RPFS - ROTA PULSE FLOW SENSOR (Insertion Paddlewheel)

****SERVICE GUIDE****

FEATURES

- **± 2.5% accuracy @ velocity range 0.5 to 8.5 m/sec.**
- **± 1 % accuracy over linear range 0.7 to 7.0 m/sec.**
- **Repeatability of ±0.6%.**
- **NPN inductive pulse with internal amplification.**
- **Square wave output with short circuit protection.**
- **Inductive coil pulse option.**
- **50°C or 120°C temperature models.**
- **Simple installation and maintenance.**
- **Large range of pipe adapter fittings in sizes 15 to 150mm.**
- **New lighter-weight rotor design for improved response at lower flowrates (from 0.25 m/sec for RPFS-P model).**
- **Marine-grade alloy rotor without magnets.**
- **Australian made since 1984.**

RPFS-P

DESCRIPTION

The Rota Pulse Flow Sensor (RPFS) paddlewheel insertion type flowmeter uses a proven principle of flow measurement, which is used worldwide. The RPFS comes in three model variants:

- **RPFS-P** for liquids up to 50°C (plug-in cable)
- **RPFS-H** for liquids up to 120°C
- **RPFS-L** for liquids up to 120°C (special low current inductive pulse)

All three models insert directly into a large range of pipe adapter fittings available in PVC, Galvanized Iron, Brass, Stainless Steel or Polypipe materials, covering pipe sizes 15 to 150mm (standard sizes). This makes the RPFS suitable for a wide range of liquid flow measurement, monitoring and batching applications.

With only one moving part and limited intrusion into the pipe, and combined with its flow-through design, the RPFS allows accurate measurement of liquid flows with virtually no headloss.

Each of the 4 blades of the rotor (paddlewheel) extends approximately one centimeter into the flowing liquid. The RPFS-P sensor generates a square wave pulse with the frequency output proportional to flow velocity and proportional to pipe diameter. The RPFS-P incorporates internal amplification, allowing pulse transmission up to 1000 metres to the receiver device. The RPFS-P's specially constructed metal shielding jacket makes that unit immune to electrical interference.

Magnets are not used in the RPFS models, thereby eliminating iron particles jamming the rotor. The alloy rotor used also makes the RPFS less susceptible to interference from turbulence and particles hitting the rotor, thereby giving superior flow results.

SPECIFICATIONS

	Model		
	RPFS-P	**RPFS-H**	**RPFS-L**
Supply voltage	5-30VDC	5-30VDC	Inductive coil 260ohms.
Output signal	NPN open collector 50% duty cycle pulse	NPN open collector 50% duty cycle pulse	Inductive sine wave pulse 50% duty cycle pulse 0.1v to 2v p/p generated
Current draw @ 5VDC / 24VDC	2.5mA / 10mA	2.5mA / 10mA	negligible
Max. switching current @ 24 VDC	200 mA	200 mA	not applicable
Cable length	5 metres, plug-in cable 3-core (3 wire)	2 metres cable 2-core shielded (3 wire)	2 metres cable 2-core shielded (3 wire)
Fluid temperature	50 °C max.	120 °C max.	120 °C max.
Weather rating	IP67	IP65	IP65
Pressure rating	200psi	400psi	150psi
Accuracy	± 2.5% for 0.5 to 8.5 m/s, ±1% for 0.7 to 7.0 m/s, Repeatability ± 0.6%		
For Pipe Sizes	15 to 150mm standard, larger pipes via the long-stem LS version with BSPB special adaptor or saddle clamps.		

INSTALLATION GUIDE

Adapter tee keyway fittings are available in:

1. PVC Class 18 Cat. 19 (glue-ends) pressure pipe sizes 20, 25, 32, 40, 50, 65, 80 & 100 mm.
   PVC high pressure saddleclamps: 50, 80, 100 & 150 mm.
2. Galvanized Iron threaded connections:
   - BSP female: pipe sizes 25, 32, 40 and 50 mm;
   - BSP male: pipe sizes 80 and 100mm.
3. Copper/Brass BSP (male) threaded connection end process pipe tube tees 15 & 20 mm.
4. Polypipe saddleclamps in pipe sizes 50, 63, 75, 90, 110 mm, up to 150mm. PVC saddles 80, 100 and 150mm.

For tapping into existing or larger pipe works:

- Use BSPB brass or BSPSS Stainless Steel pipe adapter keyway nipple - with locknut, has 1" OD BSP thread for screwed insertion into 1"(f-bsp) sockets. Or 150mm> BSP-LS version
- BSP adapters can be welded directly to pipe (see Fig. 1).

Installation Conditions

- **IMPORTANT**: A minimum of 10x pipe diameter before (upstream of) the sensor and at least 5x pipe diameter after sensor of straight pipe section must be fitted, with no bends, reductions, enlargements, restrictions, valves etc within this section. This will help eliminate flow turbulence to ensure optimum accuracy performance.
- The RPFS sensor must measure in a full pipe flow section.
- Can be installed in a horizontal, inclined or vertical pipe position. (Note: If mounted in horizontal or inclined pipe, make sure insertion position of sensor is at top or 45° from top, not on the underside).

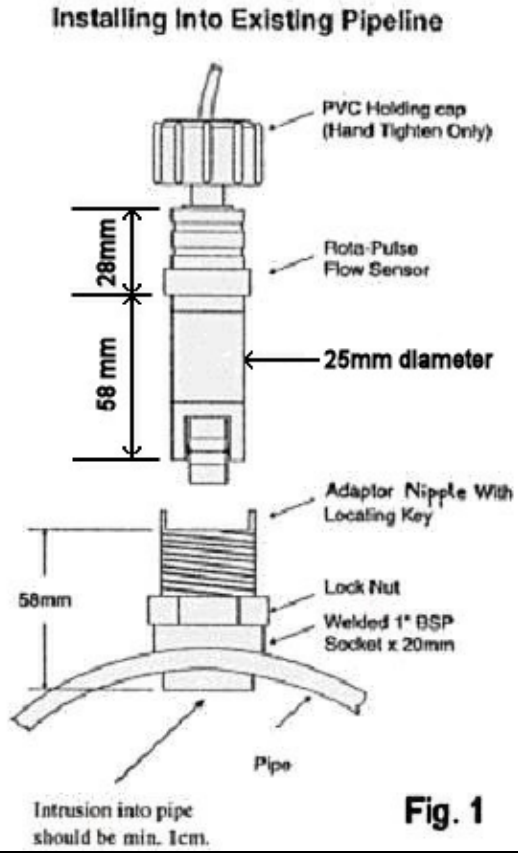
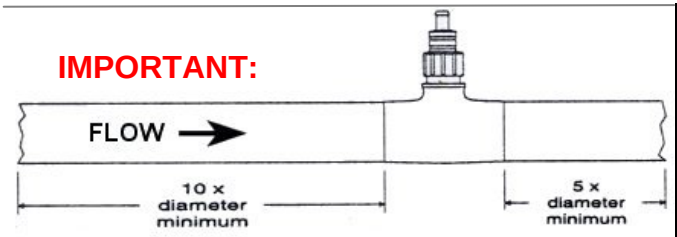


Fig. 1



Selection of pipe diameter

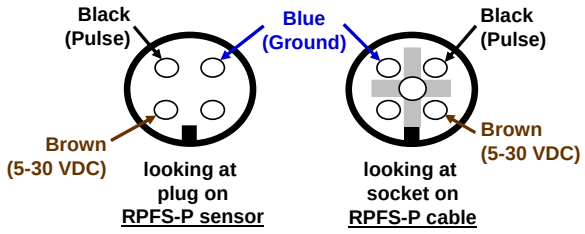
For best operating results, use the table below:

Pipe size (mm)	Flowrange (Litres/min)		Pulses/Litre (approx.) (1)(2)
	Min	Max	
20	13	160	116
25	20	250	75
32	30	410	46
40	50	640	30
50	90	1000	20
63	132	1580	11.7
65	120	1690	12
75	180	2250	8.3
80	190	2560	7.3
90	244	3240	5.7
100	300	4005	4.6
110	343	4845	3.8
125	426	6255	3.0
140	516	7850	2.4
150	600	9010	2.1
160	650	10200	1.8
195	900	15200	1.22
200	950	16000	1.16
250	1480	25000	0.7
280	1850	31400	0.6
315	2280	39720	0.46

ELECTRICAL INSTALLATION/DATA

Cable connection:

RPFS-P# Black = Pulse
Brown = + 5-30 VDC
Blue = O.V. ground/shield



RPFS-H# White = Pulse
Red = + 5-30 VDC
Shield = O.V. ground/shield

RPFS-L White = Signal
Red = Signal
Shield = connect to signal/ground

If connecting to non-ManuFlo equipment, a 2K2 pull-up resistor may be required between (+) and Pulse.

For extra cable length, use shielded cable only!

WARNING: To avoid electrical interference the RPFS-H and RPFS-L should not be installed within 30cm of any AC fields, otherwise 50Hz could be detected and create oscillations.

(1) For >315mm diameter pipes:
Pulses per Litre = 50273 / [(Pipe diameter in mm) $^{2.016}$]

(2) NOTE: Due to gravitational forces, the pulse output value can differ up to 6% between a vertical flow that is upwards or downwards. Where possible, perform a calbration check to determine pulserate given the pipe diameter and flow conditions. Once calibrated, meter will give linear and repeatable results within the flowrange

Sensor Construction

Model	RPFS-P	RPFS-H	RPFS-L
Body	Delron (Acetal)	Brass	Delron
O-rings x2	Neoprene	Viton	Neoprene
Rotor	Marine grade stainless steel		
Bushes	Delron	Delron	Delron
Axle	Tungsten Carbide		
Lockcap	PVDF	Brass	PVDF
Dimensions Overall (approx.)	130L x 30W mm	150L x 30W mm	135L x 30W mm

RPFS-H

MAINTENANCE

With clean liquids, a check is required once every year. In applications with reclaimed or contaminated fluids, regular monthly (at worst quarterly) maintenance checks are recommended.

▪ To remove the sensor, first unscrew the PVC locking cap. ▪ Remove the sensor by pulling up, do not twist until clearing keyway. Do not pull by cable. ▪ If the paddlewheel (rotor) is dirty, then clean with diluted hydrochloric acid. ▪ For ease of removal or refitting, lubricate the body O-rings. ▪ If the paddlewheel requires servicing, push out the axle, remove the wheel, and service or replace the bushes as required.

APPLICATIONS

Since the RPFS Flow Sensor was first manufactured in 1984, over 10000 units are now in use worldwide. They are used in a large variety of applications, including measurement of fresh and recycled water in concrete batch plants, measurement of petrol/diesel, water irrigation, salt water, chlorinated water and countless other low viscosity liquid measurement processes (Note: is not suitable for pulsating flows).

RPFS-P and RPFS-H sensors can be connected direct to PLCs, ManuFlo ME995 preset batch controllers or FRT303 Flowrate/Totalisers, or just about any other process controller/indicator device (up to 1000m away).

The ManuFlo UIC universal pulse scaler card allows conversion of the output pulse to individual requirements – ideal for PLC inputs of DC NPN/PNP or AC triac types.
Pulses can be scaled down or factored to a desired engineering unit, to cater for slow counting PLCs.

The RPFS-L inductive coil sensors are energy misers suitable for low current requirements and are ideal for battery powered applications using FRT303 or ME5 Indicators (up to 150m away).

RPFS-type flow sensors are designed to operate with ManuFlo equipment (our equipment has internal pull-up resistors at the inputs). If using an RPFS with non-ManuFlo equipment and pulses are not being detected, then fit a resistor of value 1.5K - 3.3K across the Pulse and (+) positive input to act as pull-up resistor (the exact resistor value should be determined by the current draw to suit your equipment).

ORDERING CODES

NOTE: All RPFS sensors are supplied with a screw-down LC locking cap.

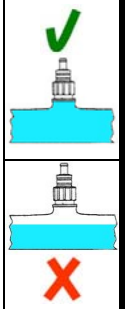
Item	Description		
RPFS-P	NPN transistor 5-25VDC sinking pulse,	liquid temperature to 50°C	
RPFS-H	NPN transistor 5-25VDC sinking pulse,	liquid temperature to 120°C	
RPFS-L	Inductive coil pulse signal for amplified inputs,	liquid temperature to 120°C	

(See page 4, for pipe installation adapter fittings)

SPARE PARTS

Order Code	Description		Order Code	Description	
BLN	25mm Brass Lock Nut for BSPSS and BSPB adapters		PW-N	Paddlewheel, with bushes	
BS020	Neoprene O-ring		PWAH	Axle for paddlewheel	
BS020V	Viton O-ring		PC-RPFSP	Plug-in cable for RPFS-P	
LC	Locking Cap		SLC	Sealer locking cap	

ORDER CODES FOR PIPE ADAPTER FITTINGS

Material	GAL	PVC	PVC	Polypropylene	Polypropylene	STAINLESS	BRASS	BRASS
Type	T-Piece	slip T-piece	Saddle Clamp	SaddleClamp	SaddleClamp	T-Piece	T-piece	Socket
For	Gal pipe	Pressure pipe	Pressure pipe	PVC Irrigation pipe	Poly Pipe Black	S/Steel pipe	Brass pipe	
20 mm		PVC20					BRA20M	
25 mm	GAL25	PVC25	PVC40SC			SS25M		
32 mm	GAL32	PVC32		SCPxxx: Polypipe Tapping Saddles available for PVC irrigation pipes 32 - 315mm				BSOC: 1" BSP Brass pipe socket adaptor for 32-500 mm pipes
40 mm	GAL40	PVC40						
50 mm	GAL50	PVC50	PVC50SC		SC50			
63 mm					SC63			
65 mm		PVC65						
75 mm					SC75			
80 mm	GAL80	PVC80	PVC80SC					
80 mm	GAL80-F *(Table D flanged)*							
90 mm					SC90			
100 mm	GAL100	PVC100	PVC100SC					
100 mm	GAL100-F *(Table D flanged)*							
110 mm					SC110			
125 mm					SC125			
140 mm					SC140			
150 mm			PVC150SC					
160 mm					SC160			
195 mm			PVC195SC					
200 mm			PVC200SC		SC200			
225 mm								
250 mm					SC250			
280 mm					SC280			
315 mm								
500 mm								
Pipe must be full at all times								
	Galvanised Iron, threaded entries BSP(female). 2000 kPa	PVC T-piece Class 18, Cat 19 Glue-in (female) 1100 kPa	PVC 1500 kPa	PVC ≤ 150mm: 1600 kPa > 150mm: 1000 kPa	Poly-pipe agricultural Saddle Clamps. ≤ 150mm: 1600 kPa > 150mm: 1000 kPa	Stainless Steel 316 T-piece. BSP (female) threaded entry 2000 kPa	Brass T-piece BSP (female) threaded entry 2000 kPa	1" BSP Brass pipe socket adaptor **(see installation diagram Fig. 1 on Page 2)**

GAL80 - 80mm Galvanized Iron pipe adapter
(80mm ϕ x 600mm long)

BSPSS Stainless Steel adapter nipple for 32-500mm pipes

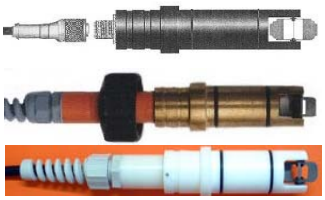
BSPB brass adapter nipple for 32-500mm pipes

Paddlewheel-type flowmeters: Application Guide

The RPFS insertion paddlewheel flowmeter was designed, manufactured and introduced by Manu Electronics in 1984. There are now thousands of units in use every day.

The current range of RPFS-type flowmeters are used primarily for fresh and recycled water batching measurement in concrete plants, and also in many other process industry applications e.g. tradewaste, water irrigation, salt water measurement, basically for any thin freely flowing liquid.

- The **RPFS-P** version can be used with ME995-7 Batch Controllers for preset automatic batching, and with UIC interface cards for pulse scaling and input to a range of PLC/computers, FRT303-D or A Flowrate/Totaliser Indicators, or coupled to any other frequency-input device.
- **RPFS-H** is used for the measurement of hot liquids. *RPFS-H shown with locking cap -->*
- **RPFS-L** has inductive coil pulse output, and is used for connection to battery-powered devices.



A wide range of pipe adaptor fittings are available to suit most pipelines (see the RPFS Datasheet from our website). If the fittings listed are not suitable for your application, consult ManuFlo for custom items. Most of our fittings are suitable for pipes up to 100mm diameter, but the RPFS has been used on pipes up to 2000mm diameters. Now use the RPFS-LS LONG STEM VESRIONS for pipe sizes 150mm>

Pulses Per Litre

The following formula approximates RPFS output pulse for a given pipe diameter (for water), for matching the RPFS to your Flowrate Indicator, PLC or other devices:

$$\textbf{Pulses Per Litre for a given pipe diameter} = \frac{46{,}512}{(\text{pipe diameter in mm})^2}$$

$$\text{e.g. Pulses Per Litre for 200 mm diameter pipe} = \frac{46{,}512}{(200)^2} = \frac{46{,}512}{40{,}000} = 1.2 \text{ Pulses/Litre}$$

Minimum/Maximum flowrate

The following formulas give the approximate minimum and maximum flowrate (for water) that can be measured to ±2.5% accuracy (0.5 - 8 m/s flow velocity) for a given pipe diameter in mm.

Minimum flowrate (Litres/min) = 0.0236 * (pipe diameter in mm)²

e.g. for 200mm diameter pipe, minimum flowrate = $0.0236 * (200)^2 = 0.0236 * 40{,}000 = 944$ Litres/min

Maximum flowrate (Litres/min) = 0.377 * (pipe diameter in mm)²

e.g. for 200mm diameter pipe, minimum flowrate = $0.377 * (200)^2 = 0.377 * 40{,}000 = 15{,}080$ Litres/min

Application characteristics

For all applications, an on-site calibration test should be performed.

RPFS-type flowmeters:

- can be used for liquids of specific gravities upto 1.1, although the actual pulse output rate must be determined onsite when calibrating.
- are ideal for medium to high-velocity flow measurement (not suitable for low velocity measurement).

RPFS-type flowmeters are not suitable for measuring liquids that:

- vary in specific gravity, or
- are highly sticky, or
- contain fibrous matter or large particles.

In the RPFS:

- the rotor (paddlewheel) used is made of a impervious injection-moulded marine alloy (SAF2205). It can be used with acids and almost any liquid composition. The axle is tungsten-carbide and practically does not wear.
- the body and rotor bushes are made from injection-moulded Delron. The body is also available in brass (model RPFS-H) for hot liquids.
- The O-rings are Neoprene as standard, or Viton for petroleum products.

Due to continuous product improvement, specifications are subject to change without notice.

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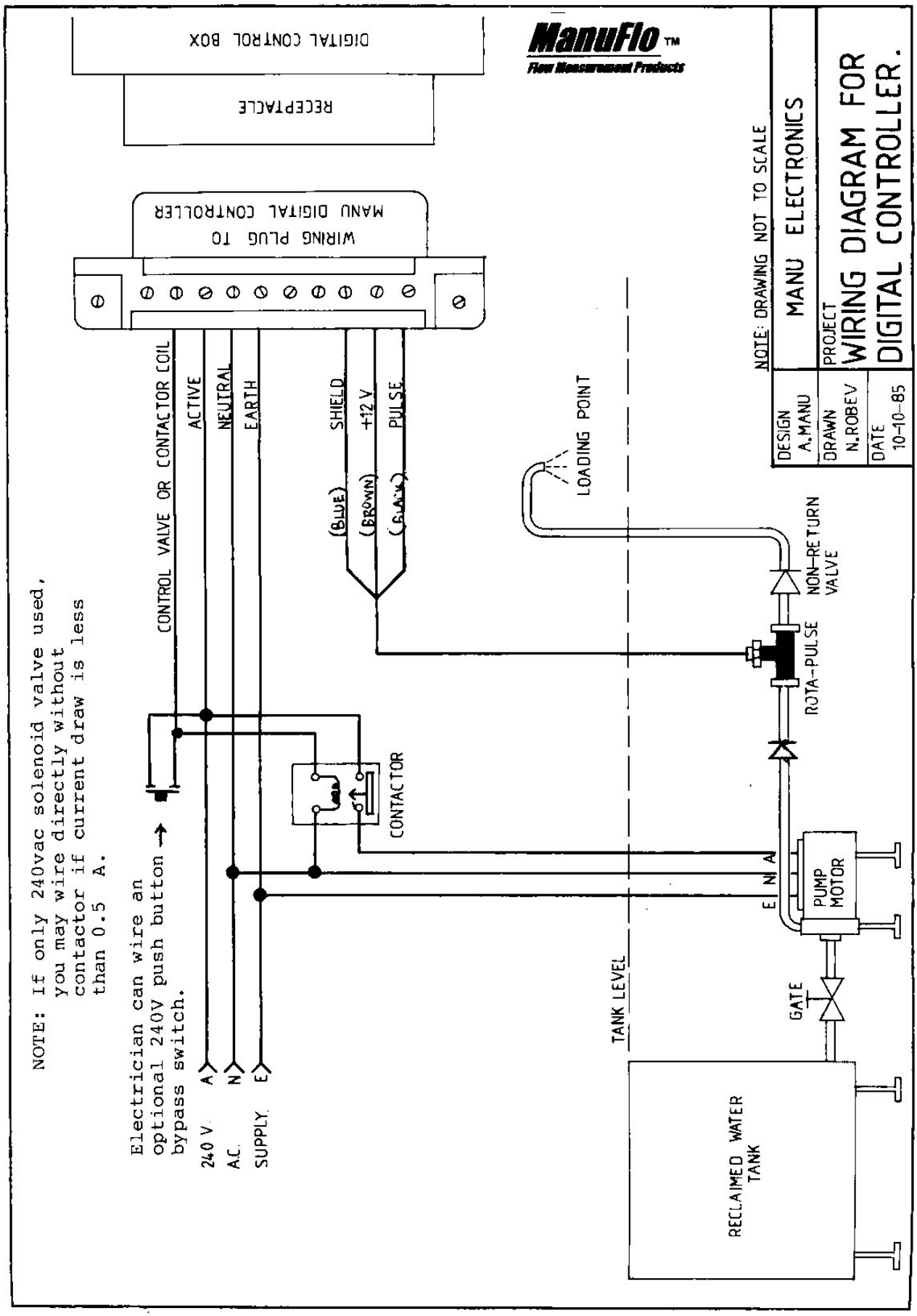
RPFS and ME995 Wiring and Plumbing Diagrams



Flow Measurement & Control products

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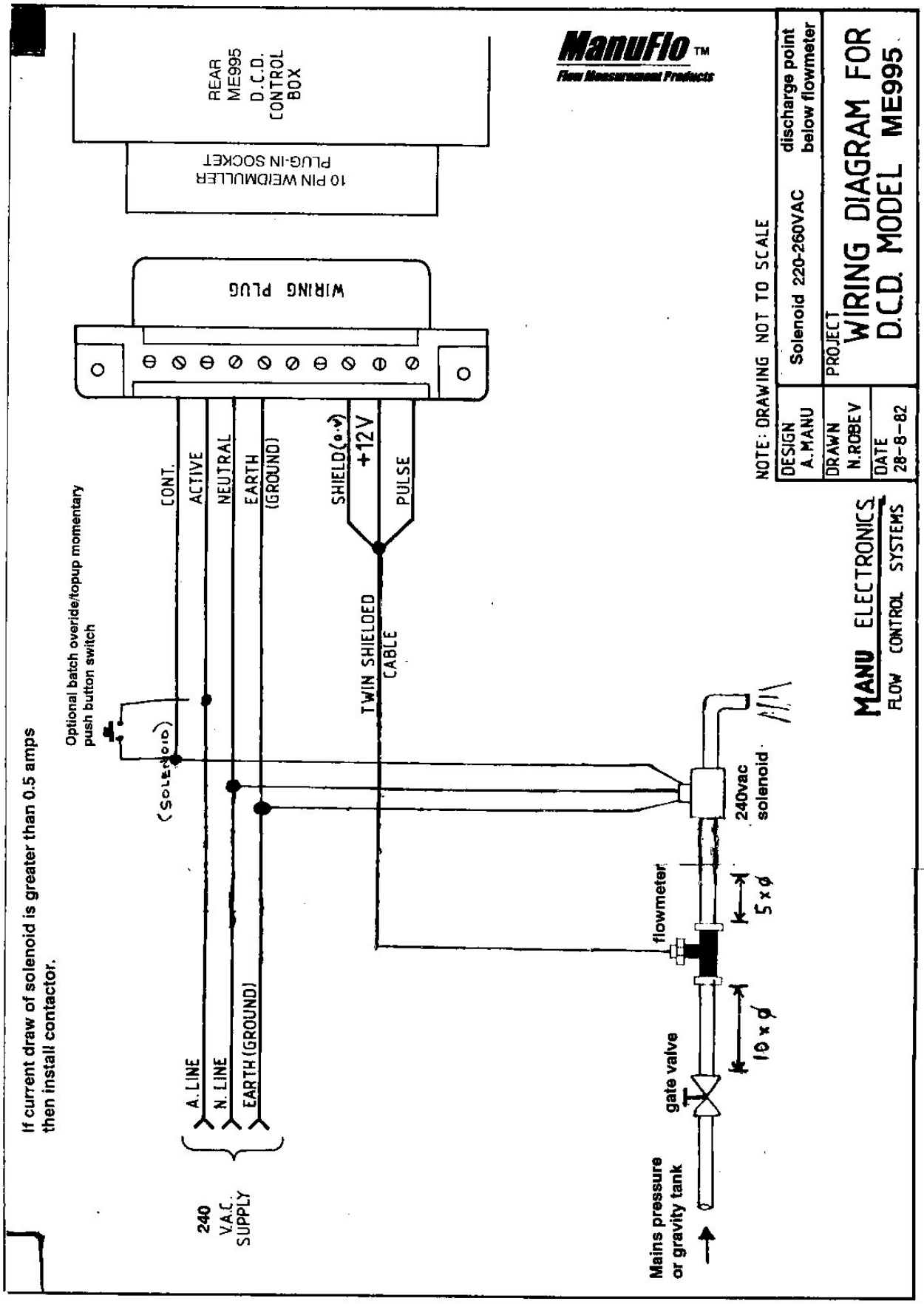

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IMPORTANT: STRAIGHT PIPE SECTION BEFORE ROTA PULSE FLOW SENSOR MUST BE MINIMUM 10 x PIPE DIAMETER BEFORE & 5 TIMES AFTER

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UNIT 4, 104 OLD PITTWATER RD
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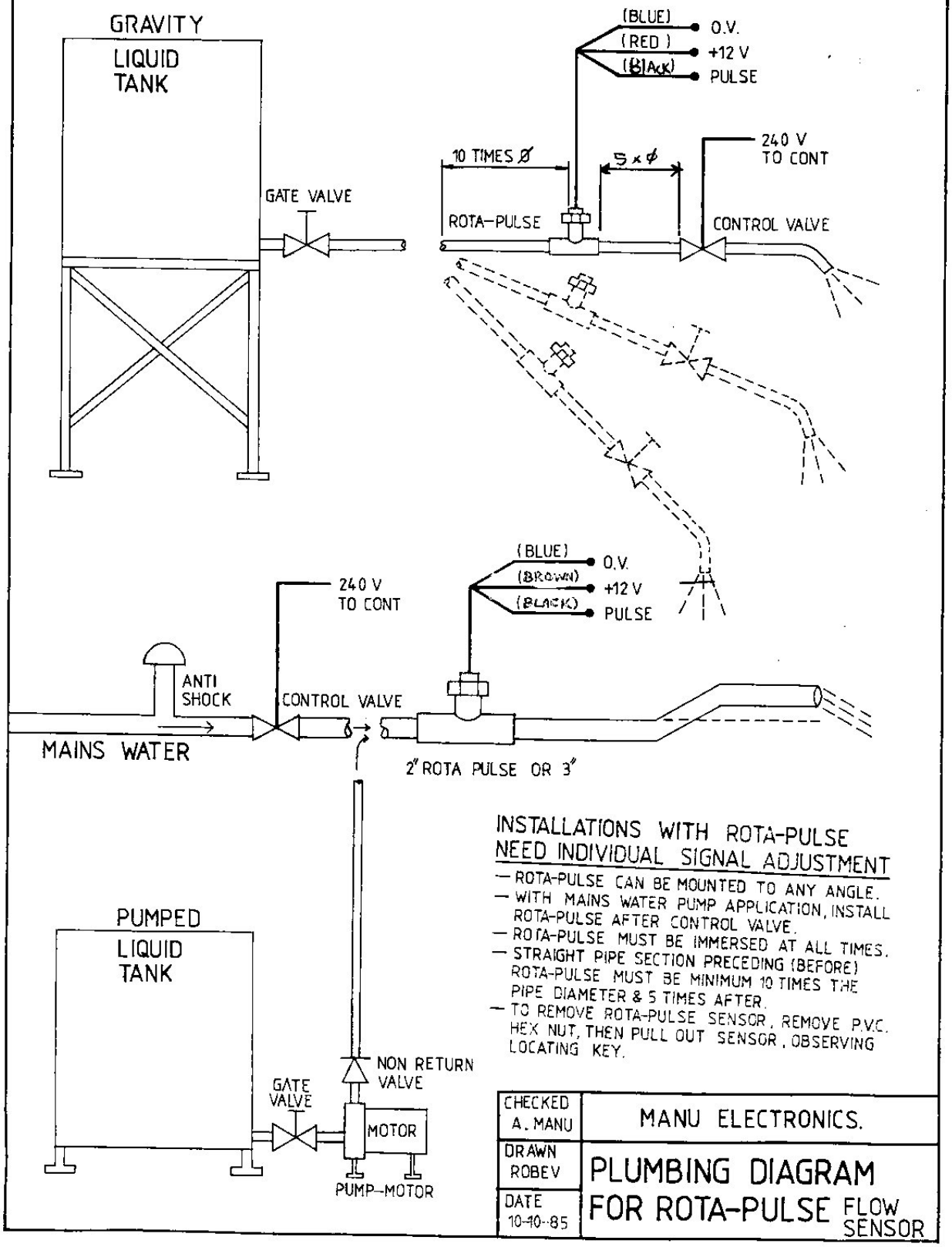
VARIOUS APPLICATIONS



INSTALLATIONS WITH ROTA-PULSE NEED INDIVIDUAL SIGNAL ADJUSTMENT

- ROTA-PULSE CAN BE MOUNTED TO ANY ANGLE.
- WITH MAINS WATER PUMP APPLICATION, INSTALL ROTA-PULSE AFTER CONTROL VALVE.
- ROTA-PULSE MUST BE IMMERSED AT ALL TIMES.
- STRAIGHT PIPE SECTION PRECEDING (BEFORE) ROTA-PULSE MUST BE MINIMUM 10 TIMES THE PIPE DIAMETER & 5 TIMES AFTER.
- TO REMOVE ROTA-PULSE SENSOR, REMOVE P.V.C. HEX NUT, THEN PULL OUT SENSOR, OBSERVING LOCATING KEY.

CHECKED A. MANU	MANU ELECTRONICS.
DRAWN ROBEV	PLUMBING DIAGRAM FOR ROTA-PULSE FLOW SENSOR
DATE 10-10-85	

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TROUBLE SHOOTING GUIDE

ManuFlo ®TM

FOR ME995 BATCH CONTROLLER / ROTA PULSE FLOW METER SYSTEMS

PROBLEM	POSSIBLE CAUSE	SUGGESTED SOLUTION
•No power to batch controller or displays not on	•Blown fuse or holder not tightened •+12vdc and O.V. shorted •No main power supply	•Check fuse, tighten fuse holder (at rear of controller) •Check pulse cable from DCD to RPFS meter •Check power supply, check wiring
•Pulse fails at start of batch (1.5 seconds after)	•Check calibration (K-factor) setting	•000 calibration -pulsefails. Make sure a calibration value is set, three switch shafts -H,T,U- located at rear top left of controller
	•Seized paddlewheel	•Remove RPFS, inspect; clean with diluted acid, check wheel/bushes make sure paddlewheel spins freely
	•Solenoid valve not opening	•Check and service solenoid valve, check output control voltage is 240vac(N & C, pins 7&9) when pushing start button
	•Restrictionor service gate valve closed	•Open gate valve
	•Empty water tank	•Check water level
	•Pump not turning	•Check and service pump
	•Pump foot valve failed	•Empty pipe, Install non-return valve
	•Signal cable cut, bad joint at JB, oxidised cable- leakage	•Check signal cable for 12VDC at junction box near RPFS meter If no power, cable cut or oxidised- repair/replace. Unwire RPFS, take upto batchroom, remove extension cable and hardwire RPFS direct into the Batch controller (P,+,-), spin wheel should count on display, if so, then extension cable or connections at JB faulty, if no counts & 12vdc present then RPFS faulty
	•RPFS not positioned in pipe	•Check RPFS slots are in keyway position, lock cap secured Paddlewheel not inserted into flow stream
	•RPFS Flowmeter faulty	•Replace with new RPFS
•Pulse fails during batch cycle	•Flowrate too slow	•Open restriction gate valve, or increase flowrate pulse fail timing capacitor (see service guide). Pipe diameter too big for flow
	•Pipe buildup restricting flow	•Cleanout pipelines, calcium buildup on pipewalls -recycle systems
	•Paddlewheel problem	•Calcuim buildup on wheel, soak in diluted acid. Warn bushes.
•Display digits count slowly after batch complete	•Non return valve faulty (jammed open) •Solenoid valve not properly closed	•Clean, service or replace, INSTALL NON RETURN valve. •damaged seal, faulty solenoid
•Batch target display counter counts past batch selection	•Flowrate too fast excessive overflow	•Turn down gate valve to restrict flowrate or set preact (overflow deduct) function to compensate •Reduce delivery pipe diameter
•Intermittant overflow past batch select or water does not stop	•Faulty solenoid valve not closing properly, insufficent air pressure	•service solenoid valve, check air pressure
•Wet loads, more water collected than indicated	•Paddlewheel bushes worn •Wheel dirty, flowing overrange	•Check paddlewheel •Replace with new paddlewheel, recalibrate
•Dry loads, less water collected than indicated	•Requires recalibration test	•Set new calibration figure, rear switches (See calibration guide for details -ME995-7 brochure)
•Controller starts counting when power switched on	•Active and contact power drive short circuited	•Contactor fused due to excessive current draw from pump •Relay fused due to excessive current draw on solenoid coil - install higher current rated contactor or install contactor
•Controller- FL(flow), LM(limit), and or CD(contact drive) LEDs on	•Controller malfunction, IC failure Diagnostic warning	•Replace controller or call for service and advise

Sequential fault finding and rectification

1. If a another ManuFlo controller (any model) is available, simply unplug doubtful unit and plug in exchange unit. If the new unit is also not operating correctly, then the problem is isolated to the pulse flowmeter or wiring.
2. When checking flowmeter, reset the ManuFlo controller. Remove the flow sensor and spin the paddlewheel. Check that the ManuFlo controller has registered a number of counts on its display. If so, the electrical connections are probably OK. If no counts are registered, check that 12VDC is supplied to the flow sensor. If supplied, then switch off the ManuFlo controller and replace the RPFS flow sensor.
3. The flow sensor paddlewheel is jammed, damaged etc. (For servicing, refer to the flow sensor brochure).

System overbatch problem

1. Selector knob batch dials on ManuFlo Batch Controller may not be positioned correctly, and therefore not correspond to rotary switch numeric values.
2. To test, set all numbered dials to the zero position 0000. Then press the RESET toggle. The alarm should beep momentarily - this will indicate correct alignment of dials. If alarm does not beep, this indicates incorrect alignment of number dials. To rectify, remove the grey colored cap from dial, unscrew knob and pull knob off. Check that the exposed switch shaft's flat (black) side is horizontal. If not, then turn to horizontal and refit the numbered dial knob to the zero number setting. Also check the calibration and preact knob settings which are located at the rear of the controller
3. If the Batch Controller is found to be operating correctly, then proceed to checking and testing the flowmeter components.

If in further doubt, contact your local representative, or ManuFlo