. Motor and pump are fitted with a one piece stainless steel shaft.

The alternative shredder style pump consists of an open impeller where product passes through a rotating cutter and stationary shredder before entering the volute. This action breaks down product to enable the use of smaller diameter discharge pipe work.

Also available is a cutter pump where an open vane impeller operates against serrated suction cover. This creates a shearing action which is particularly effective for breaking down plastics and rags.

The pump and motor are normally mounted vertically. In the most common configuration a discharge stand is permanently fixed to the wet well floor. The discharge of the pump is fitted with a locking plate which forms an automatic seal with the discharge stand when the pump is lowered onto the stand. Guide rails run from the stand to the top well opening to guide the pump onto the stand. Should maintenance on the pump or motor be required the whole unit may be lifted from the well even if the well is full.

The pump is also available in a free standing configuration, different guide arrangement or a dry well application in which the motor is fitted with a cooling jacket.

Once installed the pump will operate continuously provided there is fluid present to be pumped.

Automatic control of the pump can be achieved with a variety of electrical or mechanical controls. The pump may be stopped by isolating the motor from the power supply. **For the safety of maintenance staff it is recommended that a remote lockout type stop button or isolator is provided near the well in case of emergency.**

This is particularly important if the switchboard controlling the pump is remote from the pump station.

The pump end is normally constructed of a heavy duty high quality cast iron. All fixings are stainless steel (special materials of construction are used when specified).

2.2 MOTOR DESCRIPTION

This motor is a KSB Ajax Pumps, Forrers Works submersible motor. The motor is cooled by the pumping medium around the outside of the motor frame in the well. It is recommended that the motor operates submerged during its normal pumping cycle. With jacketed motors product fluid is circulated through jacket to provide cooling. It is recommended (although not essential) where possible to circulate clean water through this jacket. The motor frame is designed for heavy duty application and is constructed from cast iron. The stator assembly consists of laminations of low loss electrical grade steel clamped together with cleats in dovetail slots.

The windings are copper wire coated with polyester imide to a thickness complying with AS1194 Grade 2 insulations. The insulation material is Class F to BS2757. The winding overhangs are laced together securely then impregnated with a Class F varnish and baked at high temperature to cure the varnish to a solid homogeneous mass. Insulation is carried out using a vacuum impregnation process.

The winding tails consist of tinned, flexible copper wire of sufficient diameter to ensure that the current density at the rated load does not exceed 3.5 Amperes per square millimetre. The tails are insulated with Class F material. The winding tails are run to a terminal box. Motors below 3kw use a 3 wire star connection. 3kw and above have 6 wires to the terminal block.

The stator windings contain one positive temperature coefficient (P.T.C.) thermistor per phase in the overhang. The three thermistors are connected in series and the wires taken to a terminal block in the terminal box.

The rotor core is made of laminations of low loss electrical grade steel. These are stacked and fixed by pressure case aluminium or copper bars. The rotor is shrunk onto a stainless steel shaft and dynamically balanced.

The motor is sealed from the pump by a double mechanical seal. Seals consist of either a back to back arrangement or series seal configuration. In standard arrangement the upper seal is tungsten carbide against carbon with the lower seal being tungsten carbide against tungsten carbide. Upper and lower seal faces are separated by an oil filled chamber.

NOTE:Motors manufactured at KSB Ajax - Forrers Works us a white mineral oil (Whiterex 307) or equivalent which is low-toxic and environmentally friendly.

3.0 OPERATING PROCEDURE

3.1 **CAUTION**

NOTE: ANY INTERFERENCE WITH THE ENCLOSURE OF THE ELECTRIC MOTOR VOIDS ANY WARRANTY ON THE ELECTRIC WINDINGS AND TERMINALS. ENSURE CORRECT SUPPLY VOLTAGE AND PHASE ROTATION IS SUPPLIED TO MOTOR AS INCORRECT ROTATION CAN CAUSE PERMANENT DAMAGE TO EQUIPMENT.

3.2 **STARTING**

3.2.1 Check that the complete rotating element is free to turn prior to connecting electrical power.

3.2.2 Ensure pump and motor are fully submersed prior to operating. In the case of a dry well application ensure volute is full of fluid and a positive head exists on the inlet of the pump.

NOTE: WHERE STARTING CONDITIONS HAVE BEEN CHECKED THE PUMP MAY BE STARTED WITH AN OPEN DELIVERY VALVE. AS WITH ANY CENTRIFUGAL PUMP PROLONGED OPERATION AGAINST A CLOSED DISCHARGE VALVE IS NOT RECOMMENDED.

3.2.3 Where the discharge line has not been charged with fluid it is permissible to operate the pump against a partially closed discharge valve.

3.2.4 Ensure there is sufficient fluid in the well and then start the motor. Ensure equal and correct voltage is supplied to each phase.

3.2.5 Open the pump delivery valve slowly until the required pressure or flow is obtained.

CAUTION: 1. PROLONGED RUNNING WITH A CLOSED DELIVERY VALVE CAN DAMAGE PUMP INTERNAL COMPONENTS AND MUST BE AVOIDED.

3.3 **CONTINUOUS OPERATION**

Most pump installations run under automatic control so providing the pump unit has been commissioned correctly and maintenance schedules are maintained the pump unit requires little additional supervision unless there is a duty change required.

3.4 **STOPPING**

Isolate the motor from the mains and mechanically lock the isolator out. If work is to be carried out on the pump unit ensure that the isolator is mechanically locked open and power supply is isolated from motor. **Do not restart the motor before it has fully stopped.** Restarting the motor results in very high current fluctuations in the motor windings and pressure surges in the rising main and may cause serious damage to the unit or the system.

3.5 **EMERGENCY STOPPING**

Follow the procedure outlined in Section 3.4 above. It is recommended that lock out isolators be installed at all points where work is to be carried out on the pump or its associated equipment.

3.6 **ENSURING MAXIMUM LIFE FOR YOUR UNIT**

In the interest of ensuring maximum benefit and life from equipment the following basic recommendations should be followed:

a) Operate with correct power supply,
b) Provide adequate protection for equipment in the form of thermistor protection, and overload protection set to suit motor rating,
c) Do not run dry or without an adequate supply of fluid (run with motor submersed),
d) Run units in correct rotation (clockwise when viewed from drive end),

e) Operate pump in its correct range of design flow and discharge pressure.
f) Use pump in pumping medium for which unit was designed.
g) Ensure regular maintenance of station pumping units and ancillary equipment is carried out.

4.0 GOODS INSPECTION AND STORAGE

4.1 INSPECTION

4.1.1 Immediately on receipt of the equipment, inspect it thoroughly. Examine the crate and the wrapping before discarding them, since parts or accessories are sometimes wrapped individually or fastened to the crate.

4.1.2 Report any damage or shortage to KSB Ajax Pumps and the carrier immediately. All claims must be made (or confirmed) in writing within seven days.

4.1.3 If the equipment is not being installed immediately, it must be stored under suitable conditions.

4.2 STORAGE

4.2.1 SHORT TERM

4.2.1.1 When it is necessary to store a pump for a short time before it is installed, place it in a dry location. Ensure cable ends are kept dry and cable is protected against mechanical damage.

4.2.1.2 To prevent rusting-in or seizing, lubricate the unit before storing paying particular attention to components which run in close tolerance, eg. wear rings, etc. Turn the pumpset by hand at least once a week. Extreme care should be exercised with regard to the motor cables: ensure, that the pump dose not stand on the motor cables and that the cable seal on the end of the cable is not damaged as it prevents water entering the cable.

4.2.2 **LONG TERM**

4.2.2.1 More thorough precautions are required if the pump is to be stored for an extended period of time. Refer to FORRERS PUMPS WORKS for full information on long term storage.

Do not store any equipment in any area which is subject to either direct or indirect vibration as this can have a detrimental effect on bearings.

5.0 PIPEWORK INSTALLATION

5.1 DELIVERY PIPEWORK

5.1.1 It is essential to ensure that the delivery pipework is adequately supported and anchored to resist hydraulic thrust.

5.1.2 If the delivery pipe does not rise continuously air pockets can form in the pipe at high spots. If is good pumping practice to remove these air pockets in the pipe by venting the air through an air release.

6.0 PUMPSET INSTALLATION

6.1 PROCEDURES PRIOR TO INSTALLATION

6.1.1 CLEANING PRIOR TO INSTALLATIONS

6.1.1.1 All packing and crating should be removed and discarded prior to starting the installation procedure. Check all the packing before discarding it to ensure that no parts or accessories are attached to it in individual wrappings.

6.1.1.2 All parts of the assembly must be thoroughly cleaned before installation begins. All traces of rust preventative must be removed from the discharge and suction faces, exposed shafting, and all coupling surfaces.

6.1.2 LAY-OUT OF PUMP PARTS FOR INSTALLATION

6.1.2.1 Care must be taken to avoid damage to components whenever handling or installing them.

6.1.2.2 If suitable lifting tackle is not available, skids must be employed to transfer heavy weights at ground level. Loaded crates, individual components or subassemblies must never be dropped to the ground from a transport vehicle.

6.1.2.3 Individual components should be layed out on clean dry timbers or on a suitably cleaned surface in the order which they will be installed.

6.1.2.4 Any packing or other protective material must be removed before starting the installation procedure.

6.2 PUMPSET FOUNDATION

6.2.1 An adequate pump foundation is essential. It should consist of a solid block of concrete brickwork or masonry sufficiently massive and rigid to provide continuous support for the pump pedestal throughout the pumps life.

6.2.2 The top of the foundation plinth should be 25mm to 38mm below the required finished height of the stand's lower flange. This is to allow the discharge stand to be adjusted and levelled during installation. The remaining gap is filled with grout after levelling to provide support to the discharge stand.

6.2.3 Foundation bolt holes should be prepared in the foundation plinth to match the discharge stand holes. Each hole should be drilled the correct diameter to accept the masonry anchor.

6.3 DISCHARGE STAND LEVELLING

6.3.1 Position the masonry anchors or fixings using stand or dimension drawing as a guide.

6.3.2 Place solid packers approximately 30mm high on either side of each masonry anchor.

6.3.3 Sling the discharge stand and lift it onto the anchors so that it sits on the packers. Level the discharge stand by placing shims between the packers and the stand.

6.3.4 Once the discharge stand is level place a washer on each masonry anchor and screw on the nuts. tension the nuts until the masonry anchor has gripped firmly and the discharge stand is clamped tight.

6.4 **GROUTING**

6.4.1 The use of good grout is important when installing a pump as it prevents lateral movement of the discharge stand and damps vibration. The use of a non-shrink grout or other available propietry product is recommended. (Hilti provide a range of suitable fixings, adhesives & grouts).

6.4.2 After levelling and alignment is completed and all foundation bolts pulled down tightly, preparation for grouting the stand can commence. Boxing should be placed around the stand's lower flange to contain the grout when it is poured.

6.4.3 Manufacturers recommendations for application of grouting material should be followed.

NOTE: IT IS IMPORTANT THAT THE GROUT FILLS THE CAVITY BETWEEN THE LOWER FLANGES AND THE FOUNDATION SO THAT FULL SUPPORT IS GIVEN TO THE STAND. IT SHOULD BE CHECKED THAT THE GROUT DOES NOT SHRINK FROM THEN STAND'S FLANGE AFTER CURING.

6.4.4 The exposed surfaces should be covered with damp hessian to prevent the grout from drying too rapidly and cracking. The hessian should be kept damp for about forty-eight hours or until the grout is set.

6.4.5 When the grout is set, the boxing should be removed and a smooth finish given to the grout and foundation surfaces. Manufacturers recommendations should be followed.

6.4.6 After curing, guide rails and top bracket can be fitted.

6.5 CONNECTING THE PUMP

6.5.1 Before lowering the pumpset onto the discharge stand the motor and pump should be checked as per Section 3 of this manual.

6.5.2 After carrying out the above checks the pumpset is ready to be installed on the discharge stand. Attach a sling to the lifting points on the motor and position the pumpset across to the well opening and lower it onto the guide rail. Lower the unit down the guide rail until it locks onto the discharge stand. It may be necessary to manipulate the unit by hand while supported to ensure that it has seated home correctly and that the seal between the pump and discharge stand is complete. Keep the pump completely vertical when lowering into position.

6.5.3 In the case of free standing pump, discharge pipework is securely attached to the pump discharge prior to lowering into position. It is advantageous to fit pipework with a quick connect type coupling. Ensure the pump is mounted on level foundations and slung to prevent turning.

6.6 COMMISSIONING THE PUMPSET

6.6.1 Start the pump unit as per Section 3 of this manual.

6.6.2 Allow it to run for approximately ten minutes to fill the pipeline with fluid and stabilise in its operation. Test readings of head, flow, voltage, current and power should then be taken to check that the unit is operating correctly. If flow measurement equipment is not available then the flow may be calculated by measuring the rate at which the fluid level drops in the wet well. The flow may be adjusted by altering the setting of he discharge pipe valve.

6.6.3 Once the commissioning procedure outlined above has been finished the pump unit should be shut down as per Section 3 of this manual.

7.0 MAINTENANCE SCHEDULES

7.1 ROUTINE MAINTENANCE

ALWAYS COMPLY WITH CORRECT PROCEDURES WHEN MAINTAINING PUMPING EQUIPMENT. UNDER ALL CIRCUMSTANCES SAFETY FIRST.

When a pump station is initially commissioned it should be visited daily for the first two weeks to check that all the systems are working correctly. Particular care should be taken with a new installation that foreign matter such as concrete, tins, timber or tools do not foul the pump. The wet well should be hosed down and pumped to its minimum level each day to check for such foreign matter. All such material should be removed.

Each time the pump station is visited readings of the hours run, voltage and current should be taken and recorded in a station log book for each pump. Abnormalities in these readings are often the first sign that maintenance is required on the pump unit. Ideally the station should be visited on a daily basis to check the pumps operation, record the above data and clean any build ups of fats or foreign material in the wet well. The required frequency of visits to the well can often be established by the attention required during the daily visits for the two weeks following commissioning.

7.2 PERIODIC MAINTENANCE

7.2.1 The tables in Appendix 12.2 give the recommended times for periodic maintenance checks. The major check required is a six monthly or 1500 hour inspection of the motor. The procedure to be followed in this check is detailed in the following section.

7.2.2 The pump unit requires a complete overhaul once either the delivery head drops below an unacceptable level or the power consumption rises significantly. The establishing of acceptable variation to the installed performance is normally left to the maintenance engineer's discretion, however a variation of 15% in power, flow or head usually warrants investigation. The unit should then be returned to KSB Ajax Pumps or the instructions in Sections 8 to 11 followed to repair the unit.

7.2.3 Where a pump station involves sub-contractors associated equipment it is important that their instructions are read so that a fully comprehensive maintenance schedule can be drawn up for the station.

7.2.4 **SIX MONTHLY OR 1500 HOUR INSPECTION**

7.2.4.1 The pump and motor should be checked every six months or 1500 hours of operation, whichever comes first. The checks cover the condition of the electrical insulation in the motor windings, condition of the mechanical seal and the wear of the pump components.

7.2.4.2 Refer to Section 8 to electrically disconnect the motor and lift the motor-pump from the pump well. Where possible, the incoming power isolator should be padlocked in the **'OFF'** position. Any electrical work on the enclosure of the electrical motor should be carried out by suitably qualified personnel. Any work should be conducted following good safety procedures.

7.2.4.3 Inspect the pump end for wear or damage. Ensure all the fasteners are tight. Inspect the discharge sealing ring (120) for damage or excessive wear.

7.2.4.4 Refer to section 8 for instructions on disassembly of pump.

7.2.4.5 Check the diametrical clearance between the impeller wear rings and the case wear rings. If the diametrical clearance is greater than 1.5mm the wear rings will require replacement. Refer to section 8 for wear ring removal. With shredder style pumps wear of cutter and stationary will result in shredding action being diminished with resultant more frequent blocking.

7.2.4.6 After the inspection refer to Section 11 for instructions on the procedure for replacement of pump components.

7.2.4.7 The mechanical seal should be checked to ensure it is sealing correctly. Leaving pump/motor upright remove the upper plug sealing the oil reservoir in the lower end of the motor. Draw off a small sample of oil (approx. 100mls) and put into a clean glass container. Allow the oil to settle. Inspect the oil to see that it is not milky or that water has not settled at the bottom of the container. Caution should be taken when removing the taper plugs as the oil may spray out if the pressure remains in the oil chamber.

7.2.4.8 If the oil contains water and it has been ascertained that it has not leaked through the plugs the mechanical seal may require reconditioning. Refer to Section 9 for the procedure to remove the mechanical seal.

It is quite acceptable under normal operating conditions for a small amount of water to infiltrate into the seal chamber. Above 5 percent contamination normally indicates a problem with the seal.

7.2.4.9 Refer section 1 for motor frame identification.

If the oil tested is only milky (less than 5%) it is acceptable practice to drain the oil chamber, for motor frames 203, 260 with motor vertical. Remove plug 15(c) to drain oil taking care not to spill any oil. Replace plug 15(c). Use a thread sealant on the thread then tension firmly into place. Remove level plug 15(a).

With 203 & 260 frame motor still standing vertically, refill oil chamber through oil filler line 15(b) until oil reaches oil level plug. Use recommended lubrication as per appendices 12.3. After applying thread sealant replace filler plug 15(b) and level plug 15(a) after allowing any excess oil to drain off. **Do not overfill.**

For motor frames 150, 165 & 300 lay motor on side. Remove plugs 15(c) & 15(b) then roll motor over to drain oil into a suitable container.

Roll unit over with motor still on its side and plug holes to top. Fill chamber completely with oil. After applying thread sealant replace plugs 15(c) and 15(b).

7.2.4.10 If the motor was previously stripped refer to Section 10 for motor assembly and mechanical seal assembly. Ensure that the impeller is free and revolving truly and reinstall pump-motor unit back into the pump station.

7.2.4.11 Refer to Section 3 for the procedure for reconnecting the motor to the switchboard and starting the pump.

8.0 TO DISASSEMBLE THE PUMP

8.1 PREPARATION PRIOR TO DISASSEMBLY

8.1.1 Isolate the electric motor from the mains by opening the main isolator supplying power to the switchboard or lock the power isolator and control circuit isolator for the unit (remember safety first) in the **'OFF'** position.

8.1.2 Disconnect power and control cables.

8.1.3 Close the discharge isolating valve.

8.1.4 Lift the pump from the wet well and thoroughly clean down the outside of the pumpset.

8.1.5 The highest possible standard of cleanliness must be maintained throughout any maintenance operation.

8.2 DISASSEMBLY PROCEDURE (REFER SECTION 12 FOR SECTIONAL ARRANGEMENT DRAWING)

For Non Clog Pumps

8.2.1 **To remove the impeller**

8.2.1.1 Stand the pump-motor unit upright on clean, dry timbers, ensuring that it is stable. Chock it securely.

8.2.1.2 Remove the nuts which secure the motor to the volute (101).

8.2.1.3 Attach a sling to the lifting points on the motor and using suitable safe lifting equipment lift the motor off the pump end. If the gasket will not release the motor from the pump end raise the pump-motor unit approximately 5mm off the timber and strike the volute with a soft hammer onto a piece of timber. The motor complete with impeller can be withdrawn from volute.

8.2.1.4 Remove gasket (113) if damaged in any way.

8.2.1.5 Position the motor unit on a bench at a suitable working height and chock it securely.

8.2.1.6 Secure the impeller (102) to prevent rotation.

8.2.1.7 Remove the locknut (103) and washer (104). Using a puller remove the impeller (102) from the shaft. The impeller is driven by the shaft using a tapered drive and key. The impeller may require a gentle impact to remove. In the case of an impeller being difficult to remove the application of heat to the impeller will assist in its removal. Rapid heating of impeller minimising heat transfer to the shaft provides best results.

8.2.2 Complete disassembly.

8.2.2.1 Check the diametral clearance between the volute wear rings (108) and the impeller wear rings (107). if the diametral clearance is greater than 1.5mm the wear rings will require replacement. Replacement if also recommended if significant scoring of wear rings has occurred. Excessive wear of wear rings result in less efficient operation of pumps, flow loss and head loss, therefore resulting in higher operating costs.

8.2.2.2 To remove the impeller wear rings (107) set the impeller in a lathe and machine if off. If a lathe is not available grind a flat through one side of the wear ring and knock the wear ring off. Ensure the original machine surface of impeller under wear ring is not damaged.

8.2.2.3 To remove the case wear ring (108) press the wear ring out of the volute.

8.2.2.4 Remove the key (33) from the shaft (4).

8.2.2.5 Discard any gasket if damaged.

Appendix G
4BRI-06

Sump Pump

Pump system curve

Pump operation and maintenance information

ITEM No	QTY	DESCRIPTION	SUPPLIER	MANUFACTURER	CATALOGUE No	CORRECTLY INSTALLED	EXERCISE TEST	MECHANICAL TEST
00	1	SURGE DIVERTER	SEA DISTRIBUTORS	CRITEC	SAJ80A			
01	1	MAIN CIRCUIT BREAKER + SHROUD	IMP	TERASAKI	XS125CJ/50 + SHPO			
02	1	PUMP CIRCUIT BREAKER + SHROUD	IMP	TERASAKI	XH30PS/6 + SHROUD			
03								
04	1	SUB-DISTRIBUTION BOARD CPS	IMP	STROMBERG	OESA63CI			
04.1	1	CPS FUSE COVER	IMP	STROMBERG	OESA2CVT2			
04.2	1	FUSE CARTRIDGE	GEC	GEC	TIA 32			
05	1	SUB-DISTRIBUTION BOARD CHASSIS	IMP	TERASAKI	[illegible]			
06								
06.1								
07								
07.1	1	LINE CONTACTOR + AUX.	IMP	SPRECHER & SCHUH	CA3-9-10 + CA3-PV-11			
07.2								
07.3								
08	1	THERMAL OVERLOADS	IMP	SPRECHER & SCHUH	CT7-24-4			
09								
10								
11								
12								
13	1	PUMP INSTRUMENT CT	CROMPTON INSTRUMENTS	CROMPTON INSTRUMENTS	101-0431 50/5 10 PRIMARY TURNS			
14	1	INSTRUMENT FUSES	GEC	GEC	0S700			
14.1	1	FUSE CARTRIDGES	GEC	GEC	NIT2			
15	2	CT TEST LINKS	U.E.A.	KLIPPON	SAKT2/35 0[illegible]			
15.1	1	END PLATE	U.E.A.	KLIPPON	AP 032[illegible]			
15.2	1	SLIDE LINK 2 WAY	U.E.A.	KLIPPON	QVS2 03173[illegible]			
15.3	2	SLEEVE	U.E.A.	KLIPPON	WTB 0[illegible]			
15.4	2	SCREW	U.E.A.	KLIPPON	BS 033[illegible]			
16	1	PUMP AMMETER	CROMPTON INSTRUMENTS	CROMPTON INSTRUMENTS	243-02[illegible] 0-5/75A			
17	1	KILOWATT TRANSDUCER	HUNTER WATERTECH	MULTITEK	M100-WA2			
18	1	CURRENT TRANSDUCER	HUNTER WATERTECH	MULTITEK	M100-AL1			
19	1	PHASE FAILURE RELAY	CROMPTON INSTRUMENTS	CROMPTON INSTRUMENTS	252-PSGW			
20	1	PHASE FAILURE CIRCUIT BREAKER	IMP	TERASAKI	DINT6-306			
21	1	3 PHASE OUTLET CIRCUIT BREAKER	IMP	TERASAKI	DINT6-320			
22	1	1 PHASE OUTLET CIRCUIT BREAKER	IMP	TERASAKI	DINT6-110			
23								
24	1	RTU LAP-TOP GPO CIRCUIT BREAKER	IMP	TERASAKI	DINT6-102			
25	1	SW/BD FLUORO CIRCUIT BREAKER	IMP	TERASAKI	DINT6-106			
26	1	CATHODIC PROTECTION CIRCUIT BKR	IMP	TERASAKI	DINT6-106			
27	1	24VDC POWER SUPPLY CIRCUIT BKR	IMP	TERASAKI	DINT6-106			
28	1	TRANSDUCERS CIRCUIT BREAKER	IMP	TERASAKI	DINT6-106			
29	1	RTU CIRCUIT BREAKER	IMP	TERASAKI	DINT6-110			
30								
31	4	SPARE CIRCUIT BREAKERS	IMP	TERASAKI	DINT6-106			
32	2	SW/BD DOOR MICRO SWITCHES	BOXE ELECTRICS	CARSCO	SPC02			
33	2	SW/BD INTERNAL FLUORO LIGHTS	IDEAL	THORN	00F[illegible]			
34	1	FLOW RATE INDICATOR	CROMPTON INSTRUMENTS	CROMPTON INSTRUMENTS	244-01[illegible] 4-20mA 0-[illegible] L/SEC - RED POINTER			
35								
36								
37	1	PUMP CONTROL CIRCUIT BREAKER	IMP	TERASAKI	DINT6-106			
38	1	PUMP HOURS RUN METER	GEC	NATIONAL	TH13			
39	1	THERMISTOR RELAYS	IMP	SPRECHER & SCHUH	RT3-A-24VAC			
40								
41	1	CONTROL CIRCUIT ON RELAY	DUAL ELECTRONICS	IZUMI	RH2B-U-24VAC			
42								
43								
44	1	LINE CONTACTOR CONTROL RELAY	OED	KLIPPON	RS30 [illegible]			
45	1	RADIO COAX. SURGE PROTECTION	HUNTER WATERTECH	POLYPHASER CORPORATION	IS-50NX-C2			
46	1	PUMP STATUS INDICATOR	IMP	SPRECHER & SCHUH	D5P-PL3CL0			
47	1	PUMP START PUSH BUTTON	IMP	SPRECHER & SCHUH	D5P-F13LX10			
48	1	PUMP STOP PUSH BUTTON	IMP	SPRECHER & SCHUH	D5P-RT53X3LX01/01			

ITEM No	QTY	DESCRIPTION	SUPPLIER	MANUFACTURER	CATALOGUE No	CORRECTLY INSTALLED	EXERCISE TEST	MECHANICAL TEST
49	1	PUMP RESET PUSH BUTTON	IMP	SPRECHER & SCHUH	D5P-F13LX10			
50								
51								
52								
53								
54								
55	1	STATION CONTROL SELECTOR SW.	AUSTRALIAN SOLENOID	CRAIG & DERRICK	CA0[illegible]-A200-[illegible]			
56	1	SITE ATTENTION RESET	IMP	SPRECHER & SCHUH	D5P-F13LX10			
57								
58								
59	1	SITE ATTENTION ALARM	IMP	SPRECHER & SCHUH	D5P-P53CL0			
60								
61	1	3 PHASE OUTLET	IDEAL	CLIPSAL	56SO[illegible]			
62	1	1 PHASE OUTLET	IDEAL	CLIPSAL	15V/[illegible]			
63	1	NEUTRAL LINK	IDEAL	CLIPSAL	[illegible]			
64	1	EARTH LINK	IDEAL	CLIPSAL	[illegible]			
65		SWITCHBOARD TERMINALS	OED	KLIPPON				
65.1	30	ANALOGUE DISCONNECT TERMINALS	OED	KLIPPON	[illegible]			
65.2	30	END PLATE	OED	KLIPPON	AP [illegible]			
65.3	[illegible]	FUSE TERMINAL	OED	KLIPPON	ASK1/35 [illegible]			
65.4	[illegible]	END PLATE	OED	KLIPPON	AP [illegible]			
65.5	[illegible]	FUSE CARTRIDGE	OED	KLIPPON	FUSE 20x5mm			
65.6	[illegible]	DISCONNECT TERMINAL	OED	KLIPPON	SAKK/35 [illegible]			
65.7	5	END PLATE	OED	KLIPPON	AP [illegible]			
65.8	[illegible]	END STOP	OED	KLIPPON	EW35 [illegible]			
66	1	MAIN NEUTRAL LINK	IDEAL	CLIPSAL	20LAC5			
67	1	MAIN EARTH LINK	IDEAL	CLIPSAL	20LAC5			
68	1	INSTRUMENTATION EARTH LINK	IDEAL	CLIPSAL	[illegible]			
69	3	SAKA/35						
70								
71								
72								
73	1	24VDC 3A LINEAR POWER SUPPLY	POWER HOUSE	POWER BOX	[illegible]			
74	1	24VDC CIRCUIT BREAKER	IMP	TERASAKI	DINT6-[illegible]			
75	1	RTU SURGE REDUCTION FILTER	HUNTER WATERTECH	CRITEC	[illegible]			
76	1	CATHODIC PROTECTION UNIT	FREE ISSUE		FUTURE			
77	1	BATTERY ENCLOSURE	NETWORK	NETWORK	[illegible]			
78	1	BATTERY VENT	IMP	FIBOX	[illegible]			
79	1	RTU LAPTOP G.P.O.	IDEAL	CLIPSAL	15 / 230			
80	1	DECONTACTOR	CUTLER HAMMER	MARECHAL	[illegible]			
81	1	ANGLE ADAPTOR	CUTLER HAMMER	MARECHAL	[illegible]			
82	1	PLUG TOP	CUTLER HAMMER	MARECHAL	[illegible]			
83	1	RTU POWER FAIL RELAY	DUAL ELECTRONICS	IZUMI	RH2B-U-24VAC			
84	1	RTU BATTERY DISCHARGE RELAY	DUAL ELECTRONICS	IZUMI	RH2B-U-12VDC			
85	1	RTU POWER SUPPLY CLOCK	HUNTER WATERTECH	POWERBOX	[illegible]			
86	1	RTU 12/24VDC CONVERTER	HUNTER WATERTECH	POWERBOX	[illegible]			
87	1	PENSTOCK ACTUATOR C/B	IMP	TERASAKI	[illegible]	NOT USED		
88	1	PENSTOCK ACTUATOR CONTACTOR	IMP	SPRECHER & SCHUH	CA3-9			
89	1	PENSTOCK OPEN PUSHBUTTON	IMP	SPRECHER & SCHUH	D5P-F13LX10			
90	1	PENSTOCK STOP CLOSE P/BUTTON	IMP	SPRECHER & SCHUH	D5P-RT53X3LX01/01			
91	1	PENSTOCK CONT. CONTROL RELAY	OED	KLIPPON	RS30 [illegible]			
92	1	PENSTOCK CONT. CIRCUIT ON RELAY	DUAL ELECTRONICS	IZUMI	RH2B-U-24VAC			
93	1	PENSTOCK ACTUATOR CONTROL C/B	IMP	TERASAKI	[illegible]			
94	1	SPRAY VALVE C/B	IMP	TERASAKI	[illegible]			
95	1	SPRAY VALVE CONTACTOR	IMP	SPRECHER & SCHUH	CA3-9			
96	1	SPRAY VALVE OPEN PUSHBUTTON	IMP	SPRECHER & SCHUH	D5P-F13LX10			
97	1	SPRAY VALVE STOP CLOSE P/B	IMP	SPRECHER & SCHUH	D5P-RT53X3LX01/01			
98	1	SPRAY VALVE CONT. CONTROL RLY	OED	KLIPPON	RS30 [illegible]			
99	1	SPRAY VALVE CONT. CIRCUIT ON RLY	DUAL ELECTRONICS	IZUMI	RH2B-U-24VAC			
100	1	SPRAY VALVE CONTROL C/B	IMP	TERASAKI	[illegible]			
101	1	ULTRASONIC LEVEL RELAY	CDS	RANGE MASTER	FREE ISSUE			
102	1	ULTRASONIC LEVEL RELAY PROBE	CDS	RANGE MASTER	FREE ISSUE			
103	2	ULTRASONIC LEVEL RLY CONT. C/B	IMP	TERASAKI	[illegible]			
104	1	PENSTOCK STATUS INDICATOR	IMP	SPRECHER & SCHUH	D5P-PL3CL0			
105	1	SPRAY VALVE STATUS INDICATOR	IMP	SPRECHER & SCHUH	D5P-PL3CL0			

DESCRIPTION	DRAWING REFERENCE
EQUIPMENT LEGEND	2694-01
ELECTRICAL CONTROL DRAWINGS	2694-03, 05, 06, 08
RTU I/O SCHEMATIC	2694-10
GENERAL ARRANGEMENT	2694-20
CONSTRUCTION NOTES	2694-21
SECTIONAL DETAILS	2694-22
SPECIFIC DETAILS	2694-23
INTERNAL LABEL LIST	2694-25

☑ FINAL

PROJECT No. 310

DATE 19/11/99 SIGN [signature]

No	DATE	AMENDMENT	INITIALS
3	9/11/99	AS BUILT & INSTALLED	GN
2	2/6/98	AS BUILT	GN
1	2/7/98	REVISE ITEMS 12 & 13	GN

AMENDMENT & ISSUE REGISTER

MANAGER DATE:	DIRECTOR OF TECHNOLOGY SERVICES DATE:	
DIRECTOR OF PLANNING & DESIGN DATE:	DIRECTOR OF WATER SUPPLY DATE:	DIRECTOR OF CONSTRUCTION DATE:
DESIGN		ENGINEER IN CHARGE
DRAWN		SUPERVISING ENGINEER
TRACED		
CHECKED		A2 REDUCED

REFERENCES

CADD FILE No.

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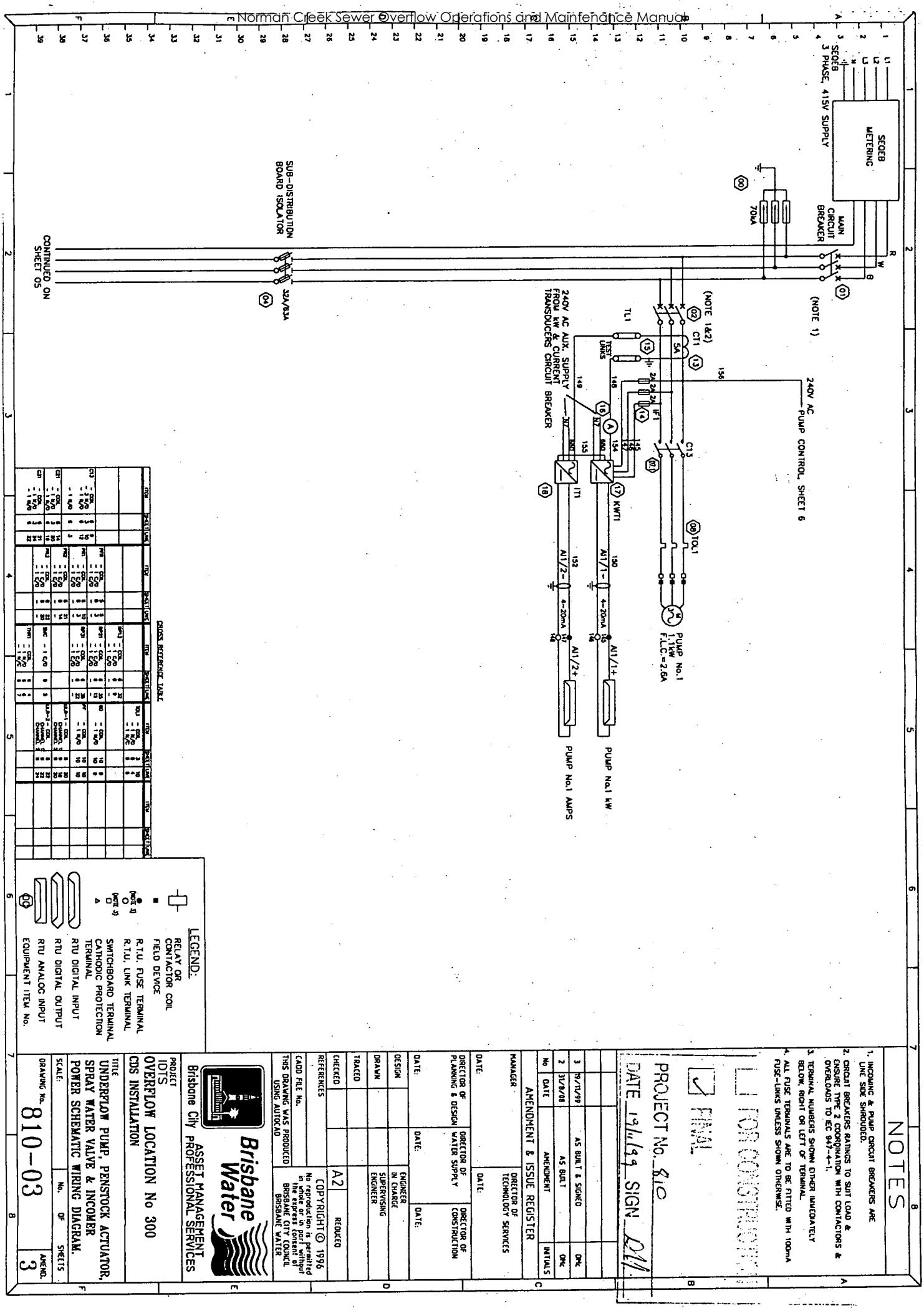
Brisbane City — Brisbane Water
ASSET MANAGEMENT PROFESSIONAL SERVICES

PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION

TITLE
SWITCHBOARD
EQUIPMENT LIST

SCALE: No. OF SHEETS

DRAWING No. 810-01 AMEND. 3


SEQEB METERING
3 PHASE, 415V SUPPLY
MAIN CIRCUIT BREAKER
70mA
SUB-DISTRIBUTION BOARD ISOLATOR
32A/63A
CONTINUED ON SHEET 05
(NOTE 1)
240V AC PUMP CONTROL, SHEET 6
240V AC AUX. SUPPLY FROM kW & CURRENT TRANSDUCERS CIRCUIT BREAKER
(NOTE 1&2)
CT1
5A
TL1
TEST LINKS
IT1
KWT1
TQ1
PUMP No.1 1.1kW F.L.C.=2.6A
PUMP No.1 AMPS
PUMP No.1 kW
4-20mA
AI1/1+
AI1/1-
AI1/2+
AI1/2-
C13
F1
NOTES
1. INCOMING & PUMP CIRCUIT BREAKERS ARE LINE SIDE SHROUDED.
2. CIRCUIT BREAKERS RATINGS TO SUIT LOAD & ENSURE TYPE 2 COORDINATION WITH CONTACTORS & OVERLOADS TO IEC 947-4-1.
3. TERMINAL NUMBERS SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.
4. ALL FUSE TERMINALS ARE TO BE FITTED WITH 100mA FUSE-LINKS UNLESS SHOWN OTHERWISE.
FOR CONSTRUCTION
FINAL
PROJECT No. 810
DATE 19/11/99 SIGN
CROSS REFERENCE TABLE
LEGEND:
RELAY OR CONTACTOR COIL
FIELD DEVICE
R.T.U. FUSE TERMINAL
R.T.U. LINK TERMINAL
SWITCHBOARD TERMINAL
CATHODIC PROTECTION TERMINAL
RTU DIGITAL INPUT
RTU DIGITAL OUTPUT
RTU ANALOG INPUT
EQUIPMENT ITEM No.
No DATE AMENDMENT INITIALS
3 19/11/99 AS BUILT & SIGNED DPK
2 31/8/98 AS BUILT DPK
AMENDMENT & ISSUE REGISTER
MANAGER
DIRECTOR OF TECHNOLOGY SERVICES
DIRECTOR OF PLANNING & DESIGN
DIRECTOR OF WATER SUPPLY
DIRECTOR OF CONSTRUCTION
DESIGN
DRAWN
TRACED
CHECKED
REFERENCES
ENGINEER IN CHARGE
SUPERVISING ENGINEER
A2 REDUCED
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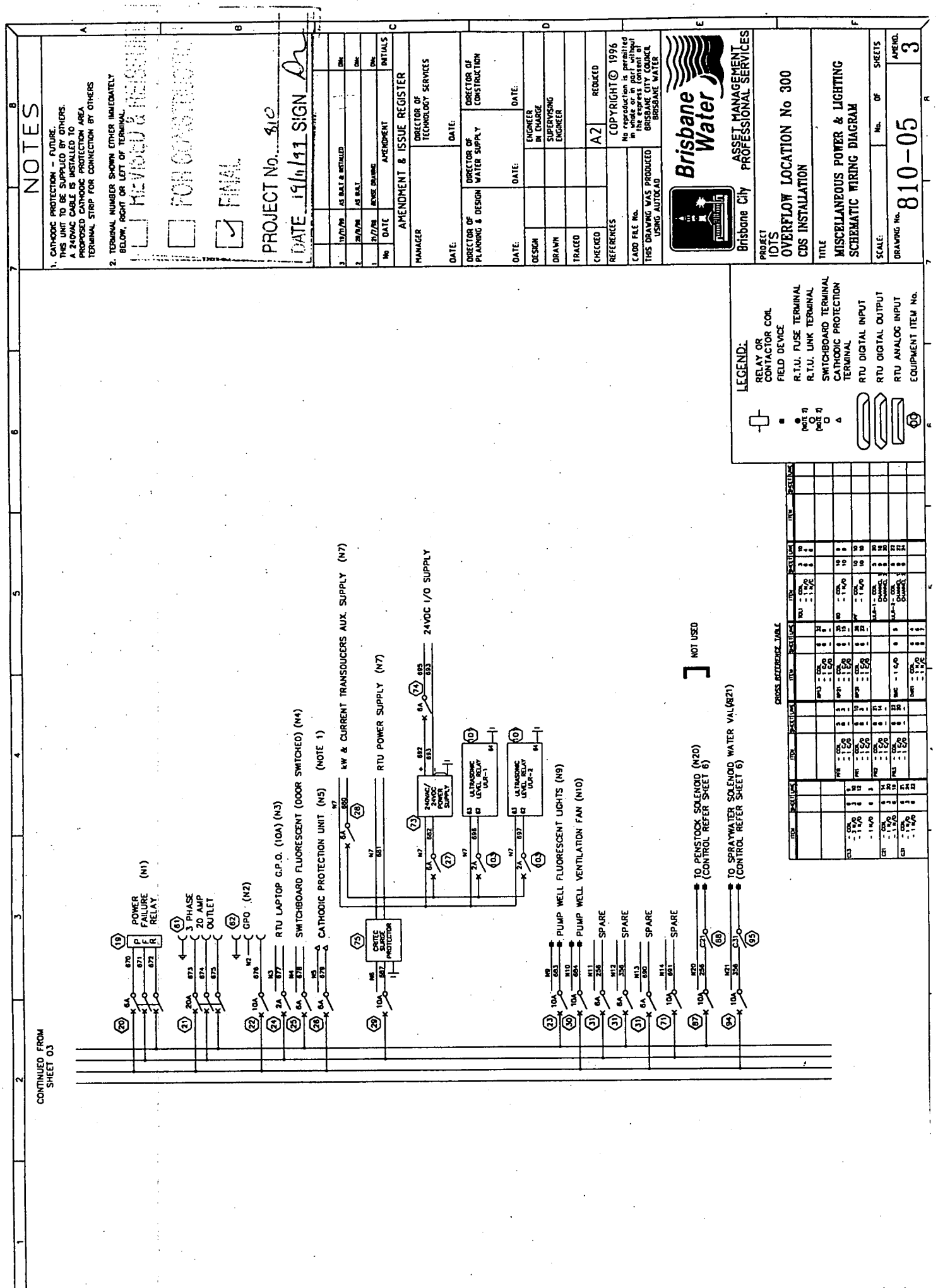
Brisbane City
ASSET MANAGEMENT PROFESSIONAL SERVICES
PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION
TITLE
UNDERFLOW PUMP, PENSTOCK ACTUATOR, SPRAY WATER VALVE & INCOMER
POWER SCHEMATIC WIRING DIAGRAM.
SCALE:
DRAWING No. 810-03
No. OF SHEETS
AMEND. 3


NOTES
1. CATHODIC PROTECTION - FUTURE.
THIS UNIT TO BE SUPPLIED BY OTHERS.
A 240VAC CABLE IS INSTALLED TO
PROPOSED CATHODIC PROTECTION AREA
TERMINAL STRIP FOR CONNECTION BY OTHERS
2. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY
BELOW, RIGHT OR LEFT OF TERMINAL
RE-ISSUED FOR CONSTRUCTION
FOR CONSTRUCTION
FINAL
PROJECT No. 310
DATE 19/11/11 SIGN
AMENDMENT & ISSUE REGISTER
No DATE AMENDMENT INITIALS
1 21/7/08 ISSUE DRAWING DMc
2 29/9/08 AS BUILT DMc
3 19/1/09 AS BUILT & INSTALLED DMc
MANAGER
DIRECTOR OF TECHNOLOGY SERVICES
DIRECTOR OF PLANNING & DESIGN
DIRECTOR OF WATER SUPPLY
DIRECTOR OF CONSTRUCTION
DESIGN
DRAWN
TRACED
CHECKED
ENGINEER IN CHARGE
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REFERENCES
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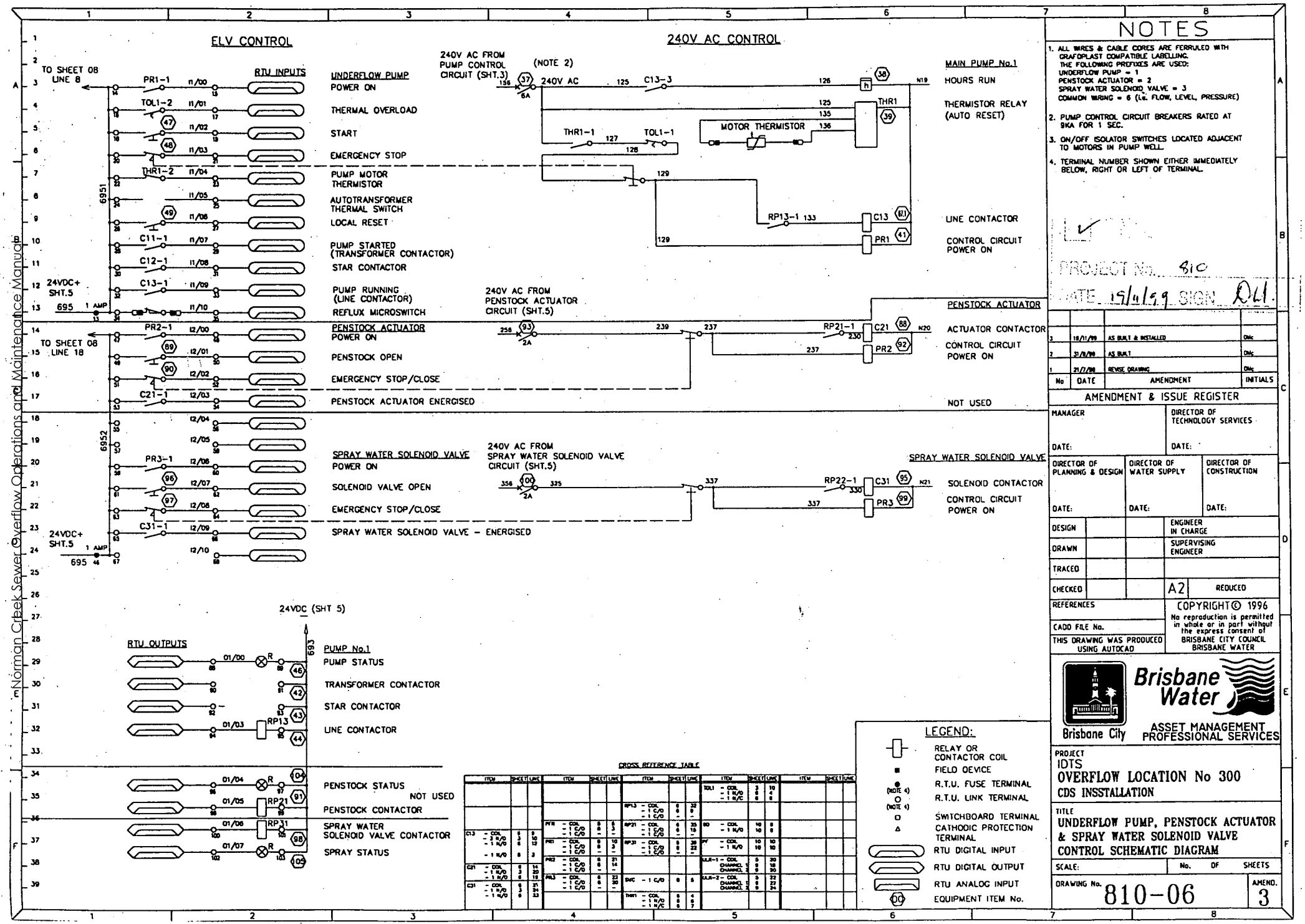
Brisbane Water
Brisbane City
ASSET MANAGEMENT PROFESSIONAL SERVICES
PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION
TITLE
MISCELLANEOUS POWER & LIGHTING
SCHEMATIC WIRING DIAGRAM
SCALE:
No. OF SHEETS
DRAWING No. 810-05
AMEND. 3
LEGEND:
RELAY OR CONTACTOR COIL
FIELD DEVICE
R.T.U. FUSE TERMINAL
R.T.U. LINK TERMINAL
SWITCHBOARD TERMINAL
CATHODIC PROTECTION TERMINAL
RTU DIGITAL INPUT
RTU DIGITAL OUTPUT
RTU ANALOG INPUT
EQUIPMENT ITEM No.
CONTINUED FROM SHEET 03
POWER FAILURE RELAY (N1)
3 PHASE 20 AMP OUTLET
GPO (N2)
RTU LAPTOP G.P.O. (10A) (N3)
SWITCHBOARD FLUORESCENT (DOOR SWITCHED) (N4)
CATHODIC PROTECTION UNIT (N5) (NOTE 1)
kW & CURRENT TRANSDUCERS AUX. SUPPLY (N7)
RTU POWER SUPPLY (N7)
240VAC/24VDC POWER SUPPLY
24VDC I/O SUPPLY
ULTRASONIC LEVEL RELAY UUR-1
ULTRASONIC LEVEL RELAY UUR-2
CORTEC SURGE PROTECTION
PUMP WELL FLUORESCENT LIGHTS (N9)
PUMP WELL VENTILATION FAN (N10)
SPARE
SPARE
SPARE
SPARE
TO PENSTOCK SOLENOID (N20) (CONTROL REFER SHEET 6)
TO SPRAYWATER SOLENOID WATER VALVE (N21) (CONTROL REFER SHEET 6)
NOT USED
CROSS REFERENCE TABLE



NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST COMPATIBLE LABELLING. THE FOLLOWING PREFIXES ARE USED: UNDERFLOW PUMP = 1, PENSTOCK ACTUATOR = 2, SPRAY WATER SOLENOID VALVE = 3, COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
2. PUMP CONTROL CIRCUIT BREAKERS RATED AT 9KA FOR 1 SEC.
3. ON/OFF ISOLATOR SWITCHES LOCATED ADJACENT TO MOTORS IN PUMP WELL.
4. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.

PROJECT No. 810

DATE 19/4/99 SIGN

No	DATE	AMENDMENT	INITIALS
3	18/11/99	AS BUILT & INSTALLED	DMc
2	31/8/99	AS BUILT	DMc
1	21/7/99	REVISE DRAWING	DMc

AMENDMENT & ISSUE REGISTER

MANAGER DATE:	DIRECTOR OF TECHNOLOGY SERVICES DATE:
DIRECTOR OF PLANNING & DESIGN DATE:	DIRECTOR OF WATER SUPPLY DATE:
DIRECTOR OF CONSTRUCTION DATE:	
DESIGN	ENGINEER IN CHARGE
DRAWN	SUPERVISING ENGINEER
TRACED	
CHECKED	A2 REDUCED
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Brisbane City

Brisbane Water

ASSET MANAGEMENT PROFESSIONAL SERVICES

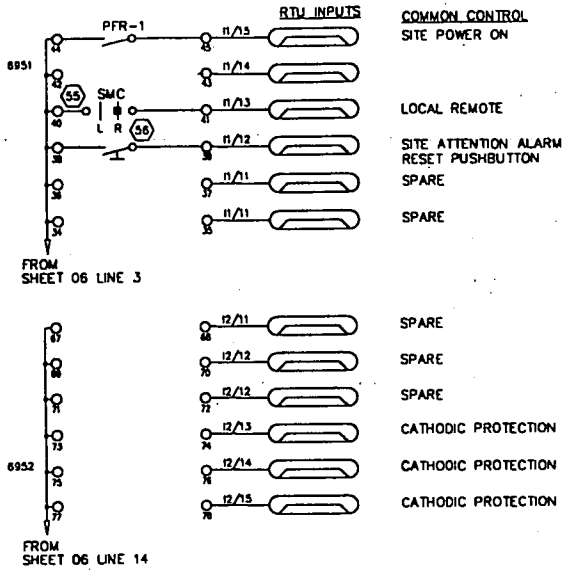
PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSSTALLATION

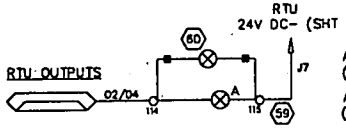
TITLE
UNDERFLOW PUMP, PENSTOCK ACTUATOR & SPRAY WATER SOLENOID VALVE CONTROL SCHEMATIC DIAGRAM

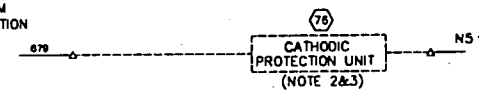
SCALE: | No. OF SHEETS

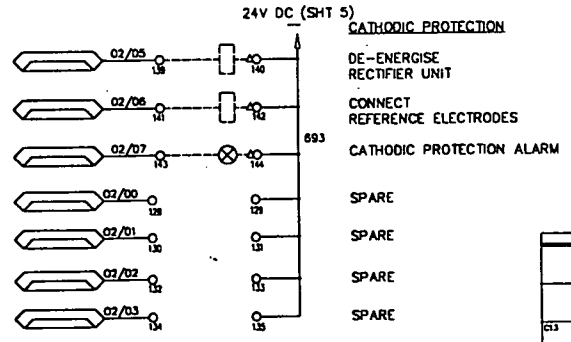
DRAWING No. 810-06 | AMEND. 3

ELV CONTROL

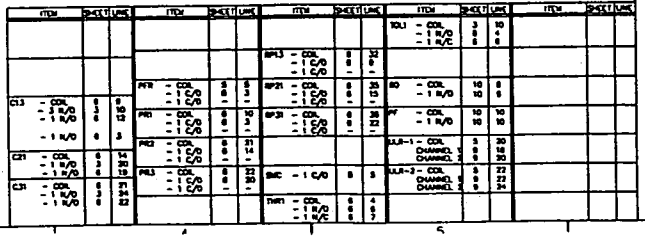








CROSS REFERENCE TABLE



LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL (NOTE 4)
- R.T.U. LINK TERMINAL (NOTE 4)
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- EQUIPMENT ITEM No.

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST COMPATIBLE LABELLING. THE FOLLOWING PREFIXES ARE USED:
   MAIN PUMP No. 1 = 1
   MAIN PUMP No. 2 = 2
   COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
2. CATHODIC PROTECTION - FUTURE. THIS UNIT IS SUPPLIED BY OTHERS. RTU I/O CABLING IS INSTALLED TO PROPOSED CATHODIC PROTECTION TERMINAL STRIP FOR CONNECTION BY OTHERS.
3. ITEMS SHOWN AS DOTTED ARE FOR FUTURE ONLY.
4. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, LEFT OR RIGHT OF TERMINAL.

PROJECT No. 810

DATE 19/11/99 SIGN

No	DATE	AMENDMENT	INITIALS
3	19/11/99	AS BUILT & INSTALLED	DMc
2	31/8/98	AS BUILT	DMc

AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF TECHNOLOGY SERVICES
DATE:	DATE:

DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DIRECTOR OF CONSTRUCTION
DATE:	DATE:	DATE:

DESIGN			ENGINEER IN CHARGE
DRAWN			SUPERVISING ENGINEER
TRACED			
CHECKED			A2 REDUCED

REFERENCES

CADD FILE No.

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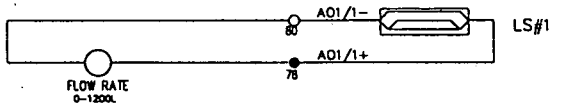
PROJECT
IDTS
OVEREFLOW LOCATION No 300
CDS INSTALLATION

TITLE
SUMP PUMP, SURCHARGE IMMINENT & CATHODIC PROTECTION SCHEMATIC WIRING DIAGRAM

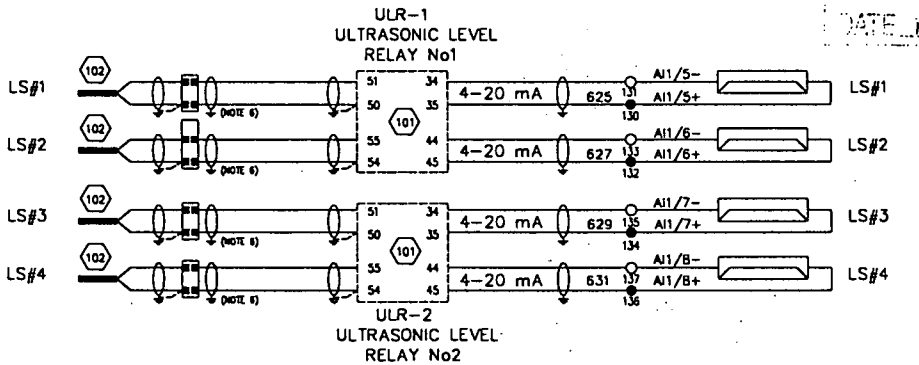
SCALE: | No. OF SHEETS

DRAWING No. 810-08 | AMEND. 3

RTU ANALOG OUTPUTS FOR INSTRUMENTS

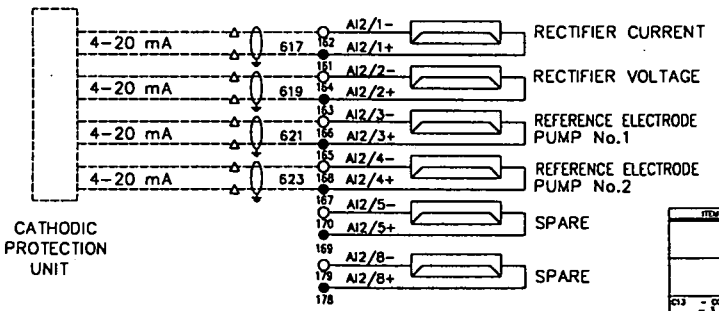


RTU ANALOG INPUTS FOR INSTRUMENTS



RTU ANALOG INPUTS FOR CATHODIC PROTECTION

(NOTE 2&3)



CROSS REFERENCE TABLE

ITEM	SHEET	LINE

NOTES

1. ALL WIRES & CABLE CORES ARE FERRULED WITH GRAFOPLAST COMPATIBLE LABELLING.
   THE FOLLOWING PREFIXES ARE USED:
   MAIN PUMP No. 1 = 1
   MAIN PUMP No. 2 = 2
   COMMON WIRING = 6 (i.e. FLOW, LEVEL, PRESSURE)
2. CATHODIC PROTECTION - FUTURE
   THIS UNIT IS SUPPLIED BY OTHERS.
   RTU I/O CABLING IS INSTALLED TO PROPOSED CATHODIC PROTECTION TERMINAL STRIP FOR CONNECTION BY OTHERS.
3. ITEMS SHOWN DOTTED ARE FUTURE.
4. TERMINAL NUMBER IS SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL.
5. ALL FUSE TERMINALS SRE TO BE FITTED WITH 100mA FUSE-LINKS UNLESS SHOWN OTHERWISE.
6. LAY BACK OUTER SHIELD. INSULATE WITH TAPE.
   DO NOT JOIN SHIELDS AT THIS END
   USE BELDEN #9222 OR R146 TRIAXIAL CABLE

☑ FINAL

PROJECT No. 810

DATE 19/11/99 SIGN DJ.

No	DATE	AMENDMENT	INITIALS
3	19/11/99	AS BUILT & INSTALLED	DMc
2	31/8/98	AS BUILT	DMc
1	21/7/98	REVISE DRAWING	DMc

AMENDMENT & ISSUE REGISTER

MANAGER DATE:		DIRECTOR OF TECHNOLOGY SERVICES DATE:
DIRECTOR OF PLANNING & DESIGN DATE:	DIRECTOR OF WATER SUPPLY DATE:	DIRECTOR OF CONSTRUCTION DATE:

DESIGN			ENGINEER IN CHARGE
DRAWN			SUPERVISING ENGINEER
TRACED			
CHECKED			A2 REDUCED

REFERENCES

CADD FILE No.

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LEGEND:

- RELAY OR CONTACTOR COIL
- FIELD DEVICE
- R.T.U. FUSE TERMINAL (NOTE 4)
- R.T.U. LINK TERMINAL (NOTE 4)
- SWITCHBOARD TERMINAL
- CATHODIC PROTECTION TERMINAL
- RTU DIGITAL INPUT
- RTU DIGITAL OUTPUT
- RTU ANALOG INPUT
- EQUIPMENT ITEM No.

Brisbane City

Brisbane Water

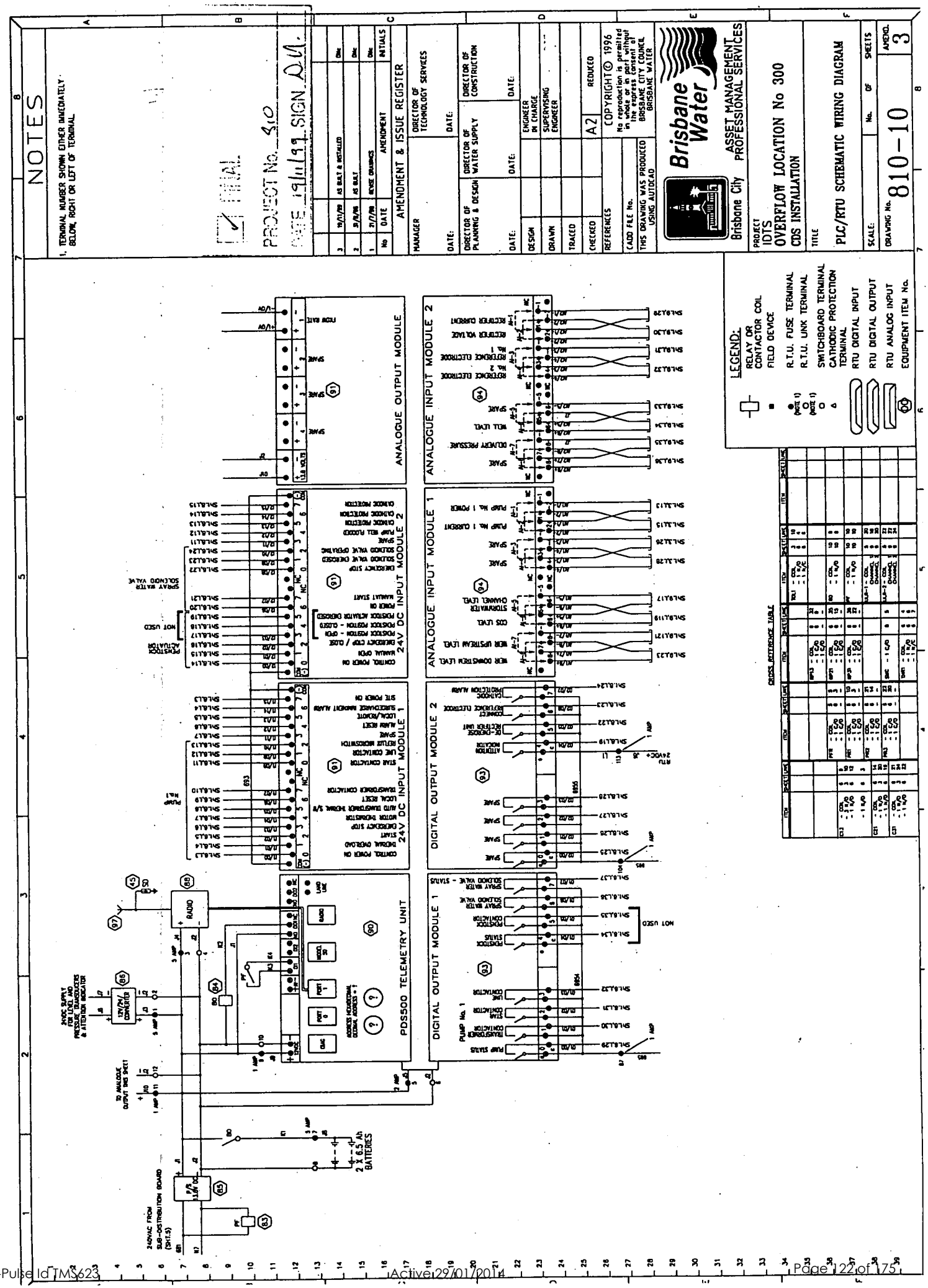
ASSET MANAGEMENT PROFESSIONAL SERVICES

PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION

TITLE
WELL LEVEL, DELIVERY PRESSURE & CATHODIC PROTECTION SCHEMATIC WIRING DIAGRAM

SCALE: | No. OF SHEETS

DRAWING No. 810-09 | AMEND. 3


NOTES
1. TERMINAL NUMBER SHOWN EITHER IMMEDIATELY BELOW, RIGHT OR LEFT OF TERMINAL
FINAL
PROJECT No. 410
DATE 19/11/99 SIGN A.M.
AMENDMENT & ISSUE REGISTER
MANAGER
DIRECTOR OF TECHNOLOGY SERVICES
DIRECTOR OF PLANNING & DESIGN
DIRECTOR OF WATER SUPPLY
DIRECTOR OF CONSTRUCTION
DESIGN
DRAWN
TRACED
CHECKED
REFERENCES
ENGINEER IN CHARGE
SUPERVISING ENGINEER
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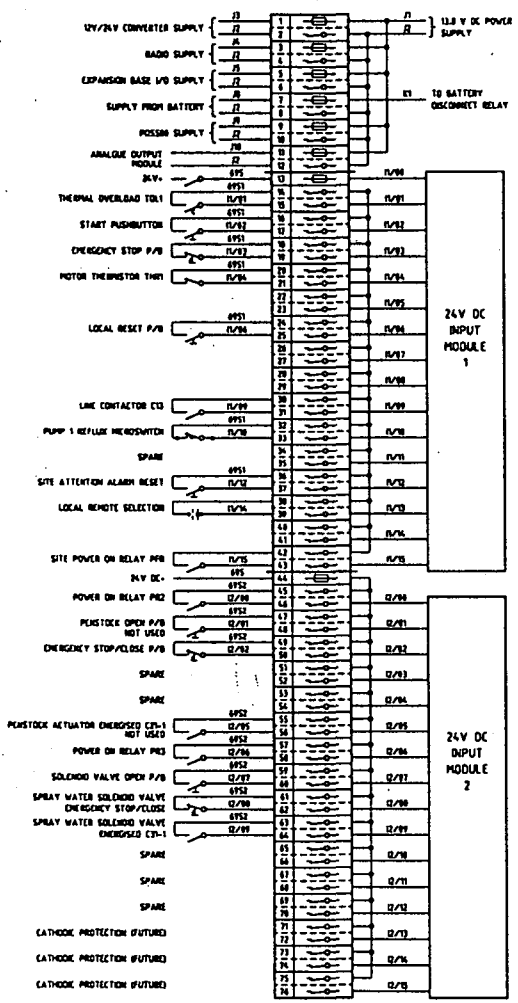
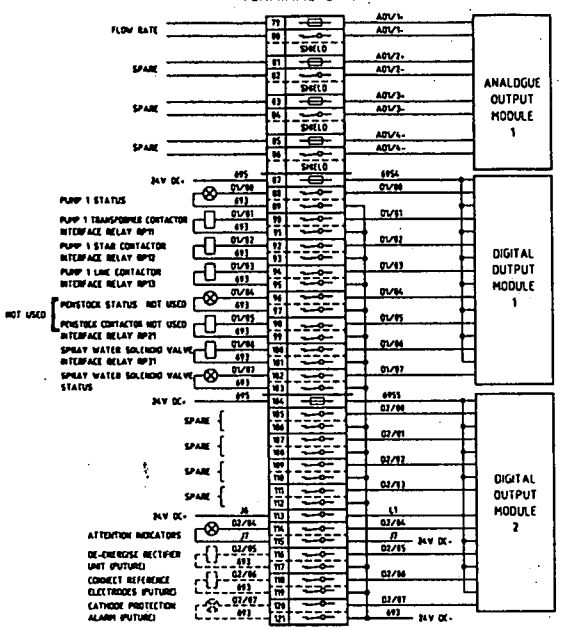
Brisbane City
ASSET MANAGEMENT PROFESSIONAL SERVICES
PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION
TITLE
PLC/RTU SCHEMATIC WIRING DIAGRAM
SCALE:
No. OF SHEETS
DRAWING No. 810-10
AMEND. 3
LEGEND:
RELAY OR CONTACTOR COIL
FIELD DEVICE
R.T.U. FUSE TERMINAL
R.T.U. LINK TERMINAL
SWITCHBOARD TERMINAL
CATHODIC PROTECTION TERMINAL
RTU DIGITAL INPUT
RTU DIGITAL OUTPUT
RTU ANALOG INPUT
EQUIPMENT ITEM No.
ANALOGUE OUTPUT MODULE
ANALOGUE INPUT MODULE 2
ANALOGUE INPUT MODULE 1
24V DC INPUT MODULE 2
24V DC INPUT MODULE 1
DIGITAL OUTPUT MODULE 2
DIGITAL OUTPUT MODULE 1
PDS500 TELEMETRY UNIT
RADIO
12V/24V CONVERTER
2 X 6.5 Ah BATTERIES
240VAC FROM SUB-DISTRIBUTION BOARD (SW1.5)
CROSS REFERENCE TABLE

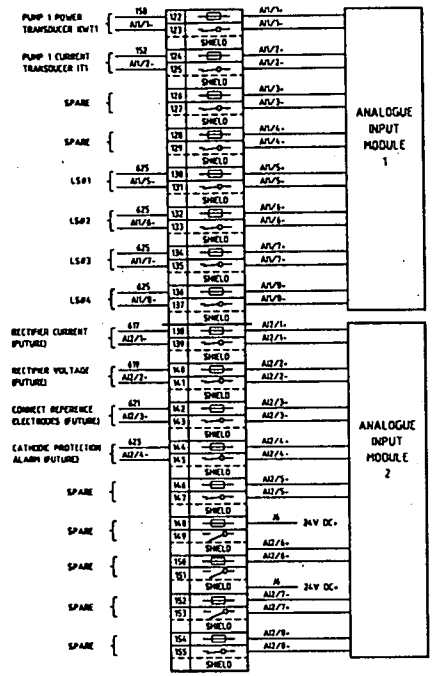
RTU
TERMINAL STRIP



RTU
TERMINAL STRIP



RTU
TERMINAL STRIP



NOTES

FINAL

PROJECT No. 810

DATE 19/11/99 SIGN

No	DATE	AMENDMENT	INITIALS
3	10/11/99	AS BUILT & INSTALLED	DMc
2	31/8/98	AS BUILT	DMc
1	21/7/98	REVISE DRAWING	DMc

AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF TECHNOLOGY SERVICES	
DATE:	DATE:	
DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DIRECTOR OF CONSTRUCTION
DATE:	DATE:	DATE:

DESIGN			ENGINEER IN CHARGE
DRAWN			SUPERVISING ENGINEER
TRACED			
CHECKED			A2 REDUCED

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Brisbane City

Brisbane Water

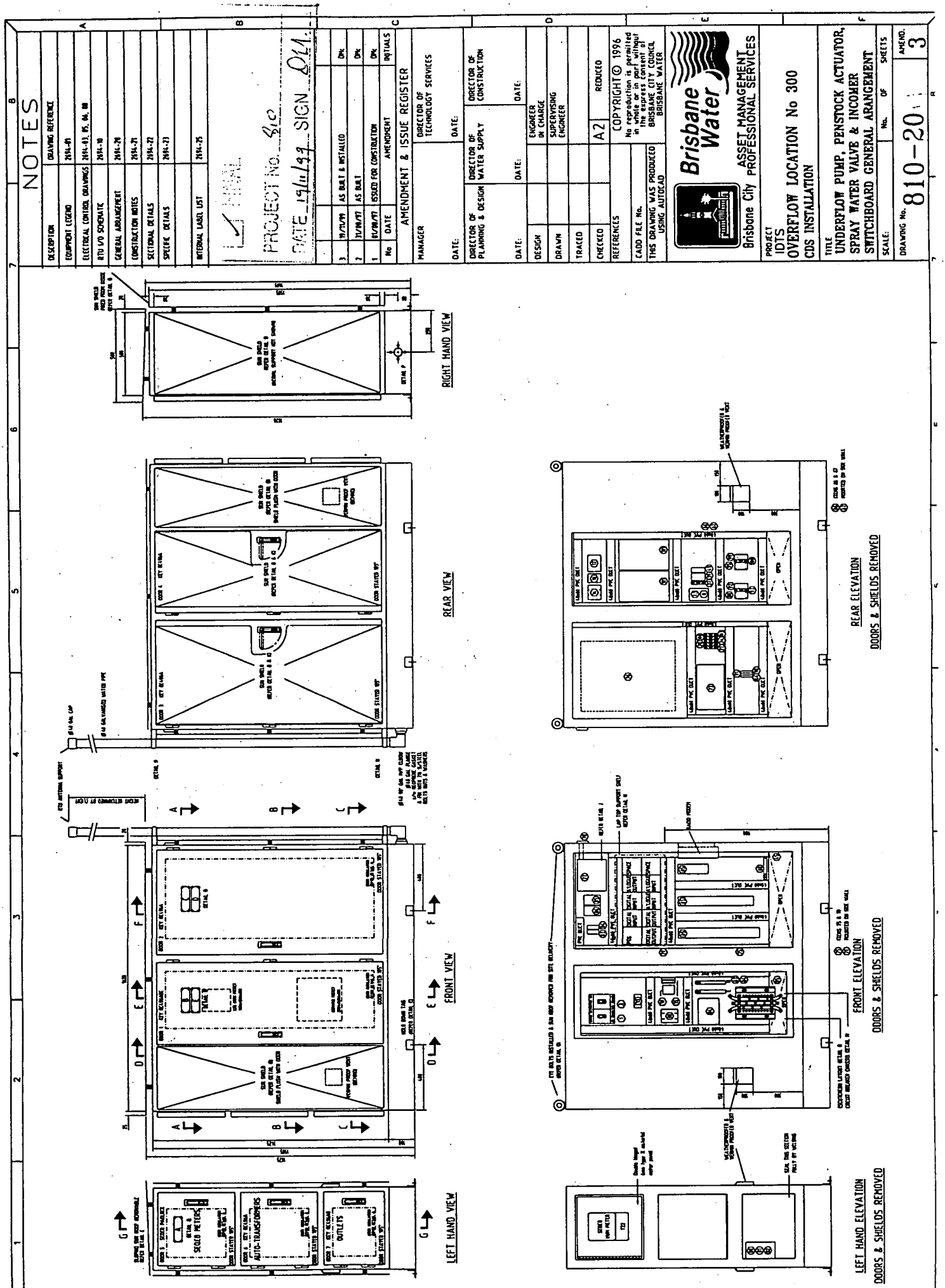
ASSET MANAGEMENT PROFESSIONAL SERVICES

PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION

TITLE
CABLE TERMINATION DIAGRAM

SCALE: | No. OF SHEETS

DRAWING No. 810-15 | AMEND. 3


NOTES
DESCRIPTION
DRAWING REFERENCE
EQUIPMENT LEGEND
2814-01
ELECTRICAL CONTROL DRAWINGS
2814-03, 05, 06, 08
RTU I/O SCHEDULE
2814-10
GENERAL ARRANGEMENT
2814-20
CONSTRUCTION NOTES
2814-21
SECTIONAL DETAILS
2814-22
SPECIFIC DETAILS
2814-23
MATERIAL LABEL LIST
2814-25
PROJECT No. 814
DATE 19/11/99 SIGN
AMENDMENT & ISSUE REGISTER
No
DATE
AMENDMENT
INITIALS
3
19/11/99
AS BUILT & INSTALLED
DK
2
31/08/99
AS BUILT
DK
1
01/08/97
ISSUED FOR CONSTRUCTION
DK
MANAGER
DIRECTOR OF TECHNOLOGY SERVICES
DIRECTOR OF PLANNING & DESIGN
DIRECTOR OF WATER SUPPLY
DIRECTOR OF CONSTRUCTION
DESIGN
DRAWN
TRACED
CHECKED
REFERENCES
ENGINEER IN CHARGE
SUPERVISING ENGINEER
A2
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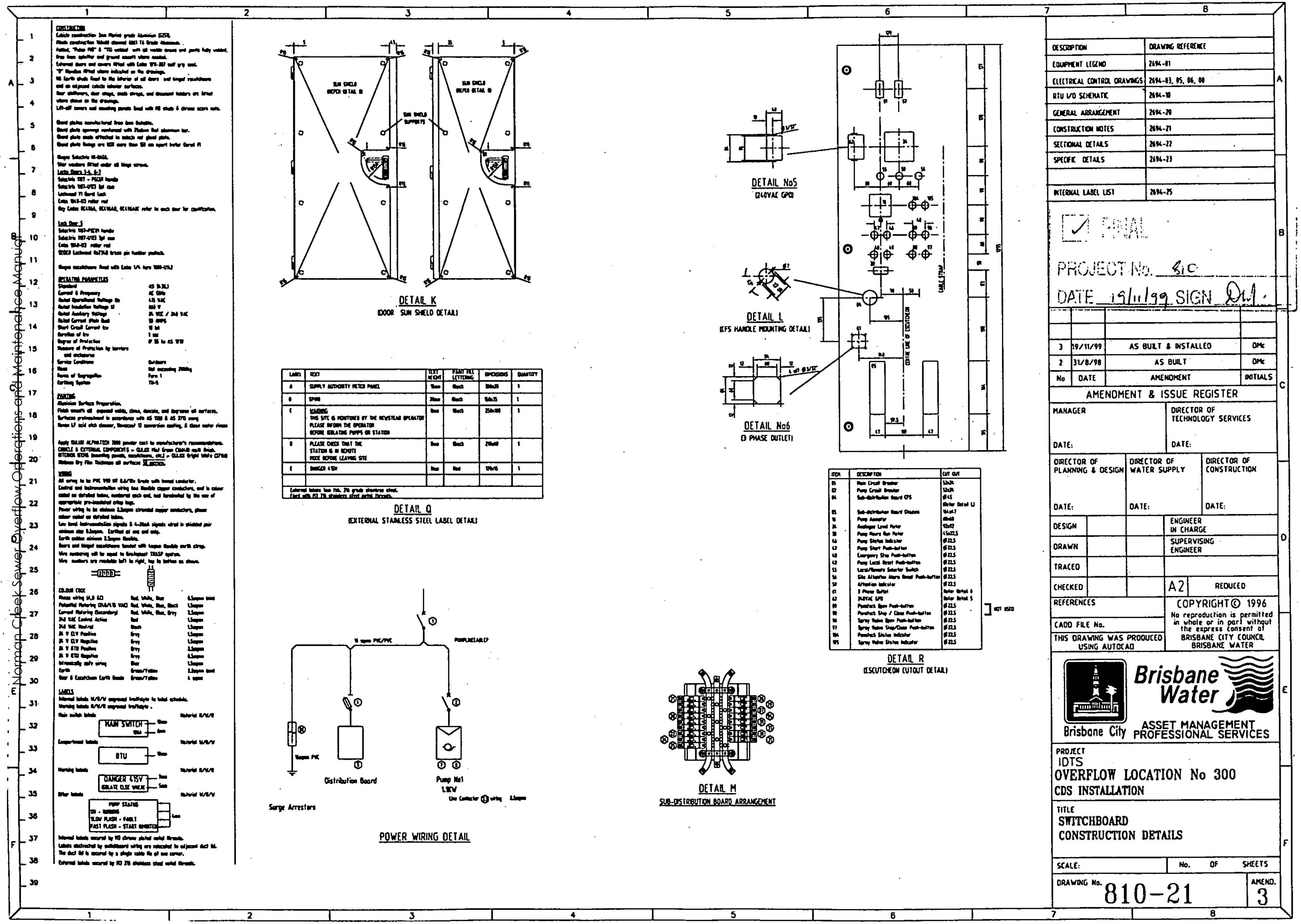
Brisbane Water
Brisbane City
ASSET MANAGEMENT PROFESSIONAL SERVICES
PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION
TITLE
UNDERFLOW PUMP, PENSTOCK ACTUATOR, SPRAY WATER VALVE & INCOMER SWITCHBOARD GENERAL ARRANGEMENT
SCALE:
No. OF SHEETS
DRAWING No. 810-20
AMEND. 3
RIGHT HAND VIEW
REAR VIEW
FRONT VIEW
LEFT HAND VIEW
REAR ELEVATION
DOORS & SHIELDS REMOVED
FRONT ELEVATION
DOORS & SHIELDS REMOVED
LEFT HAND ELEVATION
DOORS & SHIELDS REMOVED


DETAIL K
(DOOR SUN SHIELD DETAIL)
DETAIL Q
(EXTERNAL STAINLESS STEEL LABEL DETAIL)
POWER WIRING DETAIL
Surge Arrestors
Distribution Board
Pump No1
DETAIL M
SUB-DISTRIBUTION BOARD ARRANGEMENT
DETAIL No5
(240VAC GPO)
DETAIL L
(CFS HANDLE MOUNTING DETAIL)
DETAIL No6
(3 PHASE OUTLET)
DETAIL R
(ESCUTCHEON CUTOUT DETAIL)
DESCRIPTION
DRAWING REFERENCE
EQUIPMENT LEGEND
ELECTRICAL CONTROL DRAWINGS
RTU I/O SCHEMATIC
GENERAL ARRANGEMENT
CONSTRUCTION NOTES
SECTIONAL DETAILS
SPECIFIC DETAILS
INTERNAL LABEL LIST
FINAL
PROJECT No. 810
DATE 19/11/99 SIGN
3 19/11/99 AS BUILT & INSTALLED
2 31/8/98 AS BUILT
No DATE AMENDMENT INITIALS
AMENDMENT & ISSUE REGISTER
MANAGER
DIRECTOR OF TECHNOLOGY SERVICES
DIRECTOR OF PLANNING & DESIGN
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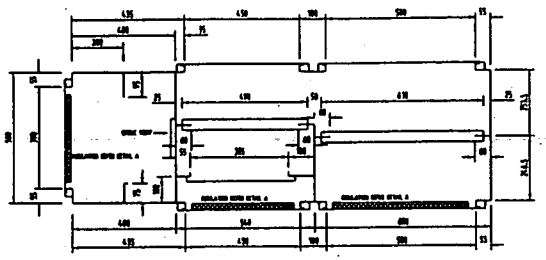
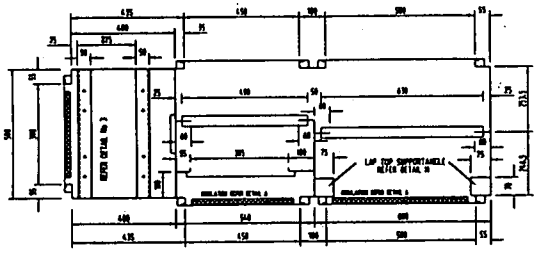
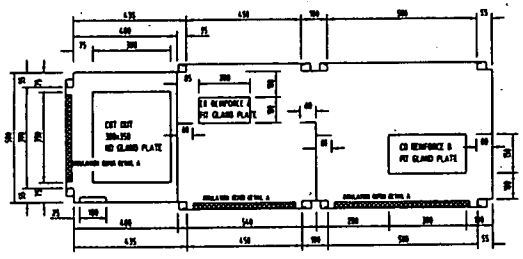
ASSET MANAGEMENT PROFESSIONAL SERVICES
PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION
TITLE
SWITCHBOARD
CONSTRUCTION DETAILS
SCALE:
No. OF SHEETS
DRAWING No. 810-21
AMEND. 3



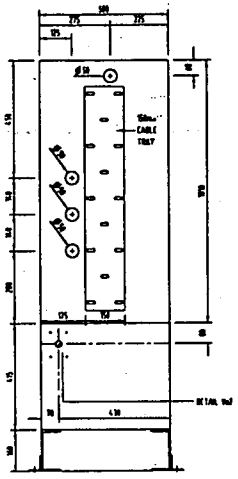
SECTION A-A



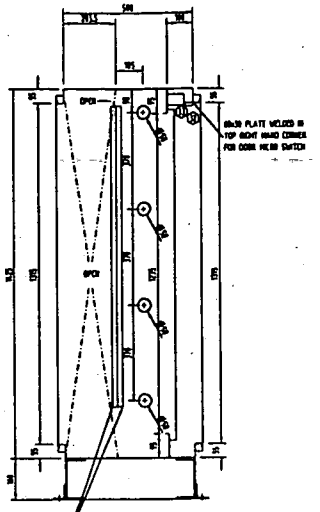
SECTION B-B



SECTION C-C

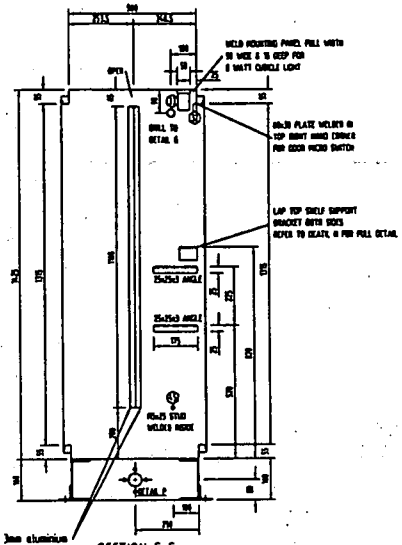


SECTION D-D



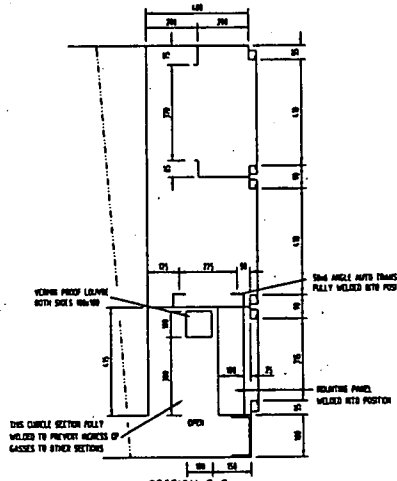
SECTION E-E

NOTE:-
All mounting panels 3mm aluminium with 20mm returns

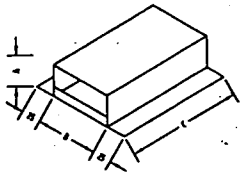


NOTE:-
All mounting panels 3mm aluminium with 20mm returns

SECTION F-F

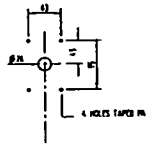


SECTION G-G

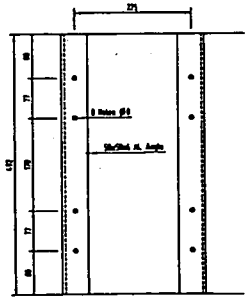


ITEM	A	B	C	Qty
Chassis	127	268	235	1
Crash Bars	105	250	105	1

Hot Sections (Supplied Loose)



DETAIL No 2 - 1 off Required
Pharechal 32amp 2 & 4 pole Decontactor



DETAIL No 3 AUTO-TRANSFORMER MOUNTING ANGLE DETAIL
(Auto-transformer mounting angles)

DESCRIPTION	DRAWING REFERENCE
EQUIPMENT LEGEND	2694-01
ELECTRICAL CONTROL DRAWINGS	2694-03, 05, 06, 08
RTU I/O SCHEMATIC	2694-10
GENERAL ARRANGEMENT	2694-20
CONSTRUCTION NOTES	2694-21
SECTIONAL DETAILS	2694-22
SPECIFIC DETAILS	2694-23
INTERNAL LABEL LIST	2694-25

☑ FINAL

PROJECT No. 810

DATE 19/11/99 SIGN DH

No	DATE	AMENDMENT	INITIALS
3	19/11/99	AS BUILT & INSTALLED	DHc
2	31/8/98	AS BUILT	DHc

AMENDMENT & ISSUE REGISTER

MANAGER DATE:	DIRECTOR OF TECHNOLOGY SERVICES DATE:
DIRECTOR OF PLANNING & DESIGN DATE:	DIRECTOR OF WATER SUPPLY DATE:
DIRECTOR OF CONSTRUCTION DATE:	

DESIGN			ENGINEER IN CHARGE
DRAWN			SUPERVISING ENGINEER
TRACED			
CHECKED			A2 REDUCED 7/06/96
REFERENCES			COPYRIGHT © 1996
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Brisbane City — Brisbane Water — ASSET MANAGEMENT PROFESSIONAL SERVICES

PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION

TITLE
SWITCHBOARD
SECTIONAL DETAIL

SCALE: | No. OF SHEETS

DRAWING No. 810-22 | AMEND. 3

ITEM No		DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR	CORRECTLY INSTALLED (tick)	
00		SURGE ARRESTER	LIGHTING ARRESTERS		5mm	TRAFFOLYTE W/B/W		
01		MAIN CIRCUIT BREAKER	MAIN SWITCH 50A		10mm	TRAFFOLYTE B/W/B		
02		PUMP CIRCUIT BREAKER	PUMP No 1 50		5mm	TRAFFOLYTE W/B/W		
03								
04		SUB-DISTRIBUTION BOARD (CP)	SUB-DISTRIBUTION BOARD 30/15A		5mm	TRAFFOLYTE W/B/W		
04.1								
04.2								
05								
06								
06.1								
07								
07.1		LINE CONTACTOR	C1 LINE CONTACTOR		5mm	TRAFFOLYTE W/B/W		
07.2								
07.3								
08		THERMAL OVERLOAD	TOL 1 OVERLOAD		5mm	TRAFFOLYTE W/B/W		
09								
10								
11								
12								
13		INSTRUMENT PWRS	PT 3/15A		5mm	TRAFFOLYTE W/B/W		
14.1								
15		CT TEST LINK	TL1		5mm	TRAFFOLYTE W/B/W		
15.1								
15.2								
15.3								
15.4								
16		PUMP ARRESTER	PUMP No 1		5mm	TRAFFOLYTE W/B/W		
17		kW TRANSDUCERS	kW/VT KILOWATT TRANSDUCER		5mm	TRAFFOLYTE W/B/W		
18		CURRENT TRANSDUCER	CT CURRENT TRANSDUCER		5mm	TRAFFOLYTE W/B/W		
19		PHASE FAILURE RELAY	PFR PHASE FAIL RELAY		5mm	TRAFFOLYTE W/B/W		
20		PHASE FAILURE CIRCUIT BREAKER	PHASE FAILURE RELAY		5mm	TRAFFOLYTE W/B/W		
21		3 PHASE OUTLET CIRCUIT BREAKER	3 PHASE OUTLET ISOLATOR		5mm	TRAFFOLYTE W/B/W		
22		1 PHASE OUTLET CIRCUIT BREAKER	1 PHASE OUTLET		5mm	TRAFFOLYTE W/B/W		
23								
24		RTU LAP TOP CPO CIRCUIT BKR	RTU LAP TOP CPO		5mm	TRAFFOLYTE W/B/W		
25		SWB/BB FLUID CIRCUIT BREAKER	SWITCHBOARD LIGHTS		5mm	TRAFFOLYTE W/B/W		
26		CATHODIC PROTECTION CIRCUIT BKR	CATHODIC PROTECTION		5mm	TRAFFOLYTE W/B/W		
27		24VDC POWER SUPPLY CIRCUIT BKR	24VDC POWER SUPPLY		5mm	TRAFFOLYTE W/B/W		
28		TRANSDUCERS CIRCUIT BREAKER	TRANSDUCERS SUPPLY		5mm	TRAFFOLYTE W/B/W		
29		RTU CIRCUIT BREAKER	RTU SUPPLY		5mm	TRAFFOLYTE W/B/W		
30								
31								
32								
33								
34		FLOW RATE INDICATOR	FLOW RATE		5mm	TRAFFOLYTE W/B/W		
35								
36								
37		PUMP CONTROL CIRCUIT BKR	PUMP No 1 CONTROL		5mm	TRAFFOLYTE W/B/W		
38		PUMP HOURS RUN METER	HOURS RUN PUMP No 1		5mm	TRAFFOLYTE W/B/W		
39		THERMISTOR RELAYS	THR1 THERMISTOR RELAY		5mm	TRAFFOLYTE W/B/W		
40								
41		CONTROL CIRCUIT ON RELAY	PR1 CCT. ON		5mm	TRAFFOLYTE W/B/W		
42								
43								
44		LINE CONTACTOR RELAY	RPO		5mm	TRAFFOLYTE W/B/W		
45								
46		PUMP STATUS INDICATOR	PUMP STATUS (REFER NOTE ON THIS SHEET)		5mm	TRAFFOLYTE W/B/W		
47		PUMP START PUSH BUTTON	PUMP START		5mm	TRAFFOLYTE W/B/W		
48		PUMP STOP PUSH BUTTON	PUMP EMERGENCY STOP		5mm	TRAFFOLYTE W/B/W		

ITEM No		DESCRIPTION	LABEL 1	LABEL 2 (IF NECESSARY)	TEXT HEIGHT	MATERIAL / COLOUR	CORRECTLY INSTALLED (tick)	
49		PUMP RESET PUSH BUTTON	LOCAL RESET	LOCAL RESET	5mm	TRAFFOLYTE W/B/W		
50								
51								
52								
53								
54								
55		STATION CONTROL SELECTOR SW.	STATION CONTROL		5mm	TRAFFOLYTE W/B/W		
56		SITE ATTENTION RESET	ALARM RESET		5mm	TRAFFOLYTE W/B/W		
57								
58								
59		SITE ATTENTION ALARM	ATTENTION ALARM		5mm	TRAFFOLYTE W/B/W		
60								
61		3 PHASE OUTLET	3 Ø OUTLET		5mm	TRAFFOLYTE W/B/W		
62		1 PHASE OUTLET	1 Ø OUTLET		5mm	TRAFFOLYTE W/B/W		
63		NEUTRAL LINE	NEUTRAL		5mm	TRAFFOLYTE W/B/W		
64		EARTH LINE	EARTH		5mm	TRAFFOLYTE W/B/W		
65								
65.1								
65.2								
65.3								
65.4								
65.5								
65.6								
65.7								
65.8								
66		MAIN NEUTRAL LINK	MAIN NEUTRAL		5mm	TRAFFOLYTE W/B/W		
67		MAIN EARTH LINK	MAIN EARTH		5mm	TRAFFOLYTE W/B/W		
68		INSTRUMENTATION EARTH LINK	INSTRUMENTATION EARTH		5mm	TRAFFOLYTE W/B/W		
69								
70								
71								
72								
73		24VDC 3A LINEAR POWER SUPPLY	24VDC POWER SUPPLY		5mm	TRAFFOLYTE W/B/W		
74		24VDC CIRCUIT BREAKER	I/O SUPPLY 24VDC		5mm	TRAFFOLYTE W/B/W		
75								
76								
77		BATTERY ENCLOSURE	RTU BATTERIES		5mm	TRAFFOLYTE W/B/W		
78								
79		RTU LAPTOP S.P.D.	RTU LAPTOP S.P.D.		5mm	TRAFFOLYTE W/B/W		
80		DECONTACTOR	PUMP No 1		5mm	TRAFFOLYTE W/B/W		
81								
82								
83		RTU POWER FAIL RELAY	PF		5mm	TRAFFOLYTE W/B/W		
84		RTU BATTERY DISCHARGE RELAY	BD		5mm	TRAFFOLYTE W/B/W		
85		RTU POWER SUPPLY	RTU POWER SUPPLY		5mm	TRAFFOLYTE W/B/W		
86		12/24VDC CONVERTER	12/24VDC CONVERTER		5mm	TRAFFOLYTE W/B/W		
87								
88		PENSTOCK CONTACTOR	C2 PENSTOCK CONTACTOR	NOT USED	5mm	TRAFFOLYTE W/B/W		
89		PENSTOCK OPEN PUSHBUTTON	PENSTOCK OPEN		5mm	TRAFFOLYTE W/B/W		
90		PENSTOCK CLOSE PUSHBUTTON	PENSTOCK CLOSE		5mm	TRAFFOLYTE W/B/W		
91		PENSTOCK CONT. CONTROL RELAY	RPEN		5mm	TRAFFOLYTE W/B/W		
92		PENSTOCK CONT. CIRCUIT ON	PR2 CCT. ON		5mm	TRAFFOLYTE W/B/W		
93		PENSTOCK ACTUATOR CONT. C/B	PENSTOCK CONTROL		5mm	TRAFFOLYTE W/B/W		
94		SPRAY VALVE	SPRAY VALVE		5mm	TRAFFOLYTE W/B/W		
95		SPRAY VALVE CONTACTOR	C3 SPRAY VALVE CONTACTOR		5mm	TRAFFOLYTE W/B/W		
96		SPRAY VALVE OPEN PUSHBUTTON	SPRAY VALVE OPEN		5mm	TRAFFOLYTE W/B/W		
97		SPRAY VALVE CLOSE PUSHBUTTON	SPRAY VALVE CLOSE		5mm	TRAFFOLYTE W/B/W		
98		SPRAY VALVE CONT. CONTROL RELAY	RPS		5mm	TRAFFOLYTE W/B/W		
99		SPRAY VALVE CONT. CIRCUIT ON	PR3		5mm	TRAFFOLYTE W/B/W		
100		SPRAY VALVE CONT C/B	SPRAY VALVE CONTROL		5mm	TRAFFOLYTE W/B/W		
101		ULTRASONIC LEVEL RELAY	ULR-1	ULR-1	5mm	TRAFFOLYTE W/B/W		
102								
103		ULTRASONIC LEVEL RELAY C/B	ULR-1 CONTROL	ULR-1 CONTROL	5mm	TRAFFOLYTE W/B/W		
104		PENSTOCK STATUS INDICATOR	PENSTOCK STATUS		5mm	TRAFFOLYTE W/B/W		
105		SPRAY VALVE STATUS INDICATOR	SPRAY VALVE STATUS		5mm	TRAFFOLYTE W/B/W		

PUMP STATUS
ON - RUNNING
SLOW FLASH - FAULT
FAST FLASH - START INHIBITED
5mm

PENSTOCK/SPRAY VALVE STATUS
ON - RUNNING
SLOW FLASH - FAULT
FAST FLASH - START INHIBITED
5mm

NOTE
LABELS FITTED ADJACENT ASSOCIATED EQUIPMENT
LABELS OBSTRUCTED BY SWITCHBOARD WIRING ARE RELOCATED TO ADJACENT CLEAR LID.
CLEAR LID SECURED BY SINGLE CABLE TIE AT ONE CORNER

DESCRIPTION	DRAWING REFERENCE
EQUIPMENT LEGEND	2694-01
ELECTRICAL CONTROL DRAWINGS	2694-03, 05, 06, 08
RTU I/O SCHEMATIC	2694-10
GENERAL ARRANGEMENT	2694-20
CONSTRUCTION NOTES	2694-21
SECTIONAL DETAILS	2694-22
SPECIFIC DETAILS	2694-23
INTERNAL LABEL LIST	2694-25

☑ FINAL

PROJECT No. 410

DATE 19/4/99 SIGN DMc

No	DATE	AMENDMENT	INITIALS
3	31/8/98	AS BUILT & INSTALLED	DMc
2	31/8/98	AS BUILT	DMc

AMENDMENT & ISSUE REGISTER

MANAGER	DIRECTOR OF TECHNOLOGY SERVICES
DATE:	DATE:

DIRECTOR OF PLANNING & DESIGN	DIRECTOR OF WATER SUPPLY	DIRECTOR OF CONSTRUCTION
DATE:	DATE:	DATE:

DESIGN		ENGINEER IN CHARGE	
DRAWN		SUPERVISING ENGINEER	
TRACED			
CHECKED		A2	REDUCED

REFERENCES

CADD FILE No.

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Brisbane City — Brisbane Water
ASSET MANAGEMENT PROFESSIONAL SERVICES

PROJECT
IDTS
OVERFLOW LOCATION No 300
CDS INSTALLATION

TITLE
SWITCHBOARD
INTERNAL LABEL LIST

SCALE: | No. OF SHEETS

DRAWING No. 810-25 | AMEND 3

Appendix F
4BRI-06

Control Panel

Circuit diagrams

8.2.2.6 Remove the discharge sealing ring (120) if it is worn, perished or damaged.

8.2.2.7 Clean all the components thoroughly and lay them out ready for reassembly.

8.3 **DISASSEMBLY OF SHREDDER PUMPS**

8.3.1 Lay pump horizontally.

8.3.2 Grip shredder cutter (7) to prevent it from rotating.

8.3.3 Remove locknut (3) and washer (4).

8.3.4 Slide shredder cutter (7) off shaft.

8.3.5 Remove fixings (17) securing volute (1) to motor. Remove volute.

8.3.6 Slide impeller (2) off shaft.

8.3.7 Turn volute (1) over and remove fixings (27). Drive stationary shredder ring (8) out of volute.

8.3.8 Check all parts for wear. Clean components thoroughly and lay them out ready for reassembly.

8.4 **DISASSEMBLY OF CUTTER PUMPS.**

8.4.1 Remove Suction Cover.

8.4.2 Remove impeller lock nut then remove impeller (a puller will be required). Procedure is similar to non-clog pumps for other disassembly work.

9.0 TO DISASSEMBLE THE MOTOR (REFER SECTION 12 FOR SECTIONAL ARRANGEMENT DRAWINGS)

9.1 TO REMOVE THE MECHANICAL SEAL

9.1.1 Introduction

9.1.1.1 Once the mechanical seal has been removed from the motor it should not be reinstalled. The seal should be reconditioned or replaced.

REMEMBER: THE MECHANICAL SEAL IS THE HEART OF THE SUBMERSIBLE MOTOR.

9.1.1.2 The area in which the motor is worked on MUST be very clean and extreme care should be taken not to damage or scratch the sealing area on the shaft or any of the seal components. The faces of the mechanical seal are hand lapped to a flatness of 50 microns and rapid deterioration of the seal faces may occur unless the instructions are followed implicitly.

9.1.2 Seal plate removal (for internal seals 1.1/8" & 1.5/8" shafts)

9.1.2.1 Stand motor on bench at a suitable working height and chock it securely.

9.1.2.2 Remove the key (33) from the shaft (4).

9.1.2.3 Remove the oil plugs (15) and drain the oil from the oil chamber. Dispose of any waste oil correctly. Remove motor adaptor (114) if fitted.

9.1.2.4 Remove the hex head set screws (13) and spring washers (9) holding the seal chamber (12) to the bottom bearing bracket (7).

9.1.2.5 Remove the seal chamber (12) complete with the seal seat assembly.

9.1.2.6 Place the seal chamber (12), with the seal seat facing downwards, on a clean, dry rag and place some padding beneath it.

9.1.2.7 Carefully prise the seal seat out of the seal chamber (12) and allow it to drop onto the padding.

9.1.2.8 Slide the seal head assembly off the shaft complete with the spring. If seals are fitted with rubber bellows they can adhere to the shaft. These require additional pressure to remove.

9.1.2.9 With multi spring seals loosen drive grub screws from centre spacer then slide complete rotating assembly off shaft.

9.1.2.10 Clean the seal components thoroughly and apply a light coat of oil to prevent corrosion. Pack the removed seal in the box which contained the reconditioned seal and return it to **KSB AJAX PUMPS**.

If seal seat is difficult to remove clean the face of the seal. Using an extended tube with similar internal and external diameter to the seal seat place some Loctite No. 601 on the seal face and tube. Press tube onto face until surfaces adhere. Gently remove seal seat with an oscillating motion. The seat can be removed from tool by tapping tool sharply on its side.

9.1.3 **Seal plate removal (for external tandem seals 2.1/4" shaft)**

Lay motor on bench and remove key (33) from shaft (4). Remove motor adaptor (114) if fitted.

9.1.3.1 Remove the oil plugs (15) and drain the oil from the oil chamber. Oil can be drained with motor standing vertically. Dispose of any waste oil correctly.

9.1.3.2 Loosen grub screws in drive ring of mechanical seal then remove drive ring completely with spring and rotating seal head.

9.1.3.3 Remove the fasteners (13) and spring washers (9) holding the seal chamber (12) to the bottom bearing bracket (7).

9.1.3.4 Remove the seal chamber (12) complete with the seal seat assembly.

9.1.3.5 Place the seal chamber (12), with the seal seat facing downwards, on a clean, dry rag and place some padding beneath it.

9.1.3.6 Carefully prise the seal seat out of the seal chamber (12) and allow it to drop onto the padding.

9.1.3.7 Loosen grub screws in drive ring of inner mechanical seal then remove drive ring completely with springs and rotating seal head. Follow same procedures as per clause 9.1.2.10 for handling of seal components and removal of seal seats.

9.2 TO REMOVE THE CABLE ASSEMBLY

9.2.1 Attach support to the cables and take the weight of the cables.

9.2.2 Remove the hex head set screws (26) and (22) and spring washers (27) holding the terminal box (16) to the motor housing (1).

9.2.3 Move the terminal box (16) away from the side of the motor a sufficient amount to be able to access the terminal blocks (232). Be careful not to strain the cable leads or the motor tails which connect to the terminal blocks.

9.2.4 Disconnect cable after recording their position.

9.2.5 Lift the entire cable assembly clear of the motor and place it in an area which is clean and dry.

9.2.6 Remove the O-ring (11E).

NOTE: 150fr motors are not fitted with a separate terminal box with cable entering motor via a cable gland).

9.2.7 **To check the cables**

9.2.7.1 Inspect the inside of the terminal box for any signs of water leaking into the motor. If water is present check the O-ring (11E) and the condition of the sealant (210). Also thoroughly inspect the cable for any nicks and cuts on the outer sheath.

9.2.7.2 Check the continuity of each lead in the cable with a multimeter. The resistance of the leads should be equal.

9.2.7.3 Check the insulation between each cable and all the rest of the cables with a 500 volt Megahom meter. The insulation between each lead and the terminal box should also be checked. All readings should be infinity.

If readings are irregular disconnect stator winding tails from terminal blocks (232) then carry out above continuity & insulation checks.

9.3 DISASSEMBLY PROCEDURE

9.3.1 Remove the set screws (35) and spring washers (36) from the top bearing cap (34). Remove the top bearing cap (34) from the motor housing (1).

9.3.2 Discard the O-ring (11C) from the top bearing cap (34) if O-ring (11C) is not in perfect condition.
Note: 150fr are not fitted with bearing cap 150fr have an upper sealed ball bearing).

9.3.3 See note below. Remove the set screws (9) and spring washers (13) holding the motor housing (1) to the bottom bearing bracket (7).

9.3.4 Using the jacking screw holes provided jack the motor housing (1) off the bottom bearing bracket (7).

9.3.3 Lift the entire motor frame vertically until it clears the top of end of the shaft (4). Lift with extreme care to ensure windings are not damaged. The slightest bump can result in permanent damage. The inner ring of the top bearing (5) remains on the shaft, sliding through the rollers of the bearing and through the oil seal (96). Place the motor frame on clean dry timbers.

NOTE: The motor housing should only be initially lifted 100mm. The lead to the water sensor probe (32) should be disconnected at the spade connector before lifting the motor completely off the bottom bearing bracket.

9.3.4 Discard the O-ring (11A) if not in perfect condition.

9.3.5 Remove the oil seal (96) by tapping it down, out of the bore, allowing it to drop through the motor housing.

9.3.6 Remove the outer race of the top bearing (5) from the motor housing (1). Do this by using a bearing puller or by inverting the housing and tapping the race out of the bore.

9.3.7 Clean the recess where the top bearing (5) seats of all grease.

9.3.8 If the stator (2) needs to be pressed out of the motor housing (1) the position of the stator in the housing should be measured and recorded so that it may be replaced in the same position when it is re-installed. Stator is an interference fit in the housing and requires a press to remove.

9.3.9 Remove the circlip (39) from the bottom bearing bracket (7). With 300fr motors remove fasteners (41 & 65) retaining bearing cap (40).

9.3.10 Lift the shaft (4) complete with top bearing inner ring (5), rotor (3) and bottom bearing (6) out of the bottom bearing bracket (7). If the outer race of the bottom bearing bracket (6) will not slide out of the bottom bearing bracket it may be necessary to apply heat quickly and uniformly around the boss of the bottom bearing bracket which houses the bottom bearing.

9.3.11 Lay the shaft on a clean bench at a suitable working height.

9.3.12 Remove the bottom bearing (6) with a bearing puller taking care not to damage the shaft particularly in the area where the mechanical seal sits.

9.3.13 Remove the inner ring of the top bearing (5) from the shaft with a bearing puller. It is permissible to grind a flat through one side of the ring and knock the ring off the shaft however **extreme care must be taken** not to damage the shaft.

9.3.14 Thoroughly clean all the components and lay them out on a clean, dry surface for re-assembly.

10.0 TO ASSEMBLE THE MOTOR (REFER SECTION 12 FOR SECTIONAL ARRANGEMENT DRAWINGS)

10.1 ASSEMBLY PROCEDURE

10.1.1 All parts including stator should be thoroughly cleaned before reassembly. If stator has been contaminated then clean and revarnish. Before the motor is re-assembled the motor housing (1) with the stator (2), shaft (4) with the rotor (3), desiccating bag (57), bottom bearing bracket (7) and seal plate (12) should all be placed in a drying oven at 80 - 90 degrees celsius overnight. The motor must be assembled on the same day that the components are removed from the drying oven, preferably while still warm. This ensures maximum displacement of any moisture from stator.

10.1.2 After the stator has been taken from the drying oven it should have the electrical checks detailed in section 3 carried out on it. It is important to carry these checks out at this stage so that it is confirmed that the stator is sound before assembly commences.

10.1.3 Before commencing to re-assemble the motor check that all the replacement parts are to hand. It is recommended that no O-rings, bearings or seals are reused when the motor is rebuilt.

10.1.4 Place the shaft (4) on a clean bench at a suitable working height.

10.1.5 Thoroughly clean the area on the shaft (4) where the bottom bearing (6) will sit with acetone to remove all traces of grease or oil. With 300fr motor slide bearing cap (40) over shaft.

10.1.6 Apply Loctite 241 to the shaft (4) on the cleaned area just prior to fitting bearing.

10.1.7 Clean out bottom bearing after removing bottom shield. Heat the bottom bearing (6) slightly so that it just slides onto the shaft. Do not over heat bearing. If it is necessary to apply pressure to seat the bearing against the shaft shoulder a dolly should be used to apply the force to the inner ring of the bearings. Pack bearing with grease BRBS72 (do not over grease). Spin bearing by hand and remove excess grease. Refit bearing shield.

10.1.8 Lift the shaft and position it above the bottom bearing bracket (7).

10.1.9 Lower the shaft (4) and allow the bearing to slide into the bottom bearing bracket (7). If the outer race of the bearing will not slide into the bottom bearing bracket apply heat quickly and uniformly around the boss which houses the bottom bearing. Care should be taken not to raise the temperature to a point where the grease begins to break down.

10.1.10 Replace the circlip (39). For 300fr fix retaining cap (40) with fixings (41 & 65).

10.1.11 Fit the inner race of the top bearing (5) to the shaft (4) using the same procedure outlined in section 10.1.5 to 10.1.7.

10.1.12 Fit the oil seal (96) to the motor housing (1) by tapping it down into its bore so that the top edge is level with the bearing bore. Ensure its correct orientation when fitting. (To retain grease).

10.1.13 Fit the outer race and rollers of the top bearing (5) to the motor housing (1). Apply heat quickly and uniformly around the boss which houses the bearing until the outer race just slides to the bottom of the bore.

Care should be taken not to raise the temperature to the point where the bearing or grease seal is affected. Use a press and suitably sized pipe jig to press outer race into place.

10.1.14 Lightly grease both the bearing race and oil seal (96) with SKF LGHT 3/1 high temperature grease.

10.1.15 Cover the top bearing (5) with a clean, dry, dust free cloth to keep dust and dirt out of the bearing.

10.1.16 If the stator (2) was pressed out of the motor housing (1) in section 9.3.5 it should be pressed back into the housing paying particular attention that it is in its original position and that the winding overhangs are not damaged in any way. Feed stator tails through side of housing and reconnect to terminal block.

The correct position of the stator (2) is centralised around the rotor.

10.1.17 Replace the O-ring (11a) on the bottom bearing bracket (7).

10.1.18 Lift the motor housing (1) across to the bottom bearing bracket. Position the housing above the shaft (4) and rotor (3) and slowly lower the housing over the rotor ensuring that the stator does not scrape down the side of the rotor.

The motor housing (1) should be held approximately 100mm above the bottom bearing bracket (7) while the control wire is connected to the water sensor (32) with its spade connector.

10.1.19 The motor housing may require rotation to line it up with the holes in the bottom bearing bracket (7).

Care should be taken that the O-ring (11a) is not pinched as the housing seats home.

The insulation between the water sensor probe (32) and the motor housing should be checked with a 500 volte Megahom Meter. Test from the water sensor lead to the motor housing. The reading should show infinity.

10.1.20 Replace the fixings (9 & 13) and tighten. Through out the assembly procedure turn shaft by hand ensuring it is free to rotate at all times.

10.1.21 Replace the O-ring (11C) to the top bearing cap (34). Fit the top bearing cap (34) to the motor housing (1). Replace the set screws (35) and spring washers (36) to the top bearing cap (34) and tighten.

10.1.22 Lift the motor at its lifting points and lay it on a bench at a suitable working height.

10.2 **CABLE ASSEMBLY**

10.2.1 Lift the terminal box (16) across to the motor.

10.2.2 Renew the O-ring (11E).

10.2.3 Position the terminal box so that the motor tails and leads reach the terminal blocks (232). Reconnect wires as per original connection.

10.2.4 Wire the earth leads to the motor housing (1) using the earth screw (29) and spring washer (28).

10.2.5 Feed the motor tails back into the motor as the terminal box (16) is placed into position against the motor housing (1).

10.2.6 Replace the set screws (26) and (22) with the spring washers (27) then tighten. Carry out insulation & continuity checks through cable to ensure no damage has occurred during assembly.

10.3 **TO ASSEMBLE THE MECHANICAL SEAL**

10.3.1 Thoroughly inspect the shaft (4), bottom bearing bracket (7) and seal chamber (12) in the areas which the mechanical seal (21) will seat. They should be free from scratches and burrs and be spotlessly clean. Pressure compensator is fitted (150fr, 165fr & 300fr motors only). Replace if it has collapsed.

10.3.2 Lubricate the shaft and elastomer components with detergent and water to assist in the assembly.

10.3.3 Check that the O-ring is properly seated in both of the seal seat assemblies.

10.3.4 Fit the seal seat assembly into the bottom bearing bracket (7). If the seal seat is difficult to push into the recess it is permissible to cover the seal seat with a clean piece of cardboard fashioned to slide over the shaft and exert pressure on the cupboard with a bronze tube. Both seal seats are tungsten carbide. The upper rotating seal head can be carbon or tungsten carbide (carbon is standard).

10.3.5 Wipe the faces of the seal with a clean, dry, dust free piece of cloth so that it is thoroughly clean.

10.3.6 Lightly oil the faces of the seal. Slide upper seal head along shaft until faces contact. The seal head can incorporate bellows which make it quite tight to press onto the shaft.

For internal type single spring seals (1.1/8")

10.3.7 Install spring making sure it is properly seated over the retainer. (It is sometimes advantageous to compress spring and tie in compressed state until lower seal head is fitted).

10.3.8 Fit the seal seat to the seal chamber (12) using similar procedure as upper seal.

10.3.9 Replace the O-ring (11b) on the seal chamber (12).

10.3.10 Slide product end seal head onto the shaft ensuring the spring is located correctly over the retainer. **Important:- Leave seal head positioned so that final compression of the spring will be by the seal chamber.** (Care should be taken not to damage the lapped face). Note the bottom product faces are tungsten carbide to tungsten carbide).

10.3.11 Before installing the seal chamber (12) clean and oil both lapped faces. The sliding the seal chamber over the shaft as far as it will go and fit securing bolts. Tighten screws or bolts evenly to keep seal and seat at right angles to the shaft. Tightening of the seal chamber (12) automatically sets the seal into it's correct position.

For multi spring back to back seals

10.3.12 Slide seal head retainer on shaft complete with springs until faces meet.

10.3.13 Compress springs to correct working length (refer appendices).

10.3.14 Tighten grub screws evenly and firmly to shaft.

NOTE: Seal must not be allowed to rest on the shaft too long before the end plate is placed in position, as the bellows has a tendency to adhere to the shaft.

As noted above final compression of spring must be executed when fitting seal chamber. Oil chamber must be filled (as per maintenance instruction) before the pump is run. Bellow seals are often tight on the shaft requiring extra pressure and lubrication to fit.

NEVER RUN THE SEAL DRY !!

10.3.15 Fit the seal plate (12) to the bottom bearing bracket (7) and tighten fixings (13) and spring washers. Rotate shaft by hand during the assembly process to ensure it does not bind. Where applicable fit external seal using same procedure as above for the internal multi spring seal.

10.3.16 For 203fr & 260fr. Stand unit vertically and fill the oil chamber with Whiterex 307 or an equivalent and replace the plugs (15B & 15A). A thread sealant should be used on these plugs to ensure a good seal. Unit is filled through (15B) with level plugs (15A). **DO NOT OVER FILL WITH OIL.** Fill chamber through 15B until oil just starts to flow out of 15A. For 150fr, 165fr & 300fr lay motor on its side and fill completely with oil.

10.3.17 Hold motor vertically and immerse shaft and lower section of seal plate (12) in a container of water. Run the motor for a maximum of two minutes for 2 pole motors and five minutes for four or six pole machines. Let it stand for a further thirty minutes. Check the shaft for any oil due to the seals leaking. If the amount of oil showing is only very slight clean the shaft carefully and repeat the two or five minute run.

If oil still leaks from the seal they have not been fitted correctly and their installation should be checked, especially the O-rings.

10.3.18 Replace the key (33).

10.3.19 Turn the motor shaft by hand to ensure that no binding has occurred. Shaft runout should be checked to ensure it is running true (within 0.05mm).

10.3.20 Remove the plug (15d) in the motor housing (1). Screw in a T-piece fitted with stop valves. Attach a vacuum pump to one branch and a bottle of dry nitrogen to the other. Evacuate the motor to a pressure of -50 to -60 Kpa (gauge pressure) and isolate the vacuum pump with the valve. Check that the motor will hold this vacuum for ten minutes. If the vacuum diminishes it is possible that an O-ring has been damaged during assembly and the O-ring will require replacement. If vacumn holds open the valve to the nitrogen tank and charge the motor with nitrogen to a pressure of 30 Kpa (gauge pressure). Repeat this procedure to ensure all air is purged from the motor.

11.0 TO ASSEMBLE THE PUMP

11.1 ASSEMBLY PROCEDURE (NON CLOG PUMP)

11.1.1 Using a new gasket is recommended during the assembly procedure below. Use anti seize on all threads.

11.1.2 Renew the discharge sealing ring (120) if required.

11.1.3 Lay the motor unit on bench at a suitable working height.

11.1.4 If the impeller wear ring (107) was removed refit a new wear ring by heating the new ring and pressing in onto the impeller (102). If required "scotch key" impeller wear ring to impeller.

11.1.5 Fit the key (33) into the shaft. Ensure key is a tight fit and all burrs in keyway and key have been removed.

11.1.6 Fit the impeller (102) onto the shaft and ensure the shaft and impeller are correctly engaged. Take care that there are no burrs, defects or dirt on the shaft or impeller bore as this will affect the fit. Prior to fitting impeller balance should be checked to ensure normal wear has not caused imbalance.

11.1.7 Fit the locknut washer (104) and screw the locknut (103) onto the thread. Locknut is the nyloc type and particular care should be taken not to damage thread on the pump shaft (4).

11.1.8 Tighten the locknut (3).

11.1.9 Check runout of impeller using a dial gauge. Runout should be within 0.2mm.

11.1.10 If the case wear ring (108) requires replacing in section 8 replace the new wear ring by pressing it into the volute (101).

11.1.11 Attach a sling to the motor complete with impeller and lift the motor over to where the pump volute is supported on clean, dry timbers.

11.1.12 Renew the gasket (113) which will be between the motor and the volute (101).

11.1.13 Lower the motor onto the double ended studs (117) making sure that the lifting points on the motor are on the same centre line as the discharge of the pump.

11.1.14 Screw the nuts (112) onto the double ended studs (117). Tighten the nuts (112) to tension.

11.1.15 Turn impeller by hand to ensure it is free. Before running the pumpset the installation procedure in section 6 should be followed through thoroughly.

11.2 **ASSEMBLY PROCEDURE (SHREDDER PUMP)**

11.2.1 FIT KEYS TO SHAFT. ENSURE the keys are fitted correctly. Slide impeller (2) on to shaft.

11.2.2 PLACE VOLUTE (1) ON BENCH. Replace shredder ring (8) and fix into place with fixing (27) and back up washers (63).

11.2.3 Lift volute into place and slide over impeller. Bolt volute (1) to motor with fixing (17). Tension fixings. Lay motor on its side.

11.2.4 Slide shredder cutter (7) onto shaft then lock into place with locknut (3) and washer (4).

11.2.5 Turn cutter by hand to ensure rotating element is free. Before running the pump set theinstallation procedure in Section 6 should be followed through thoroughly.

11.3 **ASSEMBLY PROCEDURE (CUTTER PUMP)**

11.3.1 Assembly of cutter pump is generally similar to non clog pumps with the exception of impeller and suction cover.

11.3.2 Inspect the cutting face of impeller blade. If face is worn or chipped it can be re-surfaced with wear resistant metal spray. Fit impeller following similar procedure as Non Clog Pump.

11.3.3 Once volute, impeller and motor are in place the suction cover can be fitted.

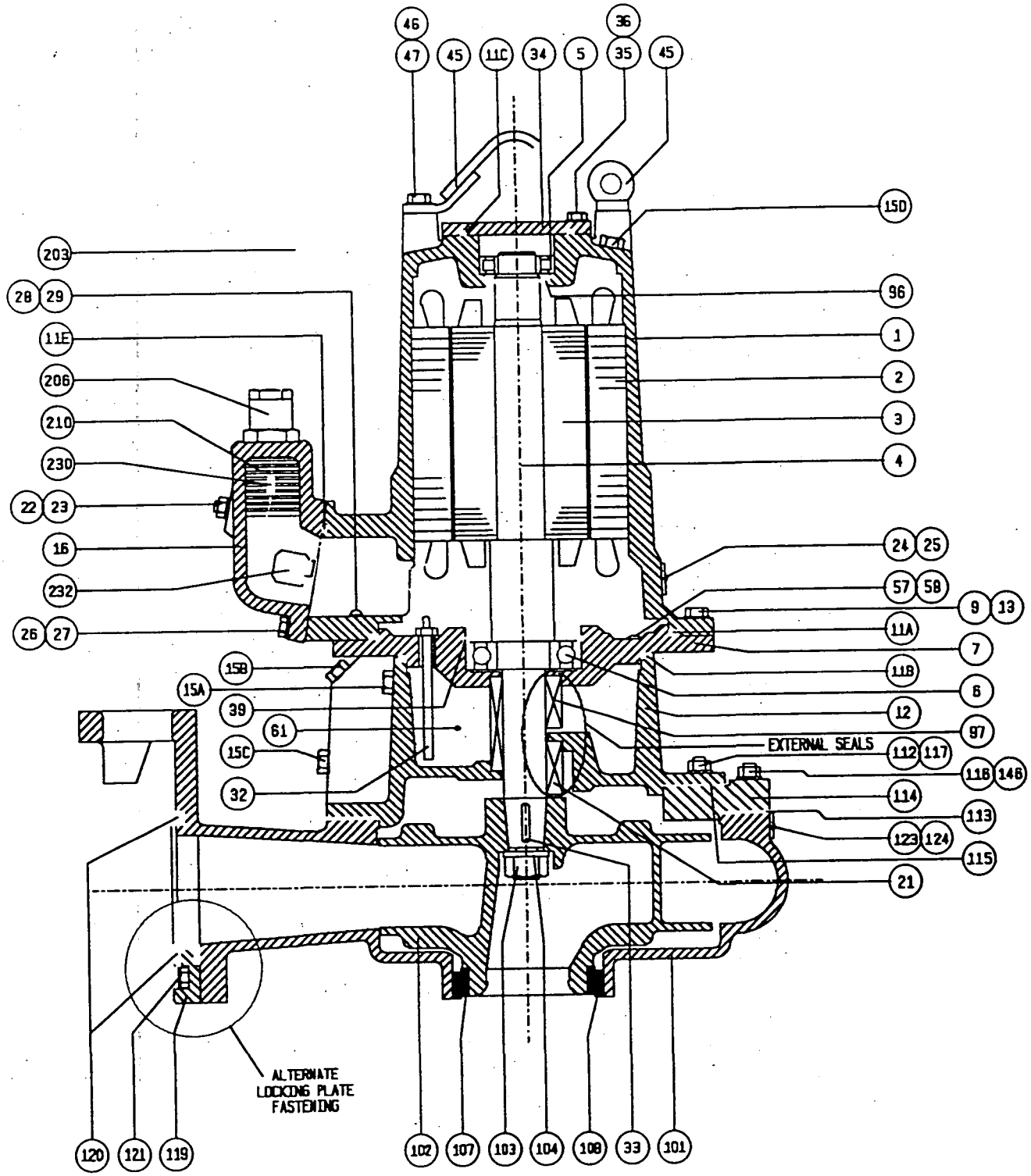
11.3.4 If suction cover has worn excessively then replace.

11.3.5 Slide suction cover onto volute. The cover needs to be packed out with approx. 0.8mm gaskets until the cutting blade just clears the suction cover. Tension suction cover in place then turn impeller by hand to ensure impeller does not foul with cover.

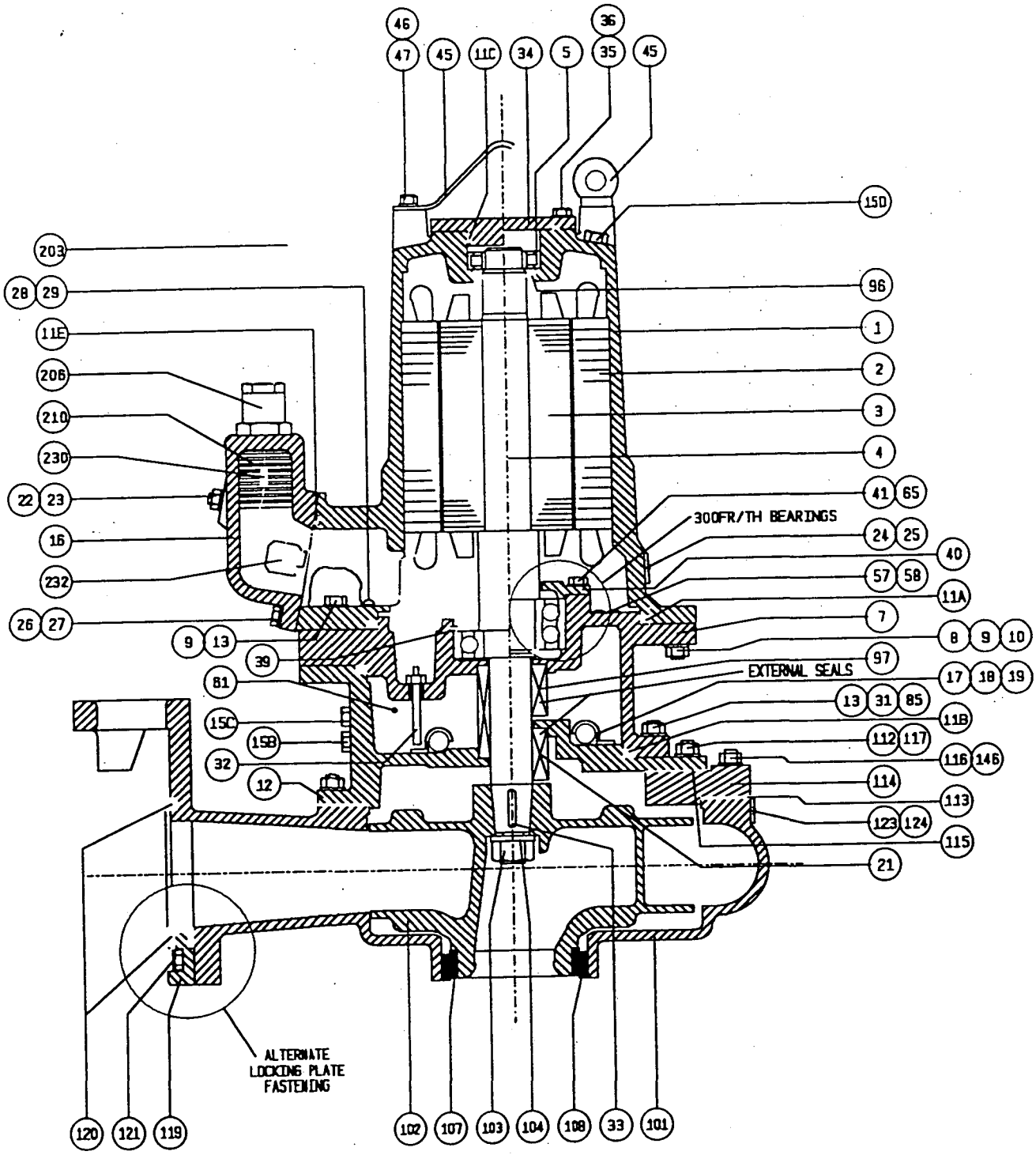
11.3.6 Install as per Non Clog Pump.

12.0 APPENDICES

12.1 SECTIONAL AND DIMENSIONAL DRAWINGS



A203FR AND A260FR MOTORS



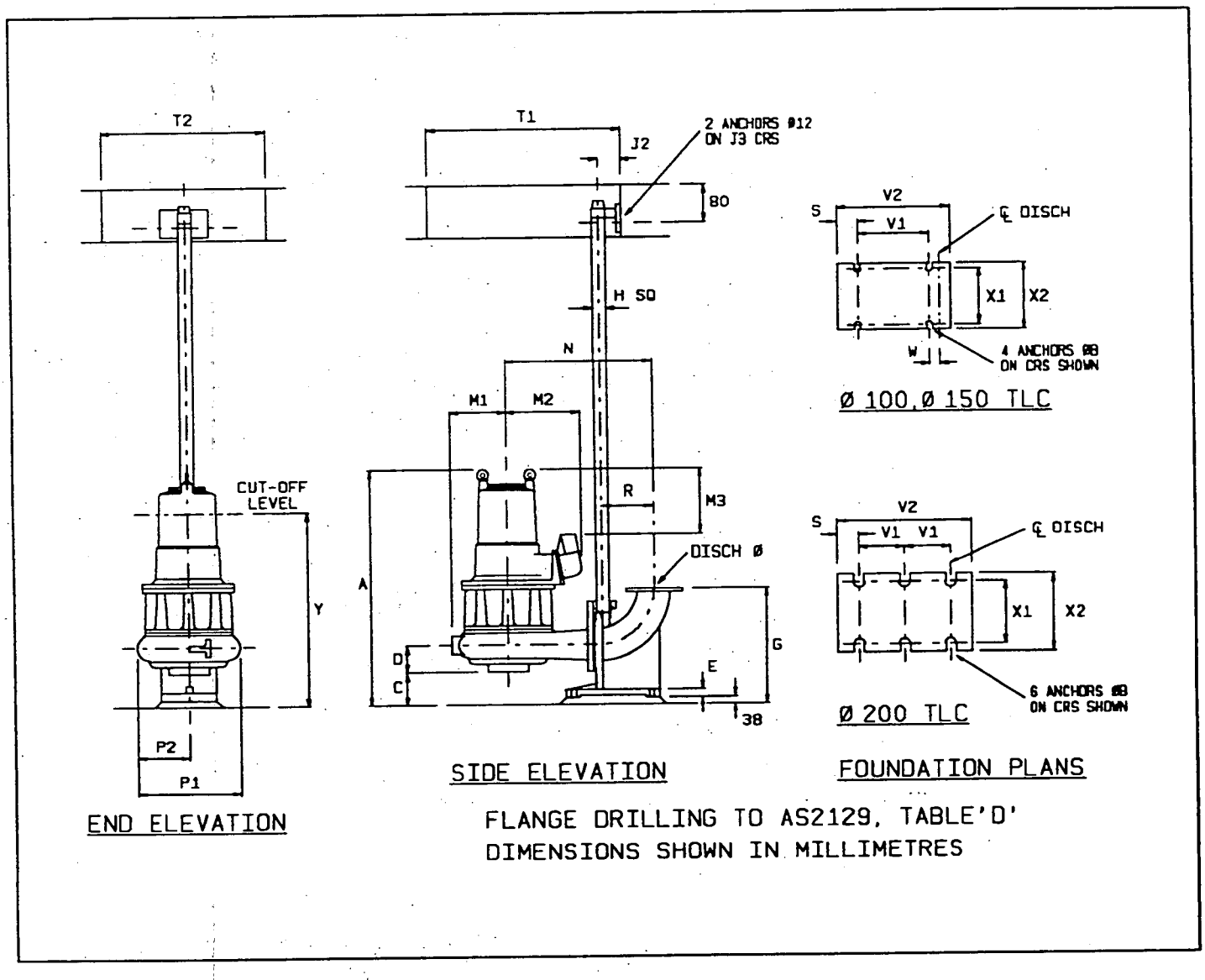
A165FR$_{4}^{4}$ AND A300FR MOTORS

MOTOR AND PUMP ASSEMBLY

ITEM	DESCRIPTION	MATERIAL	MATERIAL STANDARD
1	Housing	CI GR 220	AS 1830-1985
2	Stator	-	AS 1359
3	Rotor	-	AS 1359
4	Shaft	Stainless Steel 431	AS 2857-1986
5	Bearing	-	-
6	Bearing	-	-
7	Bottom Bearing Bracket	CI GR 220	AS 1830-1985
8	Fastener	Stainless Steel 304	AS 1111-1980
9	Spring Washer	Stainless Steel 316	AS 1968-1968
10	Nut	Stainless Steel 304	AS 1112-1980
11a	'O' Ring - Mtr Housing	Lurene	AS 2842-1986
11b	'O' Ring - Btm Brg Brkt	Lurene	AS 2842-1986
11c	'O' Ring - Top Brg Brkt	Lurene	AS 2842-1986
11d	'O' Ring - Terminal Box	Lurene	AS 2842-1986
11e	'O' Ring - Btm Brg Cap	Lurene	AS 2842-1986
12	Seal Chamber	CI GR 220	AS 1830-1985
13	Fastener	Stainless Steel 304	AS 1111-1980
15a	Plug - Oil Level	Stainless Steel 304	DZ9-1973
15b	Plug - Filler	Stainless Steel 304	DZ9-1973
15c	Plug - Oil Drain	Stainless Steel 304	DZ9-1973
15d	Plug - Gas	Stainless Steel 304	DZ9-1973
16	Terminal Box	CI GR 220	AS 1830-1986
17			
18			
19			
21	Mechanical Seal	TC/TC - TC/C	-
22	Fastener	Stainless Steel 304	AS 1111-1980
23	Nut	Stainless Steel 304	AS 1112-1980
24	Name Plate	Stainless Steel 316	AS 1449-1980
25	Rivet	Stainless Steel 304	B118-1953
26	Fastener	Stainless Steel 304	AS 1111-1980
27	Spring Washer	Stainless Steel 316	AS 1968-1976
28	Spring Washer	Stainless Steel 316	AS 1968-1976
29	Earth Screw	Stainless Steel 304	B194-1970
31	Nut		
32	Water Sensor (optional)	-	-
33	Key	Stainless Steel	ISO 3912-1977
34	Top Bearing Cap	CI GR 220	AS 1830-1986
35	Fastener	Stainless Steel 304	AS 1111-1980
36	Spring Washer	Stainless Steel 316	AS 1968-1976
39	Circlip	Carbon Steel	AS 1447-1981
40	Btm Brg Cap		
41	Fastener		
45	Eye Bolt	Forged Steel	AS 2317-1984
45	Lifting Bridle		
46	Fastener	Stainless Steel 304	
47	Spring Washer	Stainless Steel 316	
57	Dessicator Bag	Silica Gel	-
58	Rivet	Stainless Steel 304	B118-1953
61	Oil	Shell Tellus 68	AS 1767-1975
65	Spring Washer		
85	Spring Washer		
96	Oil Seal	-	-
97	Mechanical Seal	TC/TC	-

MOTOR AND PUMP ASSEMBLY

ITEM	DESCRIPTION	MATERIAL	MATERIAL STANDARD
101	Volute	CI GR 220	AS 1830-1985
102	Impeller	CI GR 220	AS 1830-1985
103	Nuloc Nut	Stainless Steel 304	AS 1285-1973
104	Washer	Stainless Steel 304	AS 1237-1973
107	Wear Ring - Impeller	Mild Steel	AS 2574-1982
108	Wear Ring - Volute	Ni Cr Iron	AS 2027-1985
112	Nut	Stainless Steel 304	AS 112-1980
113	Gasket	B.A. Unit	AS 2544-1982
114	Motor Adaptor	CI GR 220	-
115	Gasket	B.A. Unit	-
116	Fastener	Stainless Steel 304	
117	Fastener	Stainless Steel 304	AS 1111-1980
119	Locking Plate	CI GR 220	AS 1830-1985
120	Sealing Ring	Neoprene	AS 2544-1982
121	Fastener	Stainless Steel 304	-
123	Name Plate	Stainless Steel 316	AS 1449-1980
124	Rivet	Stainless Steel 304	B118-1953
146	Nut	Stainless Steel 304	
203	Cable	-	AS 2893-1986
206	Cable Gland	Brass - S/S Plated	AS 1567-385C
210	Epoxy	-	AS 1147.1-1989
230	Cable Link	Copper	AS 1299-1989
232	Terminal Box	Melamine	AS 1299.1989



FLANGE DRILLING TO AS2129, TABLE'D'
DIMENSIONS SHOWN IN MILLIMETRES

MODEL	MOTOR FRAME	DISCH	A	B	C	D	E	G	H	J2	J3	M1	M2	M3	N	P1	P2	R	S	T1	T2	V1	V2	W	X1	X2	Y
E100-280	150	100	806	12	135	106	28	459	50	86	121	205	N/A	N/A	568	408	204	199	31	900	700	300	362	12	179	220	668
	165	100	828	12	135	106	28	459	50	86	121	205	185	277	568	408	204	199	31	900	700	300	362	12	179	220	760
	203	100	925	12	135	106	28	459	50	86	121	205	294	265	568	408	204	199	31	900	700	300	362	12	179	220	810
	260	100	1005	12	135	106	28	459	50	86	121	205	294	387	568	408	204	199	31	900	700	300	362	12	179	220	759
E100-340	203	100	924	12	138	103	28	459	50	86	121	244	294	265	566	489	256	199	31	900	700	300	362	12	179	220	759
	260	100	1071	12	138	103	28	459	50	86	121	244	294	387	566	489	256	199	31	900	700	300	362	12	179	220	859
E100-350	260	100	1071	16	127	114	28	459	50	86	121	319	294	387	598	548	274	199	31	900	800	300	362	12	179	220	859
E100-380	260	100	1108	16	146	95	28	459	50	86	121	280	294	387	613	560	280	199	31	900	800	300	362	12	179	220	913
	300	100	1162	16	146	95	28	459	50	86	121	280	274	435	613	560	280	199	31	900	800	300	362	12	179	220	922
E100-405	260	100	1076	16	127	114	28	459	50	86	121	319	294	387	598	548	274	199	31	900	800	300	362	12	179	220	881
	300	100	1137	16	127	114	28	459	50	86	121	319	274	435	598	548	274	199	31	900	800	300	362	12	179	220	897
	350	100	1267	16	127	114	28	459	50	86	121	319	442	416	598	548	274	199	31	900	800	300	362	12	179	220	987
K150-330	203	150	1000	16	186	122	28	463	75	121	171	242	294	265	654	484	242	234	32	900	800	375	438	N/A	225	275	835
	260	150	1147	16	186	122	28	463	75	121	171	242	294	387	654	484	242	234	32	900	800	375	438	N/A	225	275	952
	300	150	1165	16	186	122	28	463	75	121	171	242	274	435	654	484	242	234	32	900	800	375	438	N/A	225	275	925
	350	150	1334	16	186	122	28	463	75	121	171	242	442	416	654	484	242	234	32	900	800	375	438	N/A	225	275	1054
K150-350	260	150	1136	16	151	157	28	463	75	121	171	289	294	387	683	572	315	234	32	1000	800	375	438	N/A	225	275	941
	300	150	1210	16	151	157	28	463	75	121	171	289	274	435	683	572	315	234	32	1000	800	375	438	N/A	225	275	970
	350	150	1334	16	151	157	28	463	75	121	171	289	442	416	683	580	315	234	32	1000	800	375	438	N/A	225	275	1054
	370	150	1334	16	151	157	28	463	75	121	171	289	442	416	683	580	315	234	32	1000	800	375	438	N/A	225	275	1054
K150-405	260	150	1142	16	218	90	28	463	75	121	171	283	294	387	781	569	305	234	32	900	800	375	438	N/A	225	275	947
	300	150	1204	16	218	90	28	463	75	121	171	283	274	435	781	569	305	234	32	900	800	375	438	N/A	225	275	964
	350	150	1334	16	218	90	28	463	75	121	171	283	442	416	781	569	305	234	32	900	800	375	438	N/A	225	275	1054
	370	150	1334	16	218	90	28	463	75	121	171	283	442	416	781	569	305	234	32	900	800	375	438	N/A	225	275	1054
K200-360	280	200	1389	20	370	132	35	695	75	146	241	330	294	387	936	635	350	302	51	1000	800	254	610	N/A	305	406	1174
	300	200	1401	20	370	132	35	695	75	146	241	330	274	435	936	635	350	302	51	1000	800	254	610	N/A	305	406	1161
	350	200	1527	20	370	132	35	695	75	146	241	330	442	416	936	635	350	302	51	1000	800	254	610	N/A	305	406	1247
	370	200	1527	20	370	132	35	695	75	146	241	330	442	416	936	635	350	302	51	1000	800	254	610	N/A	305	406	1247

12.2 TABLES FOR ROUTINE MAINTENANCE

MAINTENANCE CHART

	DAILY	WEEKLY	MONTHLY	3 MONTHLY	6 MONTHLY	YEARLY	REMARKS
Check for leaks.	■		■				Extend to monthly if proved satisfactory during running-in.
Check electrical continuity & insulation resistance.			■		■		Extend to 6 monthly if proved satisfactory during running-in.
Check oil in seal chamber, drain & refill.					■	■	Extend to 12 monthly if proved satisfactory during running in and 1500 hrs. Running not exceeded.
Check for vibration.	■	■					Extend to weekly if proved satisfactory during running-in.
Check cable for damage.					■		Depending on environmental condition.
Inspect wear rings.				■			Frequency can be changed depending on findings and pumping conditions.
Check for undue wear or corrosion of volute or impeller.				■		■	Check at end of first 3 months. Extend to yearly dependant on environmental and pumping conditions.
Check holding down bolts for tightness				■		■	Check at end of running in period, then at 12 monthly intervals.
Remove Waterjacket and clean out all feeder lines. (if applicable)					■		Depending on environmental condition.

PUMP OVERHAUL

The pump should be completely overhauled if the discharge pressure drops below an acceptable level the overhaul procedure is detailed in the maintenance instructions.

MOTOR OVERHAUL

The motor requires overhauling if an excessive amount of water is present in the seal chamber. The motor bearings should be replaced at each major overhaul.

PROBLEM SOLVING

PROBLEM SOLVING AND REMEDIAL ACTION REQUIRED

(A)	Power failure.	- Restore power.
(B)	Damaged cable.	- Repair or replace cable.
(C)	Blown fuses.	- Check to ensure the correct rating is being used. Check that the pump is not jammed. Check voltage supply. Carry out insulation and continuity checks. Replace fuse.
(D)	Thermistor failure.	- Check thermistors. Check for open circuit in thermistor wiring. Check backup relay. Check if more than 2.5 volts has been applied across thermistors.
(E)	Overload tripped.	- Reset. Follow procedure as for Item C.
(F)	Circuit breaker tripped.	- Reset. Follow procedure as for Item C.
(G)	Jammed/choked impeller.	- Remove cause of blockage.
(H)	Restriction/discharge line.	- Remove restriction, check gate valve.
(I)	Worn wear ring.	- Replace wear rings.
(J)	Excess air in liquid.	- Check inlet lines into station and relocate if necessary. Check level in well.
(K)	Head higher than design head.	- Check systems. Check for blockages in system.
(L)	Loose or damaged wiring.	- Repair or replace as required.
(M)	Open circuit/burnt-out stator.	- Replace, repair or rewind stator as required.
(N)	Loose plug/seal compartment.	- Tighten.
(O)	Damaged/worn mechanical seal.	- Replace or repair. NOTE - In some cases mechanical seals are suitable for re-installation after relapping of tungsten carbide faces.
(P)	"O" ring/gasket failure.	- Replace.
(Q)	Casting fracture/failure.	- Repair or replace as required.

TROUBLE SHOOTING

PUMP WILL NOT START

(A) Power failure.
(B) Damaged cable.
(C) Blown fuse.
(D) Thermistor failure.
(E) Jammed impeller.
(F) Overload tripped.
(G) Circuit breaker tripped.
(H) Electrical switch board fault.
(I) Motor incorrectly connected.
(J) Faulty motor winding.

PUMP STARTS BUT MOTOR HAS EXCESS CURRENT and/or LOW SPEED

(A) Wrong direction of rotation.
(B) Over or under voltage.
(C) Clogged impeller.
(D) Failed bearing.
(E) Fault in the motor.
(F) Incorrect motor connection.

PUMP RUNS BUT CAPACITY LOW

(A) Wrong direction of rotation.
(B) Impeller choked or inlet restricted.
(C) Restriction of discharge line.
(D) Wear rings worn excessively.
(E) Excessive air in liquid.
(F) Head higher than design head.
(G) Leakage from discharge.
(H) Supply voltage incorrect.

LOW RESISTANCE READING or SHORT

(A) Water in cone housing.
(B) Cable damaged.
(C) Water in stator housing.
(D) Stator burnt out.
(E) Loose wire.
(F) Wire clamped.

HIGH CONTINUITY READING

(A) Open circuit in stator.
(B) Broken wire or loose connection.
(C) Damaged cable.

12.3 RECOMMENDED SPARES & LUBRICANTS

RECOMMENDED SPARE PARTS LIST

DESCRIPTION	ITEM NO:
Bearing Upper	5
Bearing Lower	6
Mechanical Seal	21
Locknut	103
Wear Ring Impeller	107
Wear Ring Volute	108
Sealing Ring	120
'O' Ring & Gasket Set	

When ordering spare parts quote the serial number of the pump.

RECOMMENDED LUBRICANTS

Oil for Seal Chamber - Mobil Whiterex 307

Bottom Bearing Grease - BRBS72

Upper Bearing Grease - SKF LGHT 3/1 High Temperature Grease

12.4 RECOMMENDED TOOL LIST

This equipment can be serviced using standard equipment normally available to Electrical and Mechanical Tradespersons.

Meggar
Multimeter
Screwdrivers
Open ended spanners
Socket spanners & extension bars

Major overhauls should be carried out in a workshop containing the following:-

Presses
Heating Apparatus - Induction Heater
- Gas Flame Heater
- Oven

Bearing Pullers
Impeller Puller

12.5 PUMP PERFORMANCE CURVES AND SHEETS

12.6 PUMP TECHNICAL DATA & DIMENSION SHEETS

FORRERS PUMP DETAILS

Model (Old Model No)	SP280	SGV100-150	SGV280	4S250/3	4S330/3
Model (New Model No)				E100-280	E100-340
Discharge Diameter	75	75	75	100	100
Inlet Diameter	75	75	75	125	170
Impeller Type	Shredder	Shredder	Shredder	Non Clog	Non Clog
Impeller Fixing	Locknut	Locknut	Locknut	Taper/Locknut	Taper/Locknut
Rang to fit pump	180 - 100	150 - 100	180 - 100	277 - 185	340 - 275
W/ring Diametrical Clearance	N/A	N/A	N/A	0.82-0.61	340 - 275
W/ring Fixing	N/A	N/A	N/A	Pressed	Pressed
Min Submergence - TLC	440	440	440	440	440
Weight - Pump Only	40	38	40	96	114

FORRERS PUMP DETAILS

Model (Old Model No.)	4S350/3	4S380/4	4S405/3	6D330/3.5	6D350/4
Model (New Model No.)	E100-350	E100-380	E100-405	K150-330	K150-350
Discharge Diameter	100	100	100	150	150
Inlet Diameter	168	100	185	125	150
Impeller Type	Non Clog	Non Clog	Non Clog	Non Clog	Non Clog
Impeller Fixing	Taper/Lockn ut	Taper/Lockn ut	Taper/Lockn ut	Taper/Lockn ut	Taper/Locknut
Range to fit pump	355 - 340	370 - 270	406 - 346	330 - 250	344 - 265
W/ring Diametrical Clearance	0.81-0.71	0.81-0.71	0.81 -0.71	0.81-0.71	0.81-0.71
W/ring Fixing	Pressed	Pressed	Pressed	Pressed	Pressed
Min Submergence - TLC	440	450	440	550	550
Weight - Pump Only	135	131	155	170	198

FORRERS PUMP DETAILS

Model (Old Model No)	6D405/3	6D430/4	6D480/3	8D360/4	8D405/4
Model (new Model No)	K150-405	K150-430	K150-480	K200-360	K200-405
Discharge Diameter	150	150	150	200	200
Inlet Diameter	170	168	157	185	212
Impeller Type	Non Clog	Non Clog	Non Clog	Non Clog	Non Clog
Impeller Fixing	Taper/Lockn ut	Taper/Lockn ut	Taper/Lockn ut	Taper/Lockn ut	Taper/Lockn ut
Range to fit pump	406 - 345	440 - 342	485 - 435	364 - 272	406 - 350
W/ring Diametrical Clearance	0.81-0.71	0.81-0.71	0.71-0.71	0.89-0.64	0.79-0.64
W/ring Fixing	Pressed	Pressed	Pressed	Pressed	Pressed
Weight - Pump Only	190	218	340	310	320

12.7 MOTOR TECHNICAL DATA SHEETS

MOTOR TECHNICAL DATA
(COMMON CONSTRUCTION DETAIL)

Frame Size	150	164	203
Enclosure	IP68	IP68	IP68
Insulation Class	F	F	F
Mechanical Seal Size	1.1/8	1.1/8	1.5/8
Seal Face Material	TC/C TC/TC	TC/C TC/TC	TC/C TC/TC
Seal Style	BACK TO BACK FIGURE 1		BACK TO BACK FIGURE 2
NDE Bearing	6302 VV-C3	NU204 EC-C3	NU207 EC-C3
Size	Dia. 15	Dia. 20	Dia. 35
D.E. Bearing	6306 VV-C3	6306 VV-C3	6310 VV-C3
Size	Dia. 30	Dia. 30	Dia. 50
Bearing Lubrication	Sealed	Sealed/ Grease	Sealed/ Grease
Weight	40	86	155

Note: Bearing Types - Examples 6302 VV-C3 indicates ball bearing
NU204EC-C3 indicates roller bearing
7315BECB-C3 indicates to matched angular contact ball bearings

MOTOR TECHNICAL DATA
(COMMON CONSTRUCTION DETAIL)

Frame Size	260	300	350
Enclosure	IP68	IP68	IP68
Insulation Class	F	F	F
Mechanical Seal Size	2.1/4	2.1/4	2.7/8
Seal Face Material	TC/C TC/TC	TC/C TC/TC	TC/C TC/TC
Seal Style	TANDEM INTERNAL - EXTERNAL FIGURE 3		
NDE Bearing	NU209 EC-C3	NU209 EC-C3	NU212 EC-C3
Size	Dia. 45	Dia. 45	Dia. 60
D.E. Bearing	6312 VV-C3	3313 C3	7315 BECB-C3
Size	Dia. 60	Dia. 65	Dia. 75
Bearing Lubrication	Sealed/ Grease	Sealed/ Grease	Grease
Weight	215	315	555

Note: Bearing Types - Examples 6302 VV-C3 indicates ball bearing
NU204EC-C3 indicates roller bearing
7315BECB-C3 indicates to matched angular contact ball bearings

MOTOR TECHNICAL DATA
(COMMON CONSTRUCTION DETAIL)

Frame Size	370	420	470
Enclosure	IP68	IP68	IP68
Insulation Class	F	F	F
Mechanical Seal Size	2.7/8	3.5/8	3.5/8
Seal Face Material	TC/C TC/TC	TC/C TC/TC	TC/C TC/TC
Seal Style	TANDEM INTERNAL - EXTERNAL FIGURE 3		
NDE Bearing	NU212 EC-C3	NU212 EC-C3	NU212 EC-C3
Size	Dia. 60	Dia. 60	Dia. 60
D.E. Bearing	7315 BECB-C3	7319 BECB-C3	7319 BECB-C3
Size	Dia. 75	Dia. 95	Dia. 95
Bearing Lubrication	Grease	Grease	Grease
Weight	555	880	900

Note: Bearing Types - Examples 6302 VV-C3 indicates ball bearing
NU204EC-C3 indicates roller bearing
7315BECB-C3 indicates to matched angular contact ball bearings

MOTOR TECHNICAL DATA
(COMMON CONSTRUCTION DETAIL)

Frame Size	533		
Enclosure	IP68		
Insulation Class	F		
Mechanical Seal Size	4.7/8		
Seal Face Material	TC/C TC/CT		
Seal Style	TANDEM INTERNAL - EXTERNAL FIGURE 3		
NDE Bearing	NU315 EC-C3		
Size	Dia. 75		
D.E. Bearing	7226 BECB-C3		
Size	Dia. 130		
Bearing Lubrication	Grease		
Weight	1800		

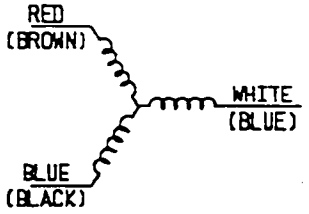
Note: Bearing Types - Examples 6302 VV-C3 indicates ball bearing
NU204EC-C3 indicates roller bearing
7315BECB-C3 indicates to matched angular contact ball bearings

12.8 WIRING DIAGRAM

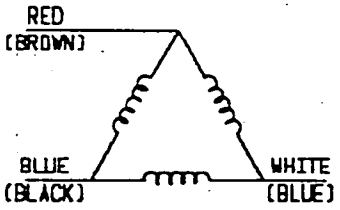
MOTOR CONNECTION FOR FORRERS AUSTRALIS SUBMERSIBLE MOTORS

POWER CABLE

1



2



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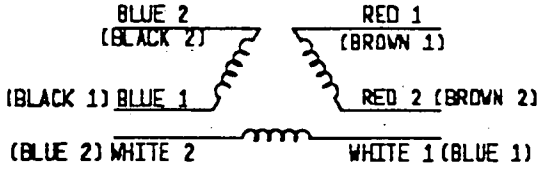

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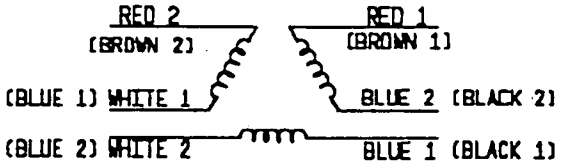

CONTROL CABLES

5 TWO BLACKS IN MAIN CABLE
WINDING THERMISTORS

6 TWO BLACKS IN MAIN CABLE
WATER SENSOR

7 TWO BLACKS IN MAIN CABLE 1
WINDING THERMISTORS

8 TWO BLACKS IN MAIN CABLE 2
WATER SENSOR

9 SEPARATE CABLE
RED & BLUE - WINDING THERMISTORS
GREEN & WHITE - WATER SENSOR

10 SEPARATE CABLE
RED & BLACK - WINDING THERMISTORS

11 SEPARATE CABLE
RED & BLACK - WATER SENSOR

FOR CORRECT ROTATION DE CONNECT
R.W.B. TO R.W.B. OF A SUPPLY WITH A
TIME SEQUENCE R.W.B.

	STANDARD MOTOR CONECTION			STAR/DELTA MOTOR CONNECTION		
RATING	STANDARD THERMS	STANDAR THERMS & SENSOR	STANDARD SENSOR	STAR/DELTA THERMS	STAR/DELTA THERMS & SENSOR	STAR/DELTA SENSOR
BELOW 3kW	1,5	1,5,11	1,6	N/A	N/A	N/A
3kW TO 45kW	2,5	2,5,11	2,6	3,7	3,7,8	3,8
55kW TO 120kW	4,7	4,7,8	4,8	3,7	3,7,8	3,8
ABOVE 120kW	4,10	4,9	4,11	67 3,10	3,9	3,11

12.9 MECHANICAL SEAL DATA

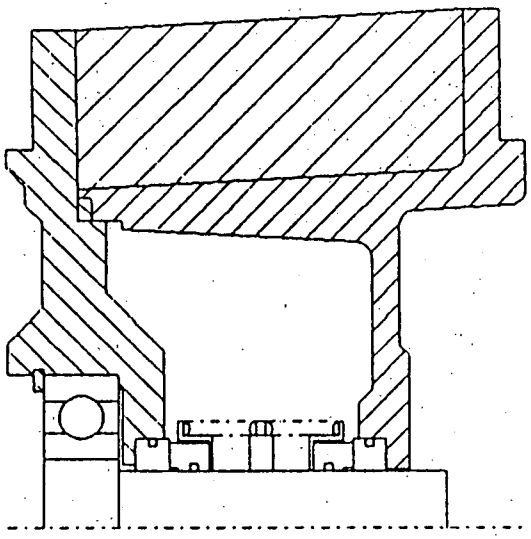

FIG No. 1 - SELF CENTERING ARRANGEMENT

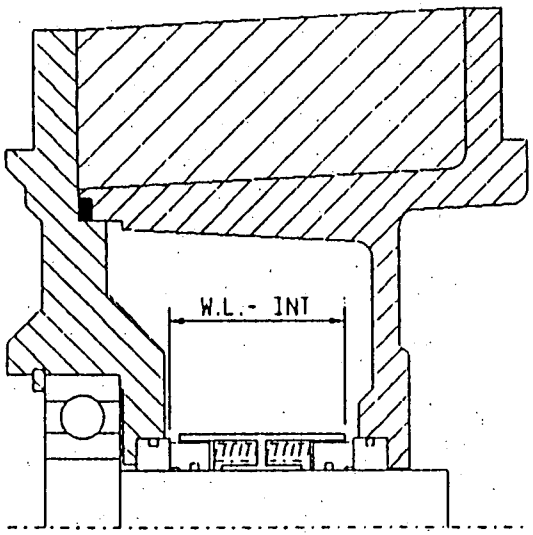

FIG No. 2 - HIGH/LOW PRESSURE ARRANGEMENT

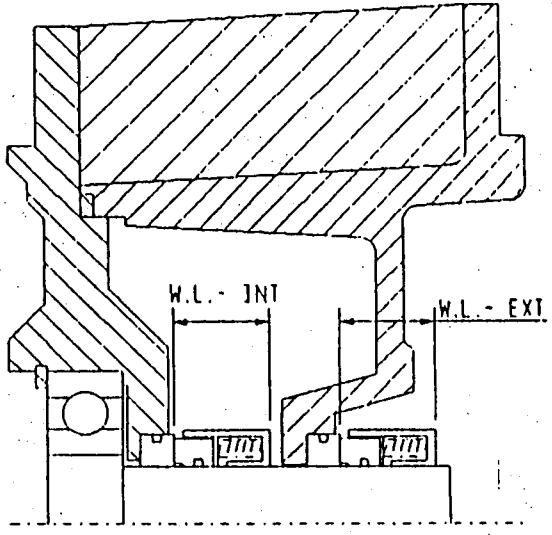

FIG No. 3 - INTERNAL/EXTERNAL ARRANGEMENT

SEAL SIZE	1.1/8"	1.5/8'	2.1/4"	2.1/4"	2.7/8"	2.7/8"	3.5/8"	3.5/8"	4.7/8"	4.7/8"
W.L.- INT	---	64.3	---	42.9	---	42.5	---	40.5	---	1.687"
W.L.- EXT	---	---	---	42.9	---	42.5	---	40.5	---	1.687"
COMP.	---						---		---	
P/No.- INT	562100	HIGH : 562120/2 LOW : 562120/3	---	562131/2	---	562151/2	---	562171/2	---	562191
P/No.- EXT	---	---	---	562132/2	---	562152/2	---	562172/2	---	562192
FIG No.	1	2	2	3	2	3	2	3	2	3

NOTE: CARBON END OF SEAL TO POINT TO BEARING

A	ORIGINAL	18/08/9			

DRN. AS | BIN CODE
CKD. | WEIGHT
PASS. | SECTION : 21GA00/1
SHEET ONE OF ONE
MAT'L CODE
MAT'L

SCALE N.T.S.

TOLERANCES UNLESS OTHERWISE SPECIFIED
FABRICATION & CASTING : 2.00
MACHINE - WHOLE NUMBERS : 0.10
MACHINE - DECIMAL : 0.15

KSB AJAX PUMPS
FORRERS PUMP WORKS

MECHANICAL SEAL DATA
STANDARD SEAL - CRANE

ISSUE A | A3
DWG No CAD