COMBINED
INSTRUMENT SYSTEMS

Irriflow I300 Electromagnetic Flowmetering System

Operation & Configuration Manual

(Revision 6: October 2009)

tyco / Flow Control / Environmental Systems

Rev 6: Oct 2009

Irriflow I300 Electromagnetic Flowmetering System Manual

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How to Get Further Assistance

If further assistance is required please contact your nearest Goyen office at the following addresses or your local distributor (see our web site for details: www.cleanairsystems.com).

Australia

Head Office

Goyen Controls Co Pty Ltd
268 Milperra Road
Milperra, NSW 2214

Telephone: 1800 805 372
Facsimile: 1300 658 799

Queensland

Telephone: 1800 805 372
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Victoria

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South Australia

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Western Australia

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Asia

Goyen Controls Co Pty Ltd
Shanghai Representative Office
1209 Greenland Business Centre
1258 Yu Yuan Road
Shanghai PC200050 CHINA

Telephone: 86 21 5239 8810
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Goyen Controls Co Pty Ltd
73-M Jalan Mega Mendung
Kompleks Bandar OUG
58200 Kuala Lumpur MALAYSIA

Telephone: 60 37 987 6839
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Office

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Telephone: 65 6457 4549
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Europe

Goyen Controls Co UK Ltd
Unit 3B Beechwood
Chineham Business Park
Basingstoke, Hampshire, RG24 8WA
UNITED KINGDOM

Telephone: 44 1256 817 800
Facsimile: 44 1256 843 164

Tyco Umwelttechnik GmbH
Im Petersfeld 6
D-65624 Altendiez
GERMANY

Telephone: 49 6432 1001/1002
Facsimile: 49 6432 63810

USA

Goyen Valve Corporation
1195 Airport Road
Lakewood
New Jersey 08701 USA

Telephone: 1 732 364 7800
Facsimile: 1 732 364 1356

www.cleanairsystems.com

When contacting Tyco Environmental Systems always have the following information available:

	Irriflow I300 Electromagnetic Flowmetering System
Instrument Serial Number	
Instrument Part Number	
Instrument Name and Model	
Power supply, voltage and frequency	

This information is found on the rating plate of each instrument.

A Product Return Form can be found at the back of this manual.

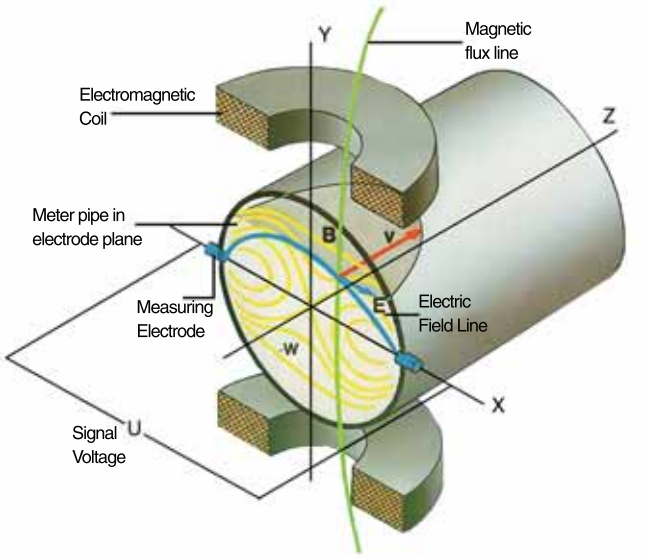
Notes

Introduction

Congratulations on your purchase of your Australian designed and manufactured Tyco Electromagnetic Flowmeter. The Irriflow Model I300 converter is a microprocessor based instrument designed for ease of use in un-powered and remote flow measurement applications. The I300 has been pre-configured and calibrated to your requirements in our calibration laboratory.

In the event of any problem, please do not hesitate to contact your representative or our head office technical staff. Always provide the serial number of your particular system that is located on a label mounted on the converter and also on the detector head.

On taking delivery of your Irriflow Flowmetering system and prior to installation and operation, we ask you to ensure that you are conversant with the operation, installation and precautions to be taken by studying the contents of this manual.



Operating Principle

The operating principal of the electromagnetic flowmeter detector head is based on Faraday's law of magnetic induction that states that the voltage induced across any conductor as it moves at right angles through a magnetic field is proportional to the velocity of that conductor (see diagram).

Es= B*d*v*K
Es = Induced electrode voltage
B = Magnetic field strength
d = Meter pipe diameter
v = Average liquid flow velocity
K = Constant of primary
Es ~ qv
Proportional and linear with volumetric flow

Es ~ v
B = Compensated
d = Fixed value
qv = Pi*d2*v 4
qv = Volumetric flow

The voltage induced within the conductive fluid is picked up by two diametrically opposed electrodes. The induced signal voltage (Es) is proportional to the magnetic flux density (B), the distance between the electrodes (d) and the average flow velocity (v) of the fluid.

Because the current to the detector head coils is held constant then the flux density will not change. The electrode spacing is constant due to the construction of the detector head and hence the flow signal is proportional to the average flow velocity of the fluid. From the equation for the volume flow rate it follows that the flow signal is linearly proportional to the volume flow rate.

Specifications

Converter

Display:	2 line x 16 digit lcd display
Power supply:	12 vdc internal supply from 7ah battery and 5 watt Solar panel.
Outputs:	1 x digital 5 vdc 20 ma, programmable as a pulse output. Maximum pulse = 5 pulses per second. Pulse width =50 ms Used for optional flashing indicator for remote reading. or may be configured to provide remote totals for Irrigation controllers. 1 x open collector output, programmable as a frequency output. Operating frequency = 5-650 hz Maximum 100 ma 24 vdc max.
Optional output	1 x 4-20 ma output Externally powered, nominal 12vdc max 24vdc
Measuring range:	<0.03 to 5.00 metres per second
Input resolution:	18 bit
Linearity:	<0.005%
Repeatability:	<0.05%
Accuracy:	Model: IR20x0. Better than ±1% of flow (±0.5% achievable under recommended installation conditions) or ±2mm per sec whichever is greater.
Temperature stability:	<0.05% over temperature range
Ambient temperature:	-10 to 55° C
Display to detector head separation:	max 30 metres
Minimum process conductivity:	5µs/cm
Parameter settings:	Via integral push buttons
Enclosure materials:	304 stainless steel
Standard features:	Automatic calibration Self diagnostics

Detector

Housing material:	IR2060 - Mild steel with 2 part epoxy coating IR2030 - 304 stainless steel IR2020 - ABS
Environmental Protection:	IP68 to 5 metres (ir2020 ip68 to 1.5 metres)
Electrodes	316 stainless steel
Lining:	IR2060 - insulation rubber IR2030 - insulation rubber IR2020 - ABS

Detector Head Installation

General description

Your Irriflow I300 Flowmetering system consists of an electromagnetic detector head, electronic converter, solar panel and battery.

The detector head installs into the distribution pipework.

The I300 converter installs on a post with the battery mounted internally. The solar panel may be integrally mounted onto the I300 enclosure or remote mounted on it own pole. Tyco Environmental Systems do not normally provide the converter post or the solar panel pole.

IR2020 Detector Head

IR2060 Detector Head

I300 Converter

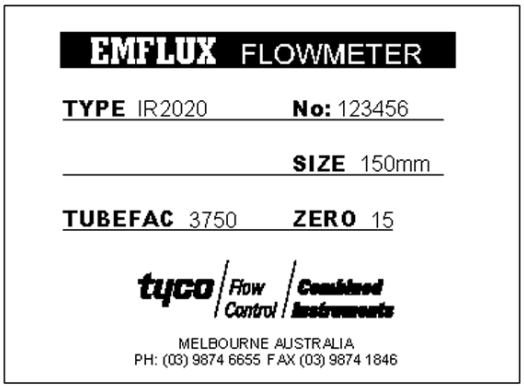
I300 Converter and remote solar panel

Nameplate

A polyester label is always fixed to the outside case of each meter. This contains information such as type number, size and calibration information.

In the case of the IR2020, a duplicate label is inserted inside the junction box. This will allow the details of the unit to be traced and/or retrieved in the event that the label is rendered illegible after prolonged burial.

IR2060 detector heads have identifying numbers stamped on one flange that allows full factory information to be retrieved. Simply call the factory or your nearest Tyco representative and provide them with this number.



Explanation of label information

Type

Abbreviated model number for the flowmeter detector head. May be either IR2020 or IR2060.

No.

Unique serial number for the detector head.

Size:

Nominal pipeline size for the flowmeter.

Tubefac:

A calibration factor established by flow testing the flowmeter system in the flow laboratory at the factory in Australia. This factor must be entered into configuration parameter 2 of the converter connected to the detector head for the system to be accurate. For your convenience, on a new installation, this parameter has normally been entered into the converter prior to the system leaving the factory. It is recommended that the calibration report form for the detector head and converter be checked to ascertain the mating serial numbers prior to installation.

Zero:

A calibration factor established by flow testing the flowmeter system at the factory in Australia. This factor must be entered into configuration parameter 3 of the converter connected to the detector head for the system to be accurate. For your convenience, on a new installation, this parameter has normally been entered into the converter prior to the system leaving the factory. It is recommended that the calibration report form (see sample below) for the detector head and converter be checked to ascertain the mating serial numbers prior to installation.

Quality System Assurance

This product is manufactured under a quality system certified as complying with ISO 9001:2000.

Statement of Traceability

Master Calibration equipment is certified in accordance with Regulation 13 of the National Measurement Regulations 1999, Certificate No 34384854801260.

Important

Storage and installation points

- In order to ensure satisfactory operation of your Emflux I300 Flowmetering system and to avoid the possibility of rendering the guarantee null and void, please ensure that you comply with the following points:
- Ensure that the converter enclosure is sealed and that the unit is stored in a dry environment if it is not to be put into service immediately.
- Your flowmeter detector head may be provided with an insulating lining that extends to the end of the detector head or over the flange faces. Do not drag or roll the unit on its end as this may damage the liner.
- When installing, locate your flowmeter detector head in a position such that it remains full of liquid at all times during normal operation.
- Cabling between the flowmeter detector head and the converter should be protected from external damage. Separate conduits should be used (pipe not full cable, if fitted may be run in the same conduit as the signal cable) and protection should be provided where the cable enters and exits the mounting pole.
- Prior to commencing installation, ensure that the detector head and converter carry the correct serial numbers as given in the calibration report. These have been set up with the correct calibration details and avoid the need to enter information after installation.
- Where fitted, eye bolts should be used to lift the meter. If eye bolts are not fitted, slings and spreaders should be used.
- If your flowmeter detector head is an IR2060 style it will be supplied with an insulating liner that extends over the flange faces. It does not act as a gasket. You must provide a gasket between the flowmeter lining and the adjacent pipework.
- Gaskets will also be required for IR2020 style detector heads when fitted with flanges.
- If the IR2020 detector head is supplied with spigot connections on one or both ends, these are for installation using a Gibault style connector. Check to be sure that the pipe OD's of the IR2020 and mating pipe are similar enough to fall within the connection range of the connector being used.

Important

Read all installation details prior to commencing

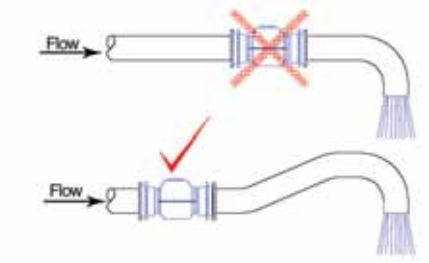
Mechanical Installation of Detector Head

General

The Emflux I300 Detector Head may be installed at any angle but it is important to ensure that it is completely filled with liquid whilst in use.

Each detector head is fitted with an arrow showing the flow direction during calibration. The detector should be installed with the arrow indicating the normal forward flow direction for the installation.

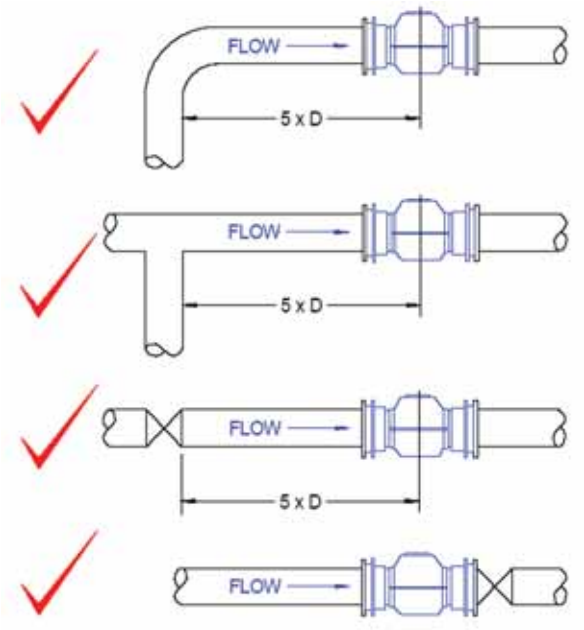
Particular care should be taken to ensure that entrained air cannot accumulate in the flowmeter or be swept through it from surrounding pipework.



Installation requirements

IR2060/XXX Flanged Meter
IR2020/XXX Flanged and Spigoted Meters

In order to obtain the full accuracy for your I300 system, sharp bends and valves used to control the flow should not be placed closer than five pipe diameters from the detector head upstream flange. Little effect will be observed by the presence of bends etc on the downstream flange side of the detector head. Where reducers are used, steep tapers of greater than 30° should be avoided.



Caution

Some government authorities have strict requirements for flowmeter installation that may overrule the above advice. Be certain to consult local authorities prior to commencing installation.

Note:

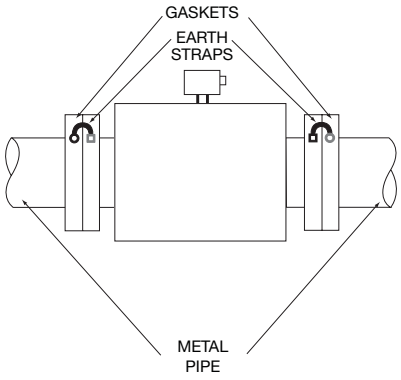
For dimensions of the Detector Heads, reference should be made to the outline diagram found at the end of this manual.

Cables between the Detector Head and converter should be run in conduits for protection, and then up the inside of the converter mounting post. Separate conduits are needed for coil supply, signal and accessories. Refer to Part C - Mechanical Installation of Converter for details.

Earthing of Detector Head

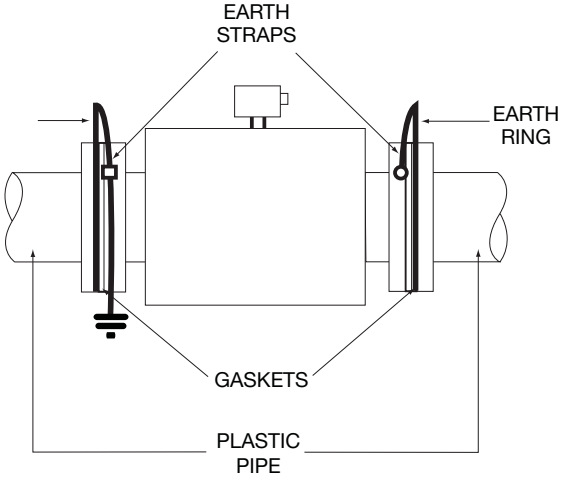
IR2060 Only

While your Emflux I300 detector head is provided with an insulating lining extending over the flange faces, this does NOT form a gasket. When installing the detector head, gaskets must be provided between the flowmeter lining and the adjacent pipework flanges. In the case of earth rings or discs, these should also be installed with a gasket either side.



For correct operation it is essential for the flowing liquid to be earthed at both ends of the detector head. Connection to adjacent metallic pipework is fully acceptable providing such pipework does not contain electrically insulating lining, for example: bitumen. Earth straps are recommended between the pipework flanges and the flowmeter flanges particularly when flexible self sealing couplings are used. Flange bolts do not always provide good electrical earth connections between metallic flanges.

If adjacent pipework is not electrically conducting or is lined with an electrically insulating material, then earth rings or earth electrodes must be used. These earth rings must be strapped to the detector head flanges at either end. In the case of earth electrodes there is no need for further termination as this is carried out at the time of manufacture.



IR2020 only

The IR2020 Detector Head is fitted with a reference electrode, therefore earthing is not required.

Submergence/Burial

Note that both the IR2020 and IR2060 are suitable for direct burial of the detector head. Be certain that their location is suitably marked or noted to avoid damage due to subsequent digging or trenching operations.

They may also be submerged under water if required. In the case of the IR2060 this may be up to a depth of 10 metres and for the IR2020 up to 1.5 metres.

Converter (Transmitter) Installation

The I300 Irriflow Converter

Converter with integral solar panel

Converter with remote solar panel

Components Of The Converter

The converter consists of an outer case that is designed for both weather protection and to minimise damage by vandalism. A solar panel may be mounted on top of the case as shown above or may be remote mounted on a pole. The electronic circuit board and battery are mounted within a locked inner box. There is a display that shows flow rate, flow totals and other information (refer Displays section) and a keypad that allows cycling between displays and which is used for entering information when in configuration mode (refer Configuration section). The converter mounts on a 50mm diameter pole normally placed within 10 metres of the detector head. Longer distances are possible but must be specified at time of ordering. The limitation is a maximum cable length of 30 metre.

In general the integral solar panel version is intended for use in the southern portion of Australia where the fixed angle of the solar panel optimises the collection of the sunlight. This arrangement is suitable for use up to the approximate latitude of Sydney. For latitudes north of Sydney the angle needs to be changed and the use of a remote solar panel is recommended. Consult the solar panel section of this manual for recommendations for installation of a remote solar panel.

Converter Installation

Mechanical Installation of Converter

The site must be selected such that no shadowing of the solar panel occurs during the middle six hours of daylight. If this is not possible a remote mounted solar panel should be used. Please select the site with care having regard to the growth of trees or bushes in the vicinity. The Irriflow flow metering system has an expected life of longer than 20 years. Trees can grow a considerable amount during this time so that what was not shading at the time of installation could be causing considerable problems some years later. Also plant with care in the vicinity of the converter for the same reasons.

The converter housing mounts onto a 50mm vertical pipe (ID52mm, OD 60mm). This pole is not normally supplied by Tyco.

The mounting height may be selected by the user. Typically this would be at eye level for convenience of reading.

The keypad and display are manufactured of a solar resistant plastic and have been designed to be weatherproof. Although Tyco have taken great care to select the most resistant plastic available, all plastics will eventually succumb to the effects of direct sunlight. For this reason we make the following warning:

Important

The converter front panel must face a southerly direction to prevent direct sunlight from striking the display. For converters with integral solar panels this ensures that the panel correctly faces toward the north. For remote solar panel systems, particularly those in northern areas it is recommended that the converter be located in a shaded area for both sunlight and heat considerations. The actual placement will be constrained by both solar panel and flowmeter cable lengths and some thought may be necessary prior to finalising the flowmeter installation.

The converter housing has been designed to prohibit unauthorised access, removal or tampering. The cables are fed up through the mounting post and then enter directly into the rear of the box to limit exposure. The direct mounted solar panel is effectively an integral part of the box which cannot be removed without removing or adjusting the housing on the mounting post.

The housing consists of two sections, the outer sunshield with post mounting brackets, and an inner lockable sealed box that houses the electronics and battery. If fitted with the integral solar panel, a solar panel mounting bracket will also be provided. The remote mounting solar panel is supplied loose.

Note:
Tyco does not supply the mounting posts for either the I300 converter or the remote mounting solar panel.

Step 1

Step 2

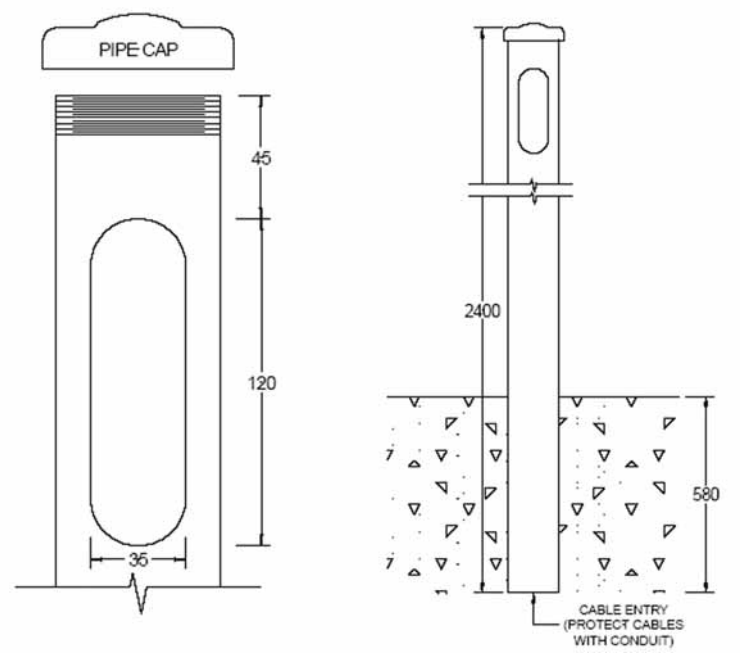
Step 3

To install the assembly onto the post the two parts must be separated. To achieve this:

1. Unlock and open the door with the key provided.
2. Remove the nuts from the inside base.
3. Lift the box up off the studs and slide forward. Close the door before removing the inner box to avoid damage to the circuit board.

Before mounting the sunshield to the post, the post must firstly be prepared and installed into the ground. If the installation involves a converter with integral solar panel, the post should not be placed in a shaded area as this will inhibit the operation of the solar panel.

If the top of the box is going to be mounted 1800mm above the ground level it is recommended that a 2400mm post be used. This allows 580mm below the ground and 20mm above the top of the box. We recommend only 20mm above the box to enable an end cap to be fitted. Any more pole above the box could result in the integral solar panel (if fitted) being shaded. The pole must finish above the box as it prevents the unauthorised removal of the solar panel.



A slot must be cut into the top of the post 35mm x 120mm starting 45mm from the top of the post. This slot enables the cable glands to sit into the post for the cables entry into the box.

In the case of a remote mount solar panel, the mounting post may be extended to a suitable height to mount the solar panel. In this case the pole may also need to be inserted deeper into the ground to ensure it remains rigid. The solar panel cable may be drawn down the

inside of the pipe and through the top gland into the converter. The remote mount solar panel should be angled as per the solar panel instructions.

Important

Note that the LCD display on the I300 converter must still face south or be protected by a cover to ensure long term reliable operation.

The detector cables enter into the bottom of the post and should be protected by conduit until inserted well up into the post. If any additional I300 output function (current and/or pulse output) are to be used then an additional conduit will be required to protect the cable serving these functions.

If it is considered that additional functions may be required it is recommended that the wiring be put in place or at least a draw wire included at the time of initial installation. This is much more convenient than having to modify the installation later.

Once the post is completed it may be secured into a hole with the cables installed inside the post and exiting at the top slot. It is now ready to have the I300 converter fitted.

1. Normally the solar panel been fitted into the mounting bracket at the factory. Where it is necessary to replace the solar panel proceed by sliding the solar panel into its mounting bracket taking care that the solar panel cable does not get damaged by the edge of the bracket. The cable should exit from the base of the bracket by way of the slot allowed for it. The solar panel should be pressed firmly up into the top fold on the bracket. Tip: A small amount of grease applied to the edge of the solar panel will allow it to slide in more easily.

Step 1

Step 2

Step 3

Remove excess grease with soap and water or a non-aggressive solvent (e.g. turpentine) prior to proceeding further with the installation.

2. Slide solar panel assembly into the folds on the top of the sunshield. Again make certain that the cable from the solar panel does not get damaged by the edge of the bracket or sunshield. The cable should be located in the slot in the sunshield.

3. The sunshield with solar panel installed can now be fitted to the post and the pipe mount U-clamps tightened. The correct mounting position for the sunshield is with the solar panel almost touching the pipe cap. This minimises any shadowing of the solar panel by the pipe which would severely reduce the efficiency of the solar panel output. At the same time it prevents removal of the solar panel.

4. Once secure, the cables can be fed through the glands of the inner box and the inner box inserted into position and secured using the nuts provided. Be sure the total assembly is at the right height prior to fitting the inner box, as the height cannot be adjusted without its removal. Note that the threads on the stainless steel bolts and clamps should be smeared with a small amount of thread grease to prevent binding and possible thread damage.

Electrical Installation

Electrical installation should be carried out by suitably qualified personnel and should conform to local codes and wiring practices.

The unit is powered by a 12V 7AH. sealed lead acid battery, which is charged from a 5 watt solar panel fitted to the enclosure or remotely mounted.

To access the electrical connections open the box with the key provided. The connection terminals are located on the bottom of the inside of the door. Refer to wiring diagram (following).

Flow Signal

The flow signal is received via the shielded 4 core black cable. The cable should be run around the inside of the box down to the terminal strip. It needs be left long enough to enable the battery to sit in the bottom of the enclosure and for the door to be opened without applying tension on the cable.

The red core connects to terminal FLOW 1 and blue core connect to terminals FLOW 2. The green core and the shield connect together and to the GND between the FLOW terminals. The yellow core is unused.

Battery Connections

The battery cables are supplied with the converter and are connected to the terminal strip. The black cable is the negative and the red cable is the positive. These connect directly to the battery which is to be located in the base of the box.

Do not connect the battery until you are ready to use the flowmeter.

Be sure to have the polarity correct when connecting to the terminals on the battery.

Once the connections have been completed, ensure all glands are tight and sealed to prevent any moisture or insects entering the enclosure.

It is recommended that the cables not be bundled with cable ties as this makes them very stiff and impedes door closing.

Also ensure that the closing of the door does not apply stress onto the terminal strip or cables.

Note:
Terminations shown with current output option connected.

Coil Connection

The coils are connected using the orange sheathed cable with red, black and green cores.

The red core connects to COIL 1 terminal, the black connects to COIL 2 terminal and the green is to be connected to the COIL GND terminal.

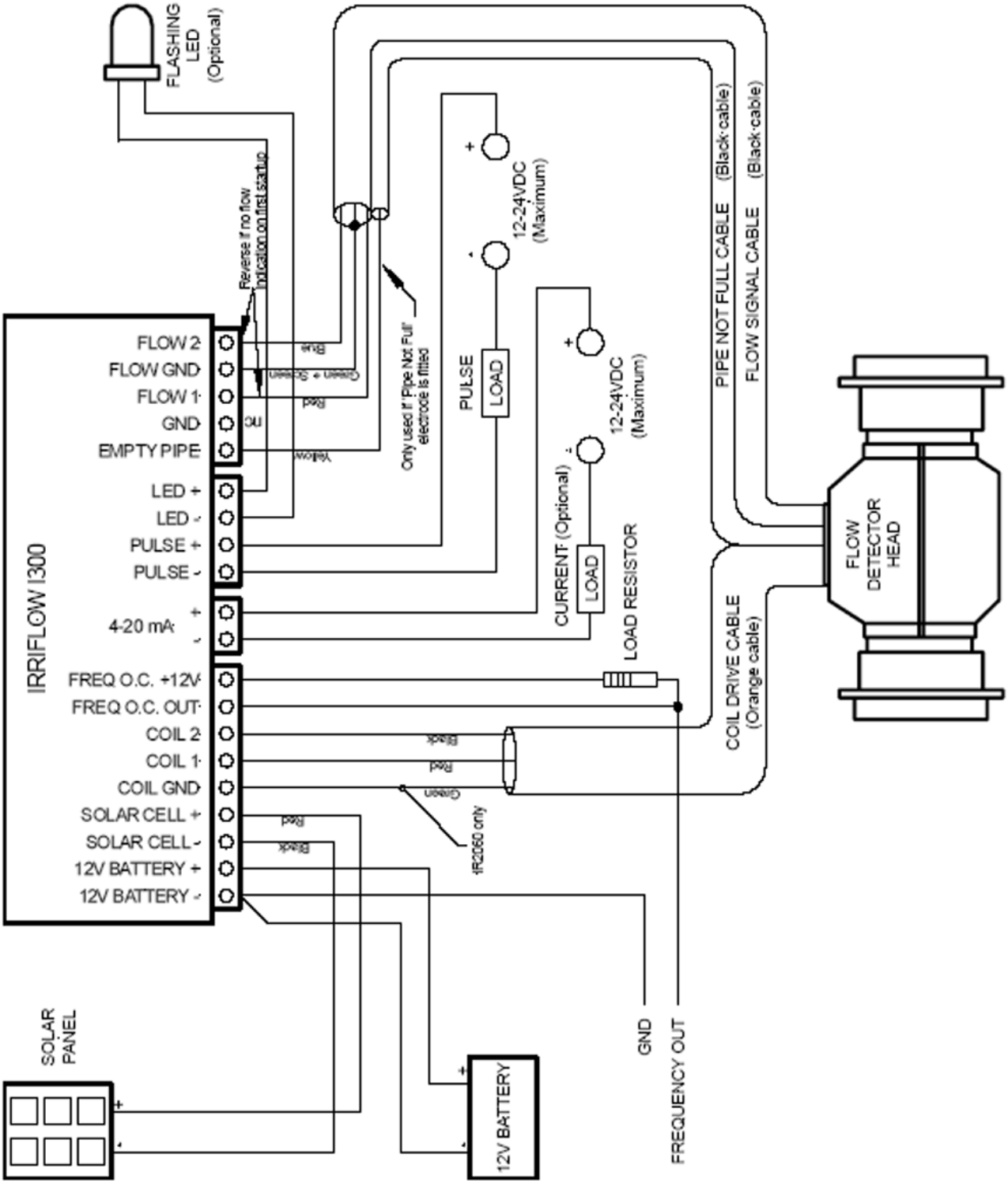
Solar Panel Connections

For a converter with integral solar panel, the solar panel cable runs into the sunshield via the slot provided in the sunshield. In the case of the remote solar panel the cable runs down through solar panel mounting pole then runs up into the post and through the gland into the box. Care should be taken to ensure the cable is not crushed between the post and the box, or caught on the edges of the slot in the post.

Run the cable to the terminal strip with the coil and flow cables. Terminate the red core to the SOLAR CELL + terminal and the black core to the SOLAR CELL - terminal.

Pipe Not Full

Where required a second black cable is fitted, the yellow conductor connects to EMPTY PIPE. All other cores are unused.



Operation

Display

The I300 display consists of an LCD screen with three keypads (Up, Tick and Down).

In normal display the keypads with the up and down arrows allow the viewer to select between the available screens.

Each screen has two lines of lines of characters with each line being up to 16 digits.

Pressing the tick key will wake up the I300 unit and display will enter flow metering mode.

When in configuration mode the tick key is used to enter values whilst the up and down arrow keys are to increase or decrease values and to move between menu items.

Power up

Prior to connecting the battery and applying power to the system, all wiring should be rechecked. Once satisfied that the wiring is correct the battery may be connected.

When first powered up, the system will perform a self-check and auto calibration following which it will revert to the normal operation mode.

Operation

Your I300 converter is supplied set up with default parameters and should be ready for use without any further programming

Configuration

Should changes be required please refer to the configuration section of this manual or separate manual as required. It is highly recommended that all configuration settings be checked and documented to ensure the unit is configured to suit the particular site requirements and to provide a history of the site configuration settings.

Hardware and Software Versions and Revisions

The I300 has been developed in conjunction with the Australian Irrigation Industry to provide a reliable and robust flow meter suitable for remote operation. Various firmware and hardware improvements and user required functions have been implemented over the past 10 years or so, in order to meet the changing requirements of the industry. Hardware and Firmware (software) revisions have been implemented and users should be aware of the differences in these versions – particularly where a range of different version flow meters may be in operation. This Manual does provide a summary of the key firmware features for each of the Versions, (Addendum 1).

The key differences being as follows:

- Version 0.9x provides a single totaliser and does not have date and time displayed. There is no logging function included and no digital communication is available.

- Version 2.x provides dual totalisers (peak and off-peak) together with date and time display. Data logging functions are available and serial RS232 communication via radio or modem is supported.
- Version 3.x and 4.x provide all the features available in version 2.x plus a Session accumulator and totaliser latch functions.
- Version 4.x also enables the I300 to be used with an external gate/valve actuator to form a feedback control loop for regulating flow. In addition, this software also supports RS485 2-wire mode (MODBUS comms), with transmitter-enable (active high) for external transceiver via pin 7 on connector CN9. Improved signal processing and error fault detection are also implemented.

Note: *The 'x' in the software number donates the revision number for that version of software. Apart from the obvious differences in the displays, there are no external indications of the software revision installed in your meter. Software version can be found on the label on the PIC micro or on screen when the unit restarts.*

Typical Examples of LCD Display for Version 4.x

Display 1

(Note the Units on the top line can be changed using config parameter 8)

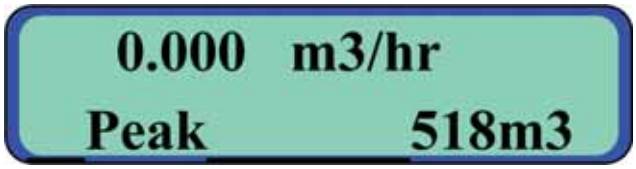
The top line is configurable to show flow rate in l/sec, Ml/day, m3/hr, Rev/min, velocity in m/sec, pulse count or to show the current date and time (if Real Time Clock is optioned).

The bottom line shows accumulating totaliser Peak + O/Peak, may be set to read in m3 or ML.

Pressing the up arrow button will take you to the next display.

Display 2

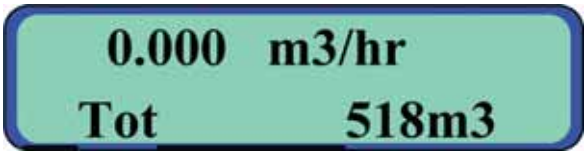
Display 2 can also be configured to show the various flow data in the same manner as described in Display 1.



Dual Totalisation Enabled -In this case the top line has been configured to display the current date and time. The bottom line either shows Peak totaliser or the sum of Peak and O/Peak, depending on whether dual totalisation is enabled.

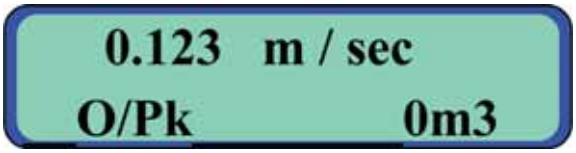
Or

Dual Totalisation Disabled



Pressing the up arrow button will take you to the next display.

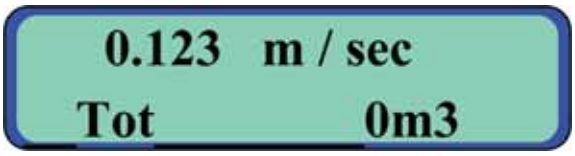
Display 3



Dual Totalisation Enabled -The top line always indicates the flow velocity down the pipeline. The bottom line either shows O/Peak totaliser or the sum of Peak and O/Peak, depending on whether dual totalisation is enabled. Again you should contact your water provider to ascertain the peak and off-peak times.

Or

Dual Totalisation Disabled



Pressing the up arrow button will take you back to the original Display No. 1.

Display 4

The top line indicates the battery volts (Bt) and solar panel volts (Sp). These are used to give an indication of the health of the electrical system. Battery volts should not drop below 12.5V and during peak daylight hours, the solar panel volts should be at least 0.5 to 1 volt above battery volts.

The bottom line indicates Resets. This is the number of times that the battery has been disconnected and reconnected to the system. This can be used to detect if any tampering has occurred with the unit. Also on the bottom line is the run time status, this indicates in days and hours the time since the last reset. This enables you to determine when the last reset occurred.

Pushing the tick button will display the meter's unique ID number, which can be set during configuration to differentiate one unit from another. This number is also readable via remote communication.

Pressing the up arrow button will take you to the next display.

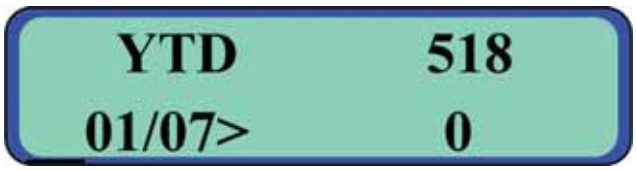
Display 5

The top line shows a stopwatch timer in seconds count. The bottom is occupied by the Session Totaliser, which records flow against the stopwatch.

Pushing the tick button will set the Stopwatch and Session Totaliser through a START - STOP - RESET cycle.

Pressing the up arrow button will take you to the next display.

Display 6 (only with RTC optioned)



The bottom line shows a configurable day and month of year (LATCH DAY and LATCH MONTH) when a snapshot of the sum of Peak and O/Peak totalisers is taken. To enable totaliser latch on a monthly basis, set LATCH MONTH equals to zero, then LATCH DAY will be fixed at the 1st of every month automatically.

The top line shows the Year-to-date (or Month-to-date) accumulator, equivalent to the sum of YTD_PK and YTD_OP accumulators (see later), which totalise flow during peak and off-peak time, respectively.

Pressing the up arrow button will take you to the next display.

Display 7 (only with Dual Totaliser enabled)

Note: Screen does not display if Dual Totalisers is disabled.

Similar to display 6 but pertaining to O/Peak totaliser.

Pressing the up arrow button will take you to the next display.

Display 8 (only with Dual Totaliser enabled)

Note: Screen does not display if Dual Totalisers is disabled.

Similar to display 6 but pertaining to Peak totaliser.

Note:

- *The totalising values displayed on screens 6, 7 and 8 share the same volumetric unit (Ml or m3) as that selected during configuration.*
- *Changing either LATCH DAY or LATCH MONTH will reset both YTD_PK and YTD_OP totalisers to zero.*

Pressing the up arrow button will take you back to the original Display No. 1.

Key Features of the I300 Measurement System

Low Power Mode Operation

The Irriflow system is designed to run on very low power. To achieve this it operates in a power saving mode whereby the unit remains in a sleep (low power) mode and only wakes up and performs a measurement (high power) mode at user predefined intervals. Typically the units are configured to wake up every 3-5 minutes and remain awake for 30 seconds. During the shutdown or sleep period, the flow totalisers continue to accumulate in real time, and all outputs such as pulse, frequency and current outputs continue to operate. Serial communications are available at any time. If two successive zero flow detections occur, the system shuts down for a configurable extended off period. (Refer configuration).

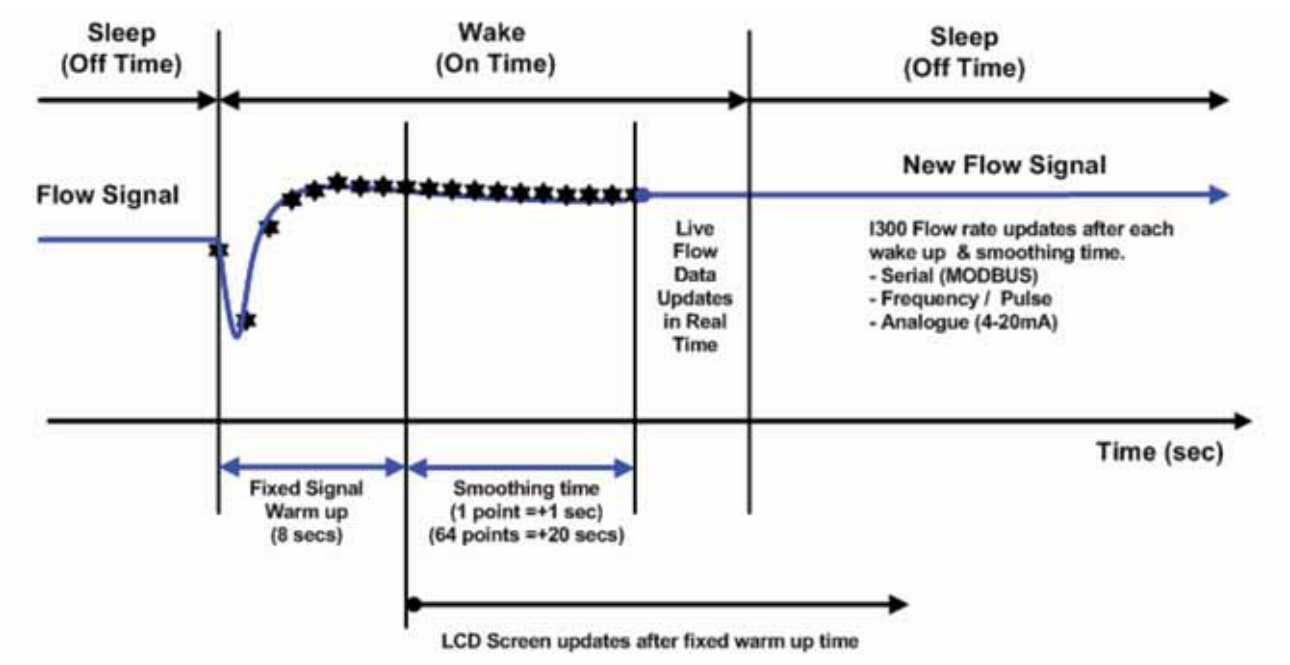
To read the meter while in the power saving mode it is simply a matter of pushing the tick button. This will wake the system up to initiate a new flow measuring cycle and to update the display with the new flow rate. This feature can also be used when setting or adjusting the flow rate.

Modular Electronics System

Although the I300 is manufactured and calibrated with a matching flow tube, the unit is designed to operate with a wide range of flow tubes (from 50mm up to 600mm diameter) and has flexibility to be able to be swapped to operate on different flow tubes. Several user configuration parameters (Flow Tube Factor and Flow tube zero) are able to be changed to allow the transmitter to operate on different flow tubes. This feature allows a small number of spare electronics packages (doors) to be held for swapping into remote sites as required.

Signal Measurement and Processing

The unit wakes up to take measurements and provide various signal processing and digital filtering routines to deliver a highly accurate and repeatable flow signal. The outputs from the flow meter update only after a smooth clean flow reading is available. The user can configure the unit to best meet the measurement requirements and wide range of site conditions.



Flow Measurement Process

- The unit wakes from Sleep mode after the user defined Off Time.
- The unit powers up the flow meter circuit and performs digital filtering to minimise signal noise and generate clean flow readings. After the fixed warm up period (approx 8 seconds) the LCD screen will update with the new flow reading.
- User defined smoothing (running average of between 1-64 points) is then applied to the flow readings.
- The unit then remains awake for the remainder of the Wake (On Time) during which time all readings are updated in real time (live data mode)
- After the Wake time the unit then returns to sleep mode.
- During sleep mode all outputs remain at their current values until the next wake up.
- All other data (Date, time, flow totals) continue to update in real time during the sleep mode.

No Flow and Pipe Not Full Conditions

At the beginning of each flow measuring cycle, an innovative flow detection algorithm is employed to detect valid flow in electrically noisy environments.

If the 'Pipe Not Full' option is also fitted and enabled, an electrode will check the level of liquid in the pipe when the instrument turns on and will set a flag if the pipe is not full.

When either of these conditions occurs, the screen will display 'NO FLOW' or 'PIPE EMPTY' respectively for a period of 3 seconds and then immediately turn off. All outputs are also forced to zero flow conditions. Any key press during the 3-second window and subsequent button pushes will keep the LCD active for another 30 seconds.

Optional Flashing LED.

This option enables the flow rate to be checked from a distance without having to read the units display. This is typically used in the Dethridge replacement application where the LED. flashes at a rate of 8 times per REV. This enables pulses to be counted in the same manner as blades are counted on a 12 Megalitre Dethridge Wheel.

The LED. may also be programmed to flash at different rates. Refer to the configuration section for details.

The LED.is directional to prevent it being seen unnecessarily. It has approximately an 8 degree viewing angle and may be read from up to 30 metres away. The LED. will continue to flash even when the unit is in power save mode.

Frequency output

This output enables retransmission of the flow via an open collector output. The maximum frequency the output can operate at is 650Hz and the minimum is 5Hz. Flows below 5Hz will register as 0 Hz.

The maximum current for the open collector is 100mA. A 12V supply is provided next to the output terminal. However, if high current, above 20mA is to be drawn for long periods then an external supply should be used to avoid flattening of the battery. The external supply should not exceed 24VDC.

Frequency output will continue during power save mode.

Pulse Out

To allow the I300 converter to be connected to other devices, such as remote counters, telemetry systems, watering systems, etc. a pulse output is available.

The output pulse is an un-powered solid-state switch. The pulse length is 50 milliseconds and the maximum pulse rate is 5 pulses per second. Maximum load should not exceed 20mA. To drive the output, a nominal supply of 12VDC should be used with a maximum supply of 24VDC. A mains to dc power supply such as the type available from Tandy or Dick Smith Electronics is suitable for the purpose.

The pulse rate (units of flow per pulse) is configurable through the keypad.

The pulses will continue to be produced during the power save mode.

Current Output

An optional output that can be provided at time of order is for a 4 to 20 mA current output proportional to a configured flow range. The output is always zero based i.e. 0 l/sec = 4mA, however the full scale point for 20mA is programmable up to a flow rate equal to a velocity of 5 metres per sec for a given size detector head. To provide the best resolution o fthe 4-20mA output, the maximum flow rate should be set to a realistic value based on site conditions. For example many irrigation systems operate with very low head pressures and the maximum velocity may actually never exceed a velocity of 2 or 3 m/s.

This output cannot be supplied from the internal battery. A nominal external supply of 12VDC - 24VDC should be used to power the 4-20mA loop. Alternatively a mains to dc power supply such as the type available from Dick Smith Electronics is suitable for the purpose.

The current output will continue to be produced during the power save mode.

Dual Totalisers (Peak and Off Peak Flow Totals)

The I300 can be configured with 2 x independent flow totalisers (Dual totalisers) to keep track of flow volumes that may be delivered during certain times of the day. This function is typically used to keep track of Pumped Flows delivered during Off Peak Electricity Tarriffs, and flow volumes delivered during Peak Electricity Tarriffs. The user can enter the start and stop times for the Off Peak Period (which usually coincides with low electricity demand – for example 23:00 – 07.00AM)

To disable the Dual Totaliser- set the start and end times both to 23:00:00

To enable the Dual Totaliser – set the start and end times to different values

When the Dual totaliser is enabled – The total flow volume will be equal to the sum of the Off Peak Total Plus the Peak Total. If using the MODBUS Registers to track flow volumes – both Off Peak and Peak totals should always be read and summed to provide a Total Flow.

When the Dual totaliser is disabled (start and end times matching), the off Peak totals will be zero, and all flow totals will be captured in the Peak Total.

Note: Some of the LCD Screen Displays change their appearance – depending whether Dual totaliser is enabled or disabled.

Solar Cells

Photovoltaic science is the science of turning energy produced from the sun into electricity. Edmond Becquerel discovered the concept known as the photovoltaic effect in 1839. However, the first positive/negative (p/n) junction solar cell was not created until 1954 at Bell Labs.

Photovoltaics are solid-state semiconductor devices that convert light directly into electricity. They are usually made of silicon with traces of other elements and are first cousins to transistors, LEDs and other electronic devices. Although making PV cells and modules requires advanced technology, they're very simple to use. PV modules are generally low-voltage DC devices (although arrays of PV modules can be wired for higher voltages) with no moving or wearing parts. Once installed, a PV array generally requires no maintenance other than an occasional cleaning, and even that is not imperative.

Most PV systems do contain storage batteries which require some water and maintenance similar to that required by the battery in an automobile. A photovoltaic device (generally called a solar cell) consists of layers of semiconductor materials with different electronic properties. In a typical BP Solar crystalline silicon cell, the bulk of the material is silicon, doped with a small quantity of boron to give it a positive or p-type character. A thin layer on the front of the cell is doped with phosphorous to give it a negative or n-type character. The interface between these two layers contains an electric field and is called a junction.

Light consists of particles called photons. When light hits the solar cell, some of the photons are absorbed in the region of the junction, freeing electrons in the silicon crystal. If the photons have enough energy, the electrons will be able to overcome the electric field at the junction and are free to move through the silicon and into an external circuit. As they flow through the external circuit they give up their energy as useful work (turning motors, lighting lamps, etc.) and return to the solar cell.

The photovoltaic process is completely solid-state and self-contained. There are no moving parts and no materials are consumed or emitted.

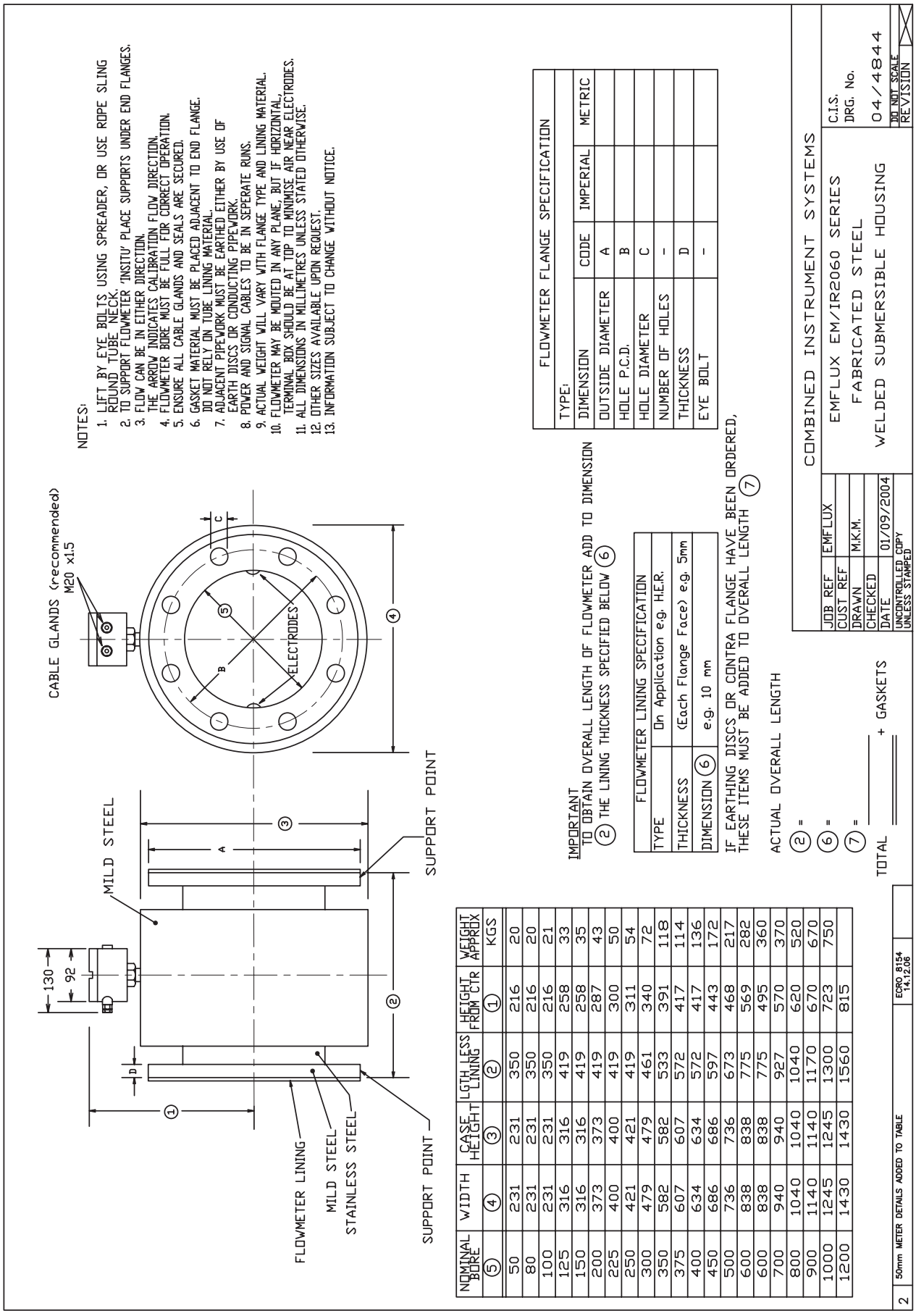
PV and the Environment

Photovoltaics are probably the most benign method of power generation known. They are silent, produce no emissions, and use no fuel (other than sunlight!). The production of photovoltaics, of course, varies among manufacturers. BP Solar makes extensive use of recycled materials and even uses waste from other industries as raw material. BP Solar's PV technology is based on silicon, the second most common element on the earth's surface. As used in PV modules, silicon is non-toxic. A BP Solar PV module will re-generate the energy used in its manufacturing process in 1 to 4 years depending on the application and location. The U.S. National Renewable Energy Laboratory published a report, 'Energy Payback: Clean Energy from PV ', describing the amount of energy consumed in creating a photovoltaic system and an estimate of the energy payback.

Cold Weather

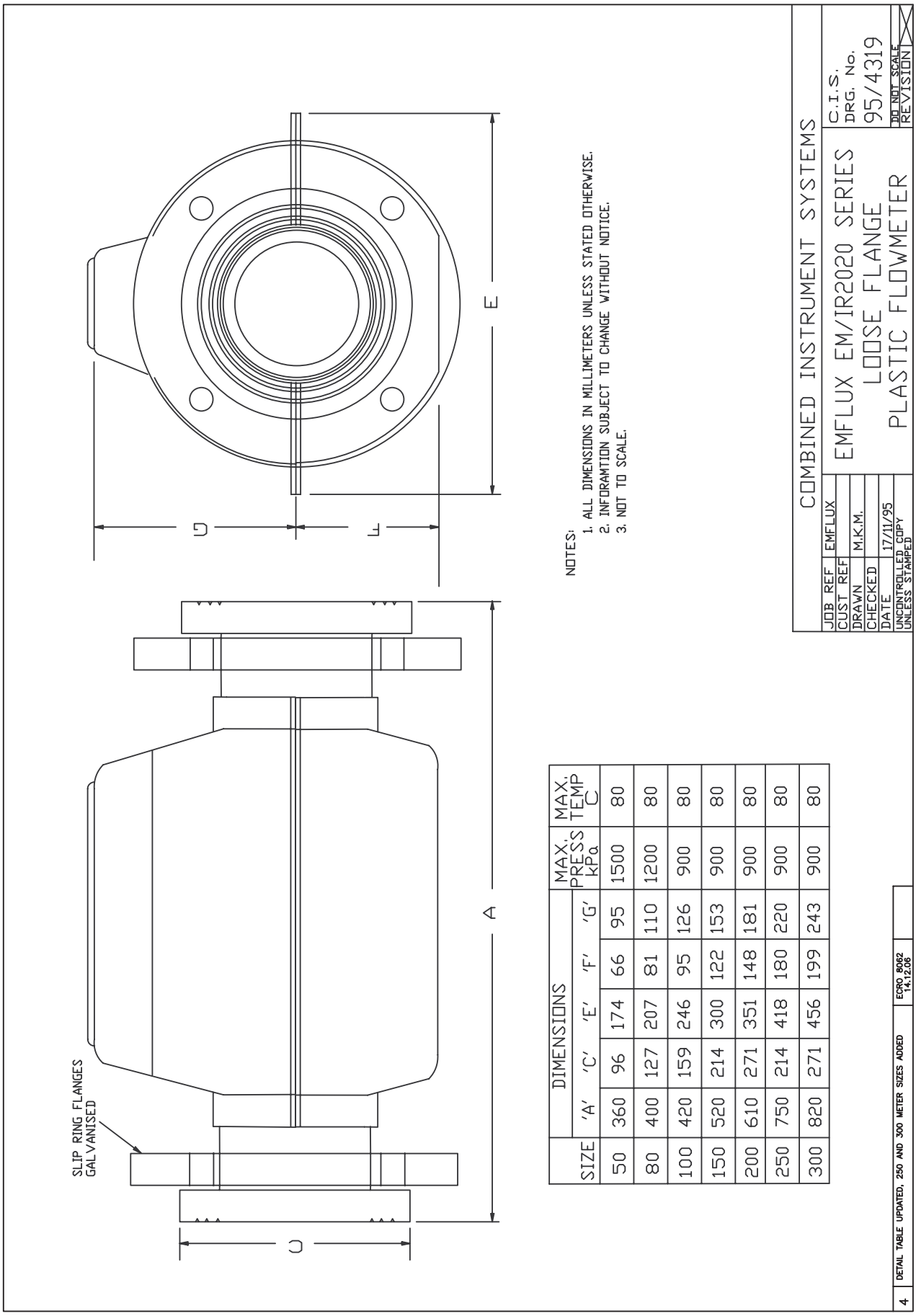
Photovoltaics actually work better in cold weather situations. Contrary to most peoples' intuition, photovoltaics actually generate more power at lower temperatures with other factors being equal. This is because photovoltaics are electronic devices and generate electricity from light, not heat. Like most electronic devices, photovoltaics operate more efficiently at cooler temperature. In temperate climates, photovoltaics will generate less energy in the winter than in the summer, but this is due to the shorter days, lower sun angles and greater cloud cover, not the cooler temperatures.

Dimensions



NOMINAL BORE ⑤	WIDTH ④	CASE HEIGHT ③	LGTH LESS LINING ②	HEIGHT FROM CTR ①	WEIGHT APPROX KGS
50	231	231	350	216	20
80	231	231	350	216	20
100	231	231	350	216	21
125	316	316	419	258	33
150	316	316	419	258	35
200	373	373	419	287	43
225	400	400	419	300	50
250	421	421	419	311	54
300	479	479	461	340	72
350	582	582	533	391	118
375	607	607	572	417	114
400	634	634	572	417	136
450	686	686	597	443	172
500	736	736	673	468	217
600	838	838	775	569	282
600	838	838	775	495	360
700	940	940	927	570	370
800	1040	1040	1040	620	520
900	1140	1140	1170	670	670
1000	1245	1245	1300	723	750
1200	1430	1430	1560	815	

IR2060 Detector Head Dimensions



SIZE	DIMENSIONS 'A'	'C'	'E'	'F'	'G'	MAX. PRESS kPa	MAX. TEMP C
50	360	96	174	66	95	1500	80
80	400	127	207	81	110	1200	80
100	420	159	246	95	126	900	80
150	520	214	300	122	153	900	80
200	610	271	351	148	181	900	80
250	750	214	418	180	220	900	80
300	820	271	456	199	243	900	80

IR2020 Detector Head Dimensions

Configuration

General Information

Your Irriflow Converters are supplied fully configured and ready for use. However should you wish to change the configuration parameters from the default settings then the following instructions should be followed.

1. Open the I300 front door (key will be required
2. Remove the Solar Power Connector (if fitted)
3. Remove the battery connector plug
4. Depress both the up and down arrow buttons simultaneously and connect the battery power plug.

The unit will start up and enter config mode and request Entry of Pin No. The default pin number is 5 and is entered by pressing the up button until the display reads 5 and then pressing the tick button. The system will then complete its start up functions and revert to the normal operation display.

Having completed this sequence the system is now in configuration mode. Once in this mode the system will be turned on continually and will not revert to power save mode for a period of 1 hour.

Pushing the Down arrow will show an additional diagnostic screen. This screen shows the ADC reading in decimal numbers on the top line. The reading on the left is the raw conversion while the averaged value is displayed on the right. Negative numbers will indicate reverse flow.

The bottom line will indicate the number of averaging points, which is adjustable between 1 and 64. The millivolts value right next to it will indicate the electrodes flow signal and will have the low

flow cut off disabled.

Pushing the tick button while on this screen will enter the configuration menu.

Using the Up and Down buttons you may step through 32 configuration parameters as listed in the next section. As each parameter is displayed it shows the current selection as the example below.

To exit the configuration mode and return to the flow display menu, simply depress both the Up and Down Arrow buttons simultaneously.

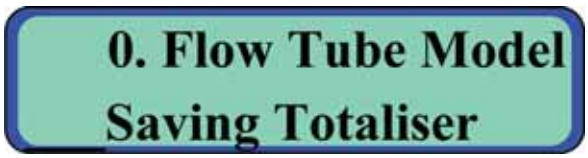
Changing Parameters

Once in the configuration menu you can use the Up or Down buttons to step through 36 configuration parameters as listed in the next section. The tick button is used to enter modifying-mode so that the displayed menu item can be modified using the up & down arrows. The tick

button is used to enter the new values. An asterisk (*) may be displayed along side the currently configured value while in modifying mode.

Tip:

If you have entered into a menu item that you do not wish to change, simply move to the item or numerical value, using the Up or Down buttons, that has the asterisk (*) along side it and again depress the Tick Button.



Once you have made the change, save it by again pushing the Tick button. You will notice the display flash up 'Saving Totaliser'.

After the values have been written and saved to the EEPROM the display will be ready to move through to the next parameter (UP arrow).

Detailed Patameter List

0. Flow Tube Model

This determines if Unit is to be configured for Area (older units), or for Diameter.

This display shows the unit set up in Diameter Mode

This display shows the unit set up in Area Mode

For flow tubes where Area is specified.

1. Flow Tube Area

For some older flow tubes or in Dethridge Wheel replacement applications, the flow tube area is determined by the nominal size of the tube and should be entered as per the following details (also detailed on tube and converter).

Model No.	Enter No.
IRRI-600	181
IRRI-450	159
12D	185

In the following X may either 2, 4 or 6 dependant on detector head type

IR20X0/50	2
IR20X0/80	5
IR20X0/100	8
IR20X0/150	18
IR20X0/200	31
IR2060/225	40
IR2060/250	49
IR2060/300	71
IR2060/350	96
IR2060/375	110
IR2060/400	126
IR2060/450	159
IR2060/500	196
IR2060/600	283
IR2060/700	385
IR2060/800	503
IR2060/900	636

Alternatively for flow tubes whose diameter is specified.

1. Flow Tube Diameter

Enter the nominal diameter of the flow detector head. For instance enter 150 for a 150mm (6 inch) flowmeter.

2. Flow Tube Constant or Flow Tube Factor

This factor is determined during factory wet-calibration and is recorded on the calibration certificate, converter and flow detector head. For the system to be accurate this value must be the same as indicated on the flow detector head. It is a 4-digit number which relates to mm/sec/mV.

3. Flow Tube Zero

This figure is also generated during factory wet-calibration and is recorded on both the converter and flow detector head. For the system to be accurate this value must be the same as indicated on the flow detector head.

4. Power On Time

Programmable from 3 to 3600 seconds. This is the time the unit stays turned on for when updating the flow reading. Typically set for 30 seconds. The I300 will stay on for as long as required to generate a new flow reading including any smoothing time. (see below).

5. Power Off Time

Programmable from 0 to 3600 seconds. This is the time the system stays turned off between flow readings. To disable power saving return this setting to zero. Typically set between 300 and 900 seconds. If set to zero seconds – the unit will not enter sleep mode and will stay on continuously.

6. Zflow Off Time

Programmable from 0 to 30000 seconds. This value sets the extended off time when zero flow has been detected for two consecutive on times, ie. following two consecutive on/off cycles with zero flow the 'ZflowOffTime' value will be used in place of the programmed 'Power Off Time' value.

Important

To disable this feature enter the same value as for the ‘Power Off Time’. This value should normally be equal to or greater than the ‘Power Off Time’.

7. Low Flow Cut Off

Sets the point for minimum measurable flow, when the flow falls below this point the reading and all flow meter outputs will drive to zero. Programmable from 1 to100 mm/sec flow velocity on later versions. Typically set to 30 mm/sec.

8. Display Scrn 1 (Display Screen 1)

Selects the information displayed on the top line of screen number 1.

0 = litres per second (L/sec)

1 = megalitres per day (ML/day)

2 = cubic meters per hour (m3/hr)

3 = Dethridge revs per minute (Rev/min)

4 = metres per second (m/sec)

5 = ADC Vref and Vgnd for diagnostic purpose

6 = Period of the output Pulse and pulse count

7 = Current date and time

9. Display Scrn 2 (Display Screen 2)

Selects the information displayed on the top line of screen number 2.

0 = litres per second (L/sec)

1 = megalitres per day (ML/day)

2 = cubic meters per hour (m3/hr)

3 = Dethridge revs per minute (Rev/min)

4 = metres per second (m/sec)

5 = ADC Vref and Vgnd for diagnostic purpose

6 = Period of the output Pulse and pulse count

7 = Current date and time

10. Totaliser Unit

Sets the units the totaliser is to be displayed in.

- Megalitres (ML)
- Cubic Metres (m3)

11. Frequency Output Scaling

Sets the Frequency of the full scale output. of the open collector port. This parameter is a user defined scaling factor with a value between 0.0 and 30.0. To disable frequency output enter the setting to zero.

Scaling factor represents frequency (Hz) per flowrate (litre/s), (also equal to pulses per litre)

Example 1: - a 300mm ABS I300 Flow Meter

Nominate the maximum output frequency (say 650Hz to get highest resolution)
Nominate the maximum flowrate of meter (say 325l/s for a 300mm I300)
(Note it is best to select a multiple of each other – as the scaling factor only has 1 decimal place)
The scaling factor is then equal to max freq (650) / max flow (325) = 2.0

Example 2: - a 450mm I300 Meter for a Dethridge Wheel Upgrade

Nominate the maximum output frequency (say 500Hz (may be limited by external RTU/device)
Nominate the maximum flowrate of meter (say 500l/s for a 450 Dethridge meter)
(Note it is best to select a multiple of each other – as the scaling factor only has 1 decimal place)
The scaling factor is then equal to max freq (500) / max flow (500) = 1.0

Note

The Maximum output frequency (hardware limited) is 650 Hz
The Minimum output frequency (hardware limited) is 5Hz

The frequency output will cease operating (drop from 5Hz to oHz) once the flow rate drops to the equivalent of 5Hz. (In most cases this will be less than 1% of the maximum flow rate, and will be well below the low flow cutoff which typically limits the lower limit of measurement to around 5% of the maximum.

12. Pulse Scaling (LED. output)

This sets the volume of flow represented by each output pulse (and/or LED flash). The units are in litres per pulse.

The maximum rate = 5 pulses per sec. (Ensure this maximum rate is not exceeded)
The pulse width = 50 mS.

To set a pulse rate to approximate the blades on a 12 Meg Dethridge wheel enter 115 ie. 115 litres per pulse.

13. Smoothing

Sets the number of flow measurement readings to calculate an average flow reading. User Selectable between1 and 64 points. Default setting is 20.

Smoothing is applied after the unit has woken up and able to provided a clean flow signal (fixed period of approx 8 seconds). Each additional flow measurement to be smoothed takes approx 1/3 second. The approximate times to generate smoothed flow signals are as follows:

Smoothing	Time taken to generate a smoothed reading
1	8 seconds
2	10 seconds
20	14 seconds
64	27 seconds

Note:

When the I300 unit wakes up to take a flow measurement – it will remain awake for the longer of the “On Time” or “Time taken to generate a smoothed reading”.

To minimise power consumption of the I300 set smoothing to 1, and On Time to 10 seconds.

14. Simulation

This simulates flow in the flowmeter without actual flow existing.

The value is selected in litres per second. All outputs and displays will drive to the selected simulation value.

To disable simulation return the setting to zero. The totaliser does not count in simulating mode.

15. Pipe Not Full

If the detector head is fitted with a pipe not full electrode the unit may be programmed to drive to zero flow in the event that the liquid level in the pipe drops below the pipe not full electrode.

16. 4-20 mA Scaling (FScale 4-20mA)

Selects the 20 mA value for the 4-20 mA output. 4 mA is always equal to zero flow.The value is set in units of litres per second, ie. 400 = 400 L/sec @ 20 mA.

17. PIN Number

Enables you to change from the default number to a new access number to enable entry to the configuration menu. Default is 5.

18. ADC Reference

This is the internal reference voltage used for the autocalibration. The value entered should be the same as that recorded on the board. This value should not be adjusted.

19. MODBUS Net Address

Programmable from 1 to 99 and 101 to 247. Sets the converter's MODBUS net address.

20. Meter ID Number

Programmable from 0 to 30000. Sets the converter's unique ID number. This number can be read via LCD display, MODBUS command or Totaliser Log file.

21. Reset Zero Totalisers

Select 'Yes' will reset both Peak and Off-Peak totalisers to zero.

22. CSV File Download (*)

To enable or disable the download of data logger file in ASCII mode. Default setting is 'Enabled' to allow collection of logged data via direct connection from a laptop or a Dial up Data Modem.

If using the I300 to communicate via serial MODBUS to an RTU device this Parameter should be “Disabled”.

23. Logging Interval (*)

Programmable from 5 to 1440. It sets the time (in minutes) between loggings of Totaliser value. Default is set to 30 minutes; if you press the tick button to change this value, the new screen will have an extra number that indicates the number of days a record would last before it gets overwritten. For example at 5 minute logging the memory will fill up and overwrite after 7 days. If logging once per day the unit will last for 2032 days.

24. Set Day (*)

Lower line will show day of week and DD-MM-YY. Use the Up or Down Arrow buttons to set the current day.

25. Set month (*)

Lower line will show day of week and DD-MM-YY. Use the Up or Down Arrow buttons to set the current month.

26. Set Year (*)

Lower line will show day of week and DD-MM-YY. Use the Up or Down Arrow buttons to set the current year. The year digits represent years between 2001 and 2099.

27. Set Hour (*)

Lower line will show hh-mm-ss. Use the Up or Down Arrow buttons to set hour.

28. Set Minute (*)

Lower line will show hh-mm-ss. Use the Up or Down Arrow buttons to set minute. Changing the minute setting will also reset seconds.

29. O/PEAK Totalising Start Time (*)

Lower line will show hh-mm-ss. Use the Up or Down Arrow buttons to set the time at which it is desired that the Off-Peak totaliser begins recording. Note that the time setting increments in 15¬minute intervals.

30. O/PEAK Totalising Finish

Lower line will show hh-mm-ss. Use the Up or Down Arrow buttons to set the time at which it is desired that the Off-Peak totaliser stops recording and reverts to Peak totaliser. Note that the time setting increments in 15 minute intervals.

31. Totaliser Latch Day (*)

This is used in conjunction with LATCH MONTH to form a specific date when snapshots of totalisers (Peak & Off-Peak) are taken, and the YTD accumulating totalisers reset to zero.

If LATCH MONTH is set as zero, then LATCH DAY will automatically be fixed at 1 so that the totalisers latching event will happen at the beginning of every calendar month.

32. Totaliser Latch Month (*)

This is used in conjunction with LATCH DAY to to form a specific date when snapshots of totalisers (Peak & Off-Peak) are taken, and the YTD accumulating totalisers reset to zero.

To enable counting on a monthly basis, set LATCH MONTH equals to zero, then LATCH DAY will be fixed to 1 automatically.

Changing either LATCH DAY or LATCH MONTH will reset the YTD accumulating totalisers and force the snapshots to take on new values.

Gate Control Parameters

The following 3 parameters (33,34,35) allow the I300 to be used with an external gate actuator or remote control system to manage the timing and flow rate of water deliveries. The 3 parameters can be entered by the operator on site via the LCD screen and are available via MODBUS serial communication. To view or configure Gate settings as follows:

- Hit up or down button to turn on Display and move to Screen No 3 (m/sec on top line)
- Push Tick button – unit will then request entry of PIN No (same PIN as above, default =5)
- The next 3 screens will contain the Gate control Parameters (Set Point, Gate Open, Gate Close)
- After 30 seconds the display will revert to the Normal flow metering display mode

33. Flow Set Point (ML/day)

This is entered by the user/landowner and refers to a predefined flow rate that may be required to be delivered through the meter. User configurable from 0.0 to 3000.0 ML/day in increments of 0.1ML/day.

34. Gate Open Time

This is entered by the user/landowner and refers to a predefined time and date (in the future) that the gate may require to be opened for water deliveries to commence. User configurable in half hour (30min) increments up to 21 days in advance. The gate open time is held in a MODBUS register as a number representing the number of minutes remaining between the current time and the gate open time. Valid range (0…30240)

35. Gate Close Time

This is entered by the user/landowner and refers to a predefined time and date (in the future) that the gate may require to be closed after water deliveries have been completed. User configurable in half hour (30min) increments up to 21 days in advance. The gate open time is held in a MODBUS register as a number representing the number of minutes remaining between the current time and the gate close time. Valid range (0…30240)

36. Set Baud Rate

This allows baud rate of serial communications port on I300 to be set to match Host Device.

Baud rate = 9600 (typically used for data retrieval via older modems or field laptop)

or

Baud rate =19200 (typically used for data retrieval via RTU eg MOSCAD)

Default setting is 9600.

Notes:

There is no input error checking on the I300. The user must ensure that all entered values are correct and in the required units. Gate control dates and times are not error checked. All register settings and configuration data are backed up by the EEPROM, and maintain their values in case of power disruption.

Exiting Configuration Mode

Once you have finished in the configuration mode it is important that you exit out of it properly. To do this it is necessary to reset the unit by disconnecting and reconnecting the battery power.

If this is not done the unit will continue to run for one hour using unnecessary battery capacity.

Default Parameter Factory Settings (Default Settings May vary)

On Time	30 Seconds
Off Time	300 Seconds
Zflow Off Time	300 Seconds
Low Flow Cut-Off	30 Mm/Sec
Smoothing	20 points
PIN Number	5
Net Address	1
Meter ID Number	0
CSV Log Download	1 - Enabled
Date and Time	Est When Leaving Factory
Off-Peak Start	23:00
Off-Peak End	07:00
Tot. Latch Date	1 July
Baud Rate	19200

Note:

It is good practice to confirm all settings in the flow meter to ensure the meter is configured to suit the local site conditions. A hard copy record should be made for ongoing management and tracking of site configuration details.

Remote Data Communication Port

The I300 unit is fitted with a serial data communication port which enables remote data access and monitoring. A personal computer or compatible data-terminal device (the host) can interface with the converter either locally or via a modem.

At the hardware level, the PCB provides a full-duplex, asynchronous serial interface on connector CN9

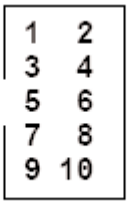
Tyco can provide a small sealed TTL-RS232 Serial Converter (Black Box) with short connecting lead to convert the TD and RD signals from TTL compatible logic levels to another form suitable for longer distance data transfer.

It is possible to establish connection with the converter in two different modes:

- Modbus RTU: up to 247 converters can be connected to the same bus/network, a cut-down version of Modbus which supports only one command - ReadHoldings - has been implemented.

- RS-232 ASCII: single end-to-end connection. This transfer mode has been included to facilitate the download of logged data using simple terminal program such as HyperTerminal. In this mode, the converter outputs the logged data in CSV format.

Port Settings	
Baud:	9600
Data bits:	8
Parity:	None
Stop bits:	1
Flow Control:	None



CN9 Pin Assignment	
Pin 1&2:	Ground
Pin 3:	TD - TTL
Pin 4:	RD - TTL
Pin 9&10:	12V

Important

ASCII mode data transfer has been implemented alongside MODBUS RTU on the same port. If multiple I300 units are to share a single communication channel using Modbus, ASCII mode download should be ‘Disabled’. A software switch (csv File Download) is provided to turn the ASCII command interpreter off so that Modbus can be used with absolute zero misinterpretation.

MODBUS RTU Connection Firmware Version 4.06T

Request Data frame

The following section describes how the packet should be structured in order to access data onboard the I300 converter. The Terminal Program (RTU host) always initiates a data transfer by sending an 8-byte Request Data Frame to the converter. Parameters and real-time data that the converter is currently holding, are stored in 16-byte registers and mapped from 0 to 41 (decimal) in the register address space. Refer Table 1 for their addressing value. Up to 18 contiguous registers can be read at once. Table 2 shows the structure of a Request Data Frame for reading Configuration Data

Table 1 Configuration Data Address

Address value (hex)	Register No. (decimal)	Variable	Description
$0000	1	Boots	Number of power resets
$0001	2	Days	Number of days since last reset
$0002	3	Hours	Number of hours since last reset
$0003	4	UV.flow_tube_diam	Flow Tube Diameter
$0004	5	UV.flow_tube_factor	Flow Tube Factor
$0005	6	UV.flow_tube_zero	Flow Tube Zero
$0006	7	UV.adc_ref	ADC Vref
$0007	8	ADC_zero>>16	ADC Zero Offset higher-word
$0008	9	ADC_zero	ADC Zero Offset lower-word
$0009	10	ADC_span>>16	ADC Span higher-word
$000A	11	ADC_span	ADC Span lower-word
$000B	12	UV.OnTime	On Time (seconds)
$000C	13	UV.OffTime	Off Time (seconds)
$000D	14	UV.ZeroFlowOffTime	Zero-Flow Off Time (seconds)
$000E	15	UV.low_flow_cut_off	Low Flow Cut Off (mm/sec)
$000F	16	UV.pipe_not_full	Pipe Not Full Check
$0010	17	UV.smoothing	Smoothing
$0011	18	UV.disp_scr_1	Display Unit 1
$0012	19	UV.disp_scr_2	Display Unit 2
$0013	20	UV.totalizer_units	Totalisers Unit
$0014	21	UV.fullscale410	Full-scale 4-20
$0015	22	UV.freqscale	Freq-scale
$0016	23	UV.litres_pulse	Litres-per-pulse-scale
$0017	24	0	Not used. Was Totaliser Records Index
$0018	25	Sys.day	Current Day
$0019	26	Sys.month	Current Month
$001A	27	Sys.year	Current Year
$001B	28	Sys.hour	Current Hour
$001C	29	Sys.minute	Current Minute
$001D	30	Ils/100	Real Time Flow (litres/sec)
$001E	31	BattVolts	Battery Voltage
$001F	32	SolaVolts	Solar Panel Voltage
$0020	33	Total.PEAK>>16	Current Peak totaliser higher-word
$0021	34	Total.PEAK	Current Peak totaliser lower-word
$0022	35	Total.OFPK>>16t	Current O/Peak totaliser higher-word
$0023	36	Total.OFPK	Current O/Peak totaliser lower-word

Table 1 Continued

Address value (hex)	Register No. (decimal)	Variable	Description
$0024	37	Uv.meter_ID	Meter ID number
$0025	38	getGateTime (&uv.gateOpenTime)	Gate Open Time
$0026	39	getGateTime (&uv.gateCloseTime)	Gate Close Time
$0027	40	Uv.gateSetPoint	Gate Set Point (flow rate)
$0028	41	mmsOut	Flow velocity (mm/s)
$0029	42	PoweredUpToReadFlow	Real time status, & initiate reading

Real Time Flow Measurements

The I300 will typically be configured to operate in a power save mode whereby it is in a low power sleep mode but wakes up periodically to perform a flow measurement. Depending upon the smoothing function, there is a short delay of approx 10-20 seconds after which time the Real time flow rate registers are updated. Other Registers (date time, flow totals etc update continuously).

A new feature has been implemented in the latest Firmware to allow the I300 unit to perform a real time flow measurement update whenever Register 42 is read by the Host Device.

The sequence of events to perform a flow measurement are as follows:

- RTU Host polls I300 unit and reads register number 42. (initial returned value will be 0)
- The unit will immediately commence a flow measurement
- After approx 10-20 seconds the registers will be updated and register 42 will reset to 1
- Unit will stay powered up and in “Real Time Mode” for the “On Period”
- Re reading Register 42 will cause the unit to remain powered up for the “On time”
- If Register 42 is repeatedly read (eg every 10 seconds or so) the unit will stay in Live Mode.

Flow Control Functions

The real time flow measurements can be used in Gate Control Applications whereby a Gate position (Valve, Penstock etc) may need to be adjusted according to a pre set flow rate, or a volumetric delivery requirement as follows:

- RTU unit Polls I300 unit and reads all registers of interest (including Register 42)
- After approx 10 seconds (when register 42 has value 1) – read the “live” flow rate register.
- Perform Gate adjustment (close, open etc)
- Wait for flow conditions to settle then read “live” flow rate again
- Adjust Gate position
- Confirm flow rate etc

When the Host RTU device has closed the connection, the I300 will revert to its normal sleep / wake mode.

Table 2 Request Data Frame - Configuration Data

Byte	Value (Hex number)	Description
1	$01 - $F7	Net address of converter
2	$03	Read Holdings Command
3 & 4	$0 - $29	Starting Address
5 & 6	$1 - $12	Number of Registers (N)
7	$xx	LSB of CRC
8	$xx	MSB of CRC

Please refer to the document “Modbus_over_serial_line_V1_02.pdf” from http://www.modbus.org/ for details regarding the calculation of the CRC and the required timing.

The I300 communicates at either 9600 or 19200 baud, 8 bit characters with no parity and transmits 2 stop bits, but will respond to either 1 or 2 stop bits.

Response Data Frame

Upon receiving the Request Data Frame, the addressed converter checks the CRC for any transmission error; if the data is error-free it will respond with a variable-length Response Data frame. Depending on the type of request, the possible responses are as follows:

Read Configuration Data

Table 3 Response Data Frame - Configuration Data

Net address of responding converter
Read Configuration Data Command ($03)
Number of bytes that follow (N x 2)
Configuration Data Register(s)
LSB of CRC
MSB of CRC

Exception Response

If there is any mismatch between the received data and that described in the Request Data Frame section. An exception response will follow.

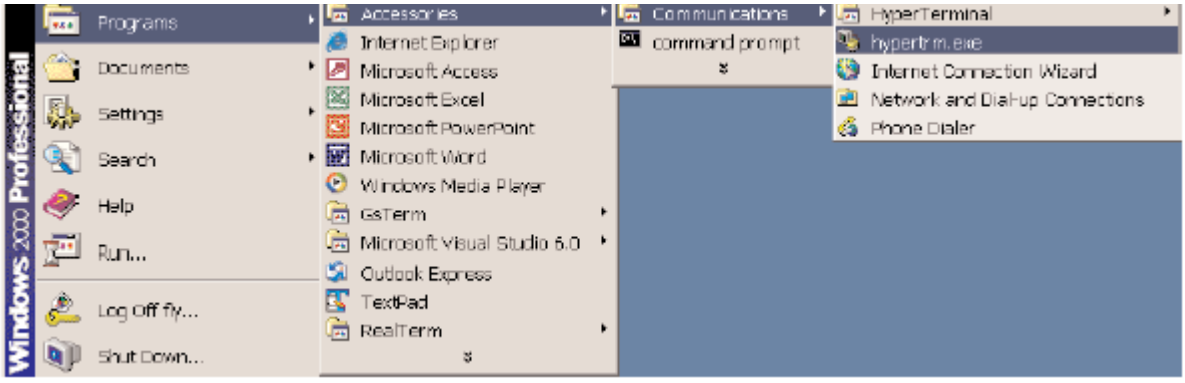
Table 4 Response Data Frame - Exceptions

Net address of responding converter
Command-code received + $80
Exception code
$01: invalid command-code
$02: out-of-range register-address / record-index
$03: invalid number of registers requested
LSB of CRC
MSB of CRC

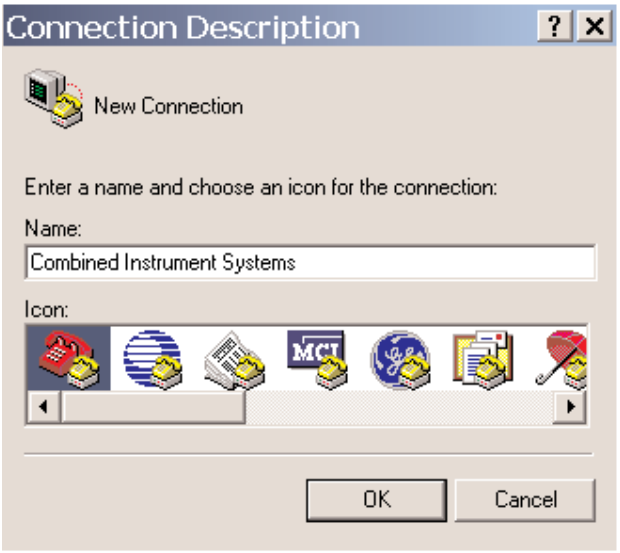
RS-232 Connection (Logged Data Download)

The following section outlines steps to download and capture the logged totaliser data using HyperTerminal. It is assumed that you have made the physical connection between the PC and the converter using a suitable serial transceiver.

Step 1: Start HyperTerminal

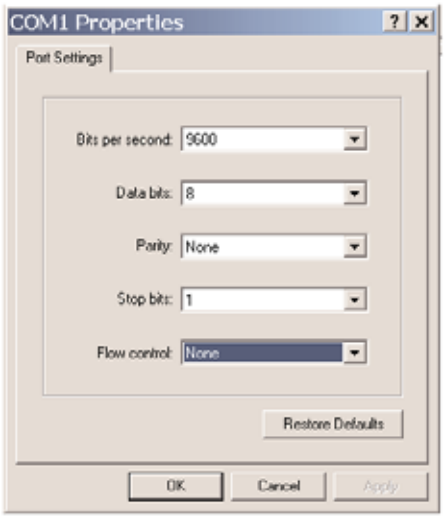


Step 2: Enter a name for the connection then click 'OK'

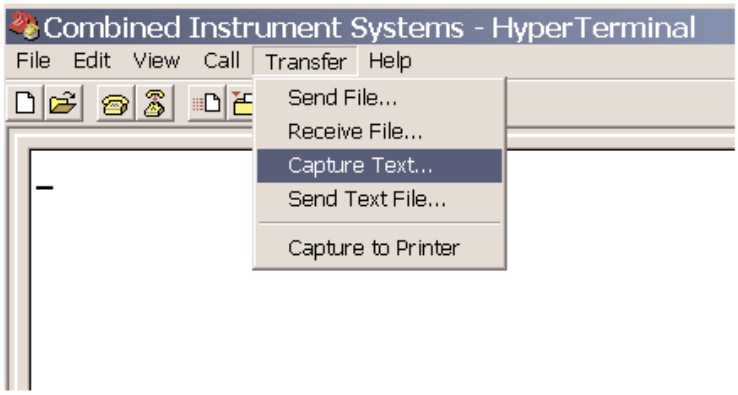


Step 3: Select the COM port for the connection then click 'OK'

Step 4: Select the port settings as shown then click 'OK'

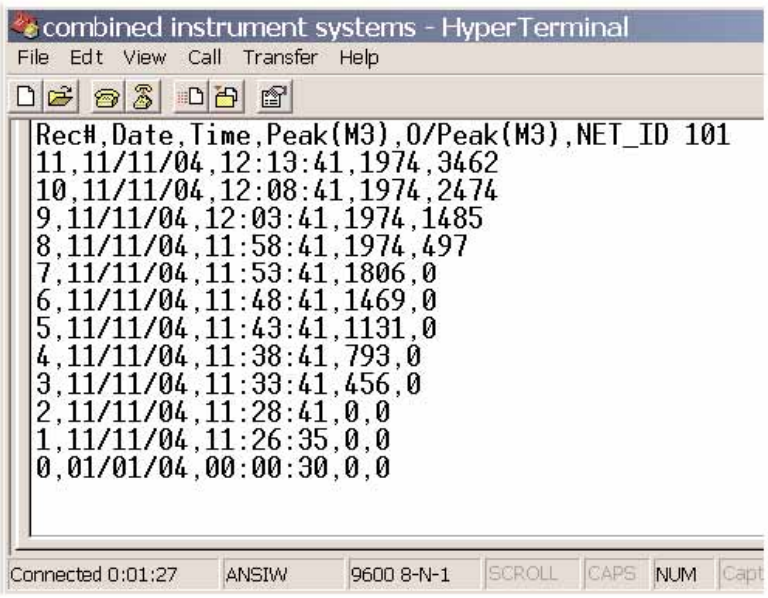


Step 5: From the Transfer menu, select Capture Text.



A new dialog will pop up. Select the folder where you want the file to be saved, choose a name for the file (with .csv extension), and then click Start.

Step 6: Type dshort, which stands for Short Download. The converter will respond with a list of logged totaliser records, starting from the most recent being stored down to record number 0, as shown in the following screen



Alternatively, you can use dlong, which stands for Long Download, to get the entire 2032 records onboard the converter. Sometimes this is necessary because the data storage has been implemented using a circular buffer pointer, which wraps back to zero once it reaches the top of the buffer.

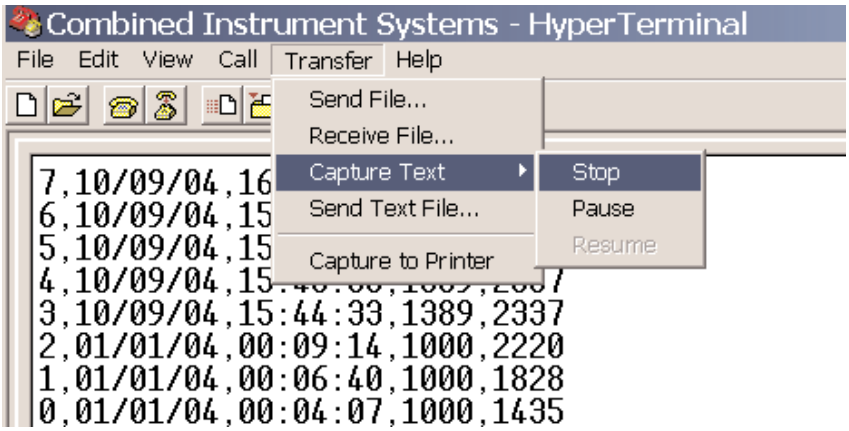
Note:

The converter can complete a dlong transfer in less than 3 minutes in power-saving mode. Longer time maybe required if it is actively measuring flow.

If you make a mistake, type q a few times then try again.

The q command can also be used to stop a data transfer.

Step 7: When the download is complete. Stop the Capture from Transfer menu.



Step 8: The CSV file is now ready to be open with MS Excel.

The "qdlong" command will now start downloading data from the most recent logged record. It will always send 2032 records unless stopped by the "q" command. If for example the most recent logged record is record 10, then the "qdlong" command will start downloading from record 10 down to record 0 and then from record 2031 down to record 11. Note it is possible that by the time the last few records are sent, that they may have been overwritten (memory wrapped) and may contain newer data than record 10.

The "qdshor" command has not been changed, but may be of limited use if the memory has wrapped.

The "q" will now stop transmission of data initiated by either the "qdshor" or the "qdlong" commands.

Note

Inclusion of the q command at the start of the “dshor” and “dlong” command ensures the unit clears all commands and responds to the download commands.

Maintenance

Electronics

Introduction

In keeping with modern electronic design there is little that is field repairable on the I300 circuit board.

The following provides a brief description of the layout of the circuit board to indicate some of the major functions. Photos of revision 1 and Revision 2 circuit boards are also provided to allow the user to distinguish between the two.

Light Emitting Diodes (mounted on PCB)

There are three (3) LEDs mounted on the Irriflow printed circuit board. Their functions are as follows:

Identifier	Colour	Function
D1	Red	Power LED, On when the flowmeter is in the measuring cycle (Power On Time). Off during the sleep cycle (Power Off Time & OffTimeZeroFlow)
D2	Red	Battery charging indicator. On during solar charging.
D8	Green	Analogue input circuit enabled. Should be on when D1 is on.

General

As there are no moving parts in the Irriflow there is very little maintenance. Provided the system is installed as per the instructions there are no parts to wear and the electronics and cable should be protected from external damage.

Solar Panel

The solar panel should be kept clean to ensure it operates to its full capacity. The amount of cleaning will depend on the location of the unit. The panel may be wiped with a damp non-abrasive cloth. Care should be taken not to scratch the panel while cleaning.

Battery

The battery volts may be read on the display; if the volts are below 11.0 volts then the charging system should be checked. Refer trouble shooting for details.

The battery should be replaced at least every 4 years.

Detector

There is no maintenance to be carried out on the detector itself. However if it is mounted in a position that enables large amounts of silt to settle in it, the silt should be removed as it will effect the overall inside area of the flowmeter which will in turn effect accuracy

Converter

The converter should be checked to ensure that insects have not infested the housing. Insects can create short circuits in the electronics causing failure. If necessary a regular program for cleaning and/or spraying insecticide should be put in place.

Note: Do not spray electronic circuit board with insecticide.

Trouble Shooting

General

The Irriflow Converter and Detector Head have been tested in our flow laboratory prior to shipment. However if you do experience problems please note the serial number and reference number of the instrument prior to contacting Tyco Environmental Systems. The serial number may be found either on the detector head at the point the cables enter, or on a label attached to the electronic board.

Display is Blank

Check that battery is charged and connected correctly.

Check that system is not in power save mode, ie. push the tick button to turn the display on. If this fails reset the system by disconnecting battery and solar panel, waiting 30 seconds and then reconnecting, this will generate a self-test and auto calibration.

Display Is Erratic and Does Not Read Zero

Pipe may not be full of liquid. Ensure pipe is full. Check signal wiring.

Increase smoothing setting (refer configuration).

No Response to Flow

Check all cabling. Check that pipe is full and there is flow. Check Diagnostic screen for reverse flow (negative voltage reading); reverse red and blue cores of flow signal cable at the terminal strip in the converter if necessary.

Battery Volts are Low

Battery volts should normally remain above 11.0V. If volts are below this value the battery could be faulty or the solar panel could be faulty and not charging the battery. Check that solar panel volts are above battery volts in normal light conditions. Solar panels volts should normally be 0.6 volts above the battery volts under normal light conditions.

To test the battery, remove it from the system and fully charge it using an external charger. The battery volts should reach 13.5 volts. Then carry out a discharge test by applying an external load. The battery should be able to source 300mA for a period of 24 hours when performing to 100% design capacity.

This value will decrease with age. Replace the battery if it performs to less than 70% capacity.

Solar Panel Volts are Low

The solar panel volts should normally be above the battery volts under normal light conditions. If not, clean the solar panel or replace if necessary.

Addendum 1 – Previous Software Revisions

Revision 0.9x software

There are three levels of display for normal operation. They are accessed by means of the up and down arrow buttons.

The main display is the default one that presents immediately after the completion of the diagnostics upon power-up. It is referred to as Display 1 and can provide flow rate information on the top line in litres per sec, megalitres per day, cubic metres per hour, Dethridge revs per minute or meters per second (programmable in configuration). Note that there are 2 displays in which the units are configurable so that alternative units may be displayed e.g. rpm - Ml/day or Ml/day - litre/sec etc.

The bottom line of the display indicates the total accumulated volume in megalitres to three decimal places, or cubic meters to two decimal places (programmable in configuration).

Where the I300 converter is operating with a flow detector as a Dethridge Wheel replacement, it is normal to have Display 1 indicating in revs per minute. This display is based on a standard 12 megalitre per day Dethridge wheel. This enables operators to read the I300 in the same units that they read the wheels.

1 Rev per Minute = 1.303 Megalitres per day

Examples of Display 0.9x

Display 1

(if set up as a Dethridge replacement).

Alternatively for pipeline flowmeters, Display 1 may be set to read in megalitre per day (Ml/Day), if which case the display would look like this (of course other units may be chosen).

 Pressing the up arrow button will take you to the next display.

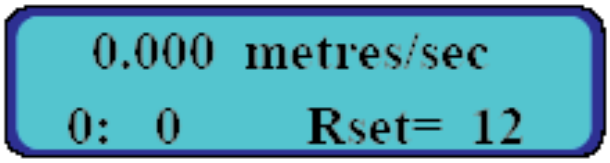
Display 2

The top line can be set up in configuration to the same variety of units as for display 1 namely: litres per second, megalitres per day, cubic meters per hour, Detheridge revs per minute, metres per second.

The bottom line indicates the battery volts (Bt) and solar panel volts (Sp). These are used to give an indication of the health of the electrical system. Battery volts should not drop below 12.5V and during peak daylight hours, the solar panel volts should be at least 0.5 to 1 volt above battery volts.

Pressing the up arrow button will take you to the next display.

Display 3



The top line always indicates flow velocity in metres per second.

The bottom line indicates Resets. This is the number of times that the battery has been disconnected and reconnected to the system. This can be used to detect if any tampering has occurred with the unit. Also on the bottom line is the run time status, this indicates in days and hours the time since the last reset. This enables you to determine when the last reset occurred.

Pressing the up arrow button will take you back to the original Display No. 1.

Revision 2.x Software

There are five levels of display for normal operation. They are accessed by means of the up and down arrow buttons.

The main display is the default one that presents immediately after the completion of the diagnostics upon power-up. It is referred to as Display 1 and can provide flow rate information on the top line in litres per sec, megalitres per day, cubic metres per hour, Dethridge revs per minute or meters per second (programmable in configuration) Alternatively the day of the week and time of day can be selected in configuration to be shown on the top line of the display.

The bottom line of the display indicates the total accumulated volume in megalitres to three decimal places, or in cubic meters (programmable in configuration). This total is the sum of two other totalisers that can be set for peak and off-peak flows. The times for peak and off-peak are configurable and are designated by your water provider. Should you wish to ascertain the times please contact your water provider.

Where the I300 converter is operating with a flow detector as a Dethridge Wheel replacement, it is normal to have Display 1 indicating in revs per minute. This display is based on a standard 12 megalitre per day Dethridge wheel. This enables operators to read the I300 in the same units that they read the wheels.

1 Rev per Minute = 1.303 Megalitres per day

Note:
Display 2 can also be configured to show the various flow data in the same manner.

Examples of Display 2.x

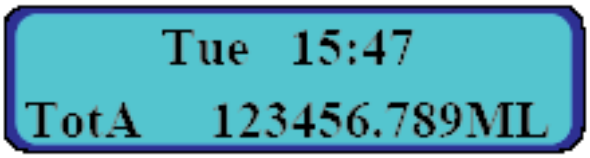
Display 1

(if set up as a Dethridge replacement).

Alternatively for pipeline flowmeters, the top line may be set to read in megalitre per day (Ml/Day), if which case the display would look like this.

Pressing the up arrow button will take you to the next display.

Display 2



In this case the top line has been configured to display Day/Time (24 hour clock) but again, the flow rate units may be configured to any one of those listed previously for Display 1.

The total designated as Totaliser A as displayed is that recorded during peak flow periods.

Pressing the up arrow button will take you to the next display.

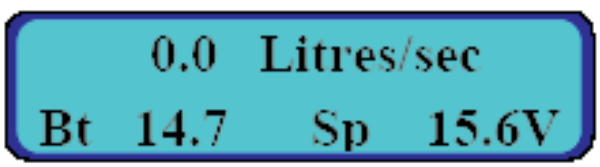
Display 3

The top line indicates the flow velocity down the pipeline.

The bottom line indicates the total flow accumulated in Totaliser B which is the off-peak flow. Again you should contact your water provider to ascertain the peak and off-peak times.

Pressing the up arrow button will take you to the next display.

Display 4



The top line always indicates flow rate in litres per second.

The bottom line indicates the battery volts (Bt) and solar panel volts (Sp). These are used

to give an indication of the health of the electrical system. Battery volts should not drop below 12.5V and during peak daylight hours, the solar panel volts should be at least 0.5 to 1 volt above battery volts.

Pressing the up arrow button will take you to the next display.

Display 5

The top line always indicates flow rate in litres per second.

The bottom line indicates Resets. This is the number of times that the battery has been disconnected and reconnected to the system. This can be used to detect if any tampering has occurred with the unit. Also on the bottom line is the run time status, this indicates in days and hours the time since the last reset. This enables you to determine when the last reset occurred.

Pressing the up arrow button will take you back to the original Display No. 1.

Version 3.04 Firmware

Table A1: Irriflow I300 Upgrade Options (with v3.04 software)

Upgrade Requirements		Price					
		Upgrade Requirements					
PCB Revision	**Upgrade Options**	**PCB Replace-ment**	**Real Time Clock**	**R36 = 3k3**	**24LC256 EEPROM**	**TCI Order No.**	**Price**
Rev 3 & 4	Dual Totalisation		✔				
	Remote Monitoring	✔					
	Logging Capability	✔					
Rev 5 & 6	Dual Totalisation		✔				
	Remote Monitoring			✔			
	Logging Capability		✔	✔	✔		

Addendum 2 – Version 3.05 and Real Time Clock Hardware

I300 3.05x Revision Software Upgrade Procedure *(Real time clock version)*

This latest revision of software enables the I300 to store the totaliser readings and configuration settings in both the EEPROM and the iButton (Real Time Clock). This feature will enable the user to transfer totaliser readings and configuration settings from one I300 to the next by simply removing the iButton from one I300 and installing it in another. This feature will be particularly useful in the unlikely event of an I300 failing, all the settings including the totaliser can easily be transferred to an operational transmitter so flow measurement can be continued. This will remove the need for the user to manually enter the existing configuration parameters into a replacement door assembly.

Upgrade Procedure 3.05x (Loading settings into iButton)

1. Remove power from the I300 by disconnecting the nine way plug from the bottom of PCB.
2. Remove the existing software chip (U6) and install the 3.05x version software.
3. Reconnect the nine way plug and depress the ‘up’ and ‘down’ buttons. The display will ask to enter a pin number. Enter the pin number and press the ‘tick’ button (default pin number is 5).
4. Press the ‘down’ button once to display the following mV reading screen.

Press the tick button to enter the configuration menu.

5. Whilst on the first parameter press the ‘tick’ button once to enable the parameter to be changed. Press the ‘tick’ button again without making any changes to the parameter. ‘Saving to EEPROM’ will briefly be displayed. This sequence will force the I300 to resave all configuration parameters to both the EEPROM and the iButton.
6. Exit the configuration mode by removing the nine way plug from the bottom of the PCB. Reconnect the nine way socket to start the I300 in normal operation mode.

Note: The I300 will automatically save the totaliser reading to both the EEPROM and iButton during its automatic saving of the totaliser.

Transferring configuration using the ‘iButton’

Please note both I300’s must have 3.05x software.

1. If the I300 is operational, press any of the buttons to wake the unit up then simultaneously press the ‘up’ and ‘down’ to save the latest totaliser reading
2. Down power the first I300 by removing the nine way connector and remove the iButton.
3. Install the iButton in the new I300.
4. Reconnect the nine way plug on the new I300 and depress the ‘tick’ button. The display will show ‘Reading iButton’ then prompt the user to copy settings to EEPROM. To save the iButton settings, press the ‘tick’ button. The display will now show ‘Confirmed saving to EEprom’.
5. The I300 can now be started in configuration mode by entering the correct pin number or in normal operation mode by entering a pin number of 0
6. All settings will now be transferred into the new I300

Note: The ADC reference parameter is not transferred during this process as it relates to the I300 PCB and is factory set.

Addendum 3 – Version 4.xx Firmware Upgrades

I300 4.x Software Revision

This revision of software enables the I300 to be used with an external gate/valve actuator to form a feedback control loop for regulating flow. In addition, this software also supports RS485 2-wire mode, with transmitter-enable (active high) for external transceiver via pin 7 on connector CN9.

Three additional user-configurable items are provided for this purpose. Access to these items is protected with the same PIN used for other settings.

Entry to the configuration menu is via display screen 3 – where it shows flow velocity in m/sec.

Pushing the Tick button while on this screen will result in the display asking for the PIN number. The configuration menu will follow if a correct PIN is entered. Using the Up and Down buttons you may step through the configurable parameters as listed below. After 30 seconds, the instrument will revert to normal flow metering function if there is no user interaction.

Setpoint Ml/Day

- Programmable from 0.0 to 3000.0, incremented by 0.1 Ml/Day.
- Accessible via holding register $0027; valid value range [0…30000]

Gate Open

- Date and time selectable on half-an-hour marks, can be up to 21 days in advance
- Accessible via holding register $0025; implemented as a count down register representing number of minutes between current time and set time, valid value range [0…30240]

Gate Close

- Date and time selectable on half-an-hour marks, can be up to 21 days in advance
- Accessible via holding register $0026; implemented as a count down register representing number of minutes between current time and set time, valid value range [0…30240]

Please note that the instrument doesn't check for input errors. It's up to the user to ensure that Gate Close date/time is later than Gate Open date/time; otherwise the external valve controller may ignore the user settings.

All register values are backed up by EEPROM; gate open and close counters are adjusted for lost time in case of power disruption.

Also note that the converter can be remotely waken up if an Error-Pipe-Not-Full ($0028) register read is followed immediately by a Real-Time-Flow ($0018) register read.

Addendum 4 - Firmware Revisions T6 and T5 August 2009

Firmware Version Number to be included in MODBUS Register

Modifications to Modbus Register 1 to allow the I300 to store the firmware Version No and make it available to an external RTU device via MODBUS communications.

Register 1 has always held the “No of Power Resets” or “Boots” as an 8 bit number in the lower 8 bits of the 16 bit Register. (The higher 8 bits were not previously used in this register.)

An Enhancement in Firmware Version 6 has been made to now included the Firmware Version No as an 8 bit number in the higher 8 bits of the Register 1.

Register 1 – ‘Boots’ – Modified to Now Include Firmware Version and Boots

First (higher) 8 bits = Firmware Version No (value = 0-256) (new feature)

Last (lower) 8 bits = No. of boots (value = 0-256) (unchanged from earlier versions)

How to use this Firmware enhancement

When the external device (Rubicon RTU) reads the Modbus Register 1 – it needs to separate the higher 8 bits from the lower 8 bits. Each 8 bit word can store a value between 0 and 256.

The number of Power Resets or ‘boots’ will operate as they did previously (each time the unit is powered down the boots will increment by 1).

The Firmware version number will be a decimal number hard coded into the unit at time of Firmware loading. It will consume the higher 8 bits of the Register.

The first firmware version to include this feature will be Version 6

The proposed enhancements provide backward compatibility across older I300 flow meters and will provide opportunity for external RTU devices to interrogate the flow meter and determine the Firmware version. The Firmware version will then determine what additional Gate Control Features are supported by the Flowmeter.

The following section describes the Gate Control Functions introduced at Version T5 and included in Version T6.

Firmware Version T5 – July 2009

The Irriflow Firmware version T5 now includes a number of enhancements to improve the performance and functionality of the Mag meter in farm outlets. The enhancements are specifically designed to provide full backward compatibility across all existing G-MW, FutureFlow and NVIRP Meter sites. The changes are applicable for Remote Read (RR), Remote Operate (RO) and Manual Sites. They also apply to all I300 sites including closed conduit or Pit style Meter systems.

The key enhancements include:

Gate Closed/Open feature

The I300 now has an additional Gate Shut feature to provide a zero flow interlock when the control Gate (Penstock, Slip Gate, Flume Gate, Butterfly Valve) is in the fully shut (closed) position. This feature is equivalent to placing a fence post through a Dethridge Wheel to guarantee zero flow totalisation during non-watering or Gate closed situations.

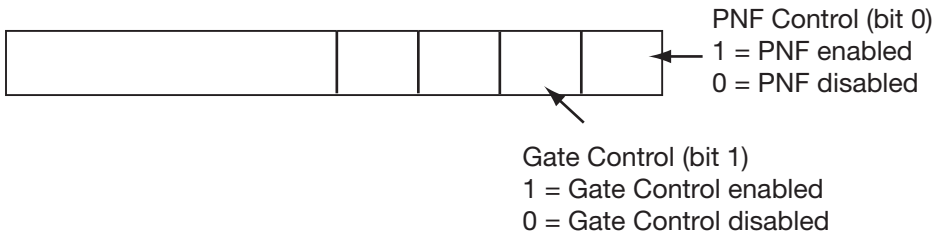
The Meter does need to be user configured to take advantage of the enhanced Gate Closed feature.

The user will configure the Gate Control Feature through the LCD Keypad at Parameter No 15 which also controls the Pipe Not Full (PNF) functions.

- PNF disabled and Gate Control disabled (existing option)
- PNF enabled and Gate Control disabled (existing option)
- PNF disabled and Gate Control enabled (new option)
- PNF enabled and Gate Control enabled (new option)

The settings entered by the user are held in Modbus Register 16 and can be read by the RTU to confirm unit is configured correctly.

Register 16



Note:
For Remote Operate Site the Register 16 settings should be set to 1 and 1 (numeric = 3)
Remote Read or Manual Sites, Register 16 settings should be set to 0 and 1 (numeric = 1)
If the PNF is disabled or not fitted – the unit will always assume the pipe is full.

Gate Interlock and Pipe Not Full Logic Sequence

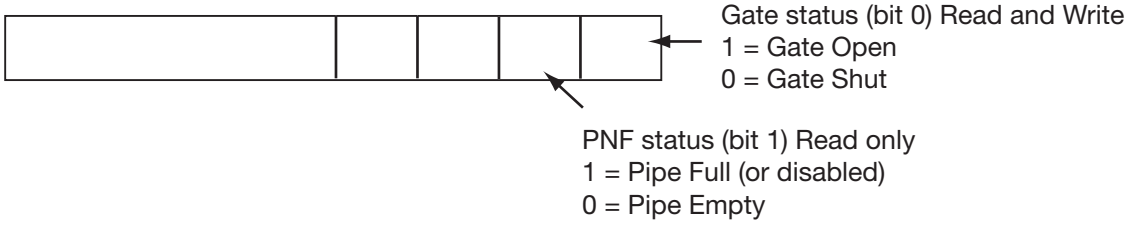
The Pipe Not Full Feature of the I300 has not been changed – If PNF is enabled it will perform an electrical check and then write either a 1 or 0 to bit 1 of Register 24 to indicate if the unit has detected a Pipe Not Full condition.

The enhanced Gate Closed feature involves the RTU (MOSCAD) reading the Gate position and then writing either a 1 or 0 to bit 0 of Register 24. This informs the I300 that the Gate is either open or shut When the I300 performs its measurement process it also checks the Gate status in Reg 24, and if the Gate is shut – the I300 will return a zero flow condition.

Register 24 can only be written to bit 0 using the Modbus write function 06.

Register24 can be read at any time (read holding registers) to confirm the status of the PNF and Gate position.

Modbus Register 24



The default condition is bit 0 set to 1 (assumes Gate Open). The RTU unit will read the Gate position and then write to bit 0 to advise the I300 if the Gate is Open or Shut.

Register 24 can be written to at any time without waking the I300 (it remains in sleep mode) We suggest that the write function to Register 24 be included in the RTU function, which is performing the 5 second read function of the I300.

Only a read of Register 42 will force the I300 to wake up and commence a flow measurement. (This feature is unchanged from Version T3.)

Totaliser Display

Totaliser Display Unit (Parameter No 15) now allows the user to select display of total volume in ML with 1 decimal place.

User can select which type of totaliser units:

- cubic meters – with no decimal point – m3
- ML with 3 decimal points – ML(3DP)
- ML with 1 decimal point – ML(1DP)

(This feature will be of particular benefit for large outlets where volume readings for billing purposes are only recorded to 1 decimal place)

This feature only changes the display of totals to the front LCD screen. All internal calculations and Modbus registers are unchanged and continue to hold volume data to 3 significant figures

Turn On Warm up signal processing

On turn on or wake up – the I300 unit performs a series of signal conditioning to derive a steady and reliable flow reading. This requires a minimum fixed period of approx 10 s after which time any additional smoothing is applied – to derive a live smoothed flow reading.

Smoothing

Smoothing (averaging) is a user entered variable and has been enhanced to allow entry from 1 to 100 points. After the initial fixed 10s warm up – each additional smoothing point will take an extra 1/3 sec.

Diagnostic Message

After the normal wake up and measurement cycle, the meter will display a diagnostic message on LCD for 3 seconds to inform the user of the flow measurement result:

The possible results are:

If the Meter detects a ‘Pipe Not Full Condition’ – Message shows – Not Full

If the Meter detects a ‘Gate Shut Condition’ – Message shows – Gate Shut

If a valid flow measurement and flow = 0, Message displayed = Zero Flow

If Meter performs a valid flow measurement and measures a flow > 0 – no Message is displayed.

LCD Screen Display

The LCD screen will now stay turned on for the ‘On Time’ after the last button push. This allows user to perform in-field diagnostics and view various screens as long as required – after the last button push and the ‘On Time’, the unit will enter sleep mode.

Flow Measurement Process

- The unit wakes from Sleep mode after the user defined Off Time.
- Or the unit is requested by a Remote RTU to perform a measurement.
- The unit powers up the flow meter circuit and performs digital filtering to minimise signal noise and generate clean flow readings.

- There is a fixed warm up period (approx 10 seconds) to generate an initial result.
- The unit will then read the Pipe Not Full Circuit (if enabled) to determine if pipe is full.
- If the PNF is disabled – the meter always assumes a full pipe flow condition.
- Register 24 is then updated with the PNF condition.
- The unit then reads the internal register (Reg 24) holding the 'Gate Shut' condition.
- If either the PNF or the Gate Shut is detected the unit will drive all outputs to zero and will turn off – enter sleep mode.
- If a valid flow measurement can be generated the unit then updates the LCD screen and updates with the new flow reading.
- Applies any User defined smoothing (running average of between 1-100 points).
- Applies the user entered 'Low Flow Cutoff' to remove non-valid flows.
- After the smoothed reading is generated all outputs and Registers are updated.
- The unit then remains awake for the remainder of the Wake (On Time) during which time all readings are updated in real time (live data mode).
- After the Wake time the unit then returns to sleep mode.
- During sleep mode all outputs remain at their current values until the next wake up.
- All other data (Date, time, flow totals) continue to update in real time during the sleep mode.

Standard feature Zflow Off Time

Programmable from 0 to 30000 seconds. This value sets the extended off time when zero flow has been detected for two consecutive on times, ie. following two consecutive on/off cycles with zero flow the 'ZflowOffTime' value will be used in place of the programmed 'Power Off Time' value.

Important

To disable this feature enter the same value as for the 'Power Off Time'. This value should normally be equal to or greater than the 'Power Off Time'.

This feature could be used to make the I300 go into an extended sleep mode at Remote Operate sites. The extended sleep would apply during non watering periods and could significantly reduce power consumption at these sites. At RR and Manual sites the normal on/off periods should be specified.

MODBUS RTU Connection - Firmware Version T5

Address value (hex)	Register number (decimal)	Variable	Description
$0000	1	boots	Number of power resets
$0001	2	days	Number of days since last reset
$0002	3	hours	Number of hours since last reset
$0003	4	uv.flow_tube_diam	Flow Tube Diameter
$0004	5	Uv.flow_tube_factor	Flow Tube Factor
$0005	6	Uv.flow_tube_zero	Flow Tube Zero
$0006	7	Uv.adc_ref	ADC Vref
$0007	8	Adc_zero>>16	ADC Zero Offset higher-word
$0008	9	Adc_zero	ADC Zero Offset lower-word
$0009	10	Adc_span>>16	ADC Span higher-word
$000A	11	Adc_span	ADC Span lower-word
$000B	12	Uv.OnTime	On Time (seconds)
$000C	13	Uv.OffTime	Off Time (seconds)
$000D	14	Uv.ZeroFlowOffTime	Zero-Flow Off Time (seconds)
$000E	15	Uv.low_flow_cut_off	Low Flow Cut Off (mm/sec)
$000F	16	Uv.pipe_not_full	Pipe Not Full and Gate Shut/ Open functions
$0010	17	Uv.smoothing	Smoothing
$0011	18	Uv.disp_scr_1	Display Unit 1
$0012	19	Uv.disp_scr_2	Display Unit 2
$0013	20	Uv.totalizer_units	Totalisers Unit
$0014	21	Uv.fullscale410	Full-scale 4-20
$0015	22	Uv.freqscale	Freq-scale
$0016	23	Uv.litres_pulse	Litres-per-pulse-scale
$0017	24	0	PNF status (full or empty) Gate condition (shut or open)
$0018	25	Sys.day	Current Day
$0019	26	Sys.month	Current Month
$001A	27	Sys.year	Current Year
$001B	28	Sys.hour	Current Hour
$001C	29	Sys.minute	Current Minute
$001D	30	Ils/100	Real Time Flow (litres/sec)
$001E	31	BattVolts	Battery Voltage
$001F	32	SolaVolts	Solar Panel Voltage
$0020	33	Total.PEAK>>16	Current Peak totaliser higher-word
$0021	34	Total.PEAK	Current Peak totaliser lower-word
$0022	35	Total.OFPK>>16t	Current O/Peak totaliser higher-word
$0023	36	Total.OFPK	Current O/Peak totaliser lower-word
$0024	37	Uv.meter_ID	Meter ID number
$0025	38	getGateTime(&uv.gateOpenTime)	Gate Open Time
$0026	39	getGateTime(&uv.gateCloseTime)	Gate Close Time
$0027	40	Uv.gateSetPoint	Gate Set Point (flow rate)
$0028	41	mmsOut	Flow velocity (mm/s)
$0029	42	PoweredUpToReadFlow	Real time status, & initiate reading

Real Time Flow Measurements

The I300 will typically be configured to operate in a power save mode whereby it is in a low power sleep mode but wakes up periodically to perform a flow measurement. Depending upon the smoothing function, there is a short delay of approx 10-20 seconds after which time the Real time flow rate registers are updated. Other Registers (date time, flow totals etc update continuously).

A new feature has been implemented in the latest Firmware to allow the I300 unit to perform a real time flow measurement update whenever Register 42 is read by the Host Device.

The Sequence of events to perform a flow measurement are as follows:

- RTU Host polls I300 unit and reads register number 42 (initial returned value will be 0).
- The unit will immediately commence a flow measurement
- After approx 10-20 seconds the registers will be updated and register 42 will reset to 1
- Unit will stay powered up and in “Real Time Mode” for the “On Period”
- Re reading Register 42 will cause the unit to remain powered up for the ‘On time’
- If Register 42 is repeatedly read (eg every 10 seconds or so) the unit will stay in Live Mode.

Flow Control Functions

The real time flow measurements can be used in Gate Control Applications whereby a Gate position (Valve, Penstock etc) may need to be adjusted according to a pre set flow rate, or a volumetric delivery requirement as follows:

- RTU unit Polls I300 unit and reads all registers of interest (including Register 42)
- After approx 10 seconds (when register 42 has value 1) – read the ‘live’ flow rate register.
- Perform Gate adjustment (close, open etc)
- Wait for flow conditions to settle then read “live” flow rate again
- Adjust Gate position
- Confirm flow rate etc

When the Host RTU device has closed the connection, the I300 will revert to its normal sleep/wake mode.

Equipment Returned for Testing or Repair

Your product has been manufactured and tested with care. It should not present any problems if it is installed, maintained and operated in accordance with the manual provided. However, if you need to return your product for testing or repair, please help us by supplying all the requested information to facilitate the speedy repair and return of your equipment.

Tyco Environmental Systems will only test and repair returned products when all the required information regarding substances that have come into contact with the product, is supplied. This information is required to safeguard the health and safety of our personnel and to comply with environmental legislation.

To ensure that your product is serviced, and particularly if the product was operated with toxic, caustic, flammable, biohazard or water-endangered substances it is required that:

1. You ensure all surfaces do not contain traces of hazardous substances, and that you rinse or neutralise before shipping the product.
2. You include the Product Certificate on page 18 with the product, to confirm that it is safe for us to handle and service.

If a quotation is required, an inspection charge of $100.00 will apply. If the quotation is accepted the inspection fee will cover the first hour of labour.

To commence testing or repairs the Product Certificate and a purchase order are required along with your product.

Please return the Product Certificate and the product to:

Tyco Environmental Systems

268 Milperra Road

Milperra, NSW 2214

Ph: 1800 805 372

Product Certificate

Company Details

Company: .....

Address: .....

.....

Contact: .....

Phone: ..... Fax: .....

Product Details

Product: .....

Model No.: ..... Serial No.: .....

Date Purchased: .....

Detailed description of fault: .....

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Safety Checks

This product has been operated with the following liquid and possible contaminants:

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The liquid is:

❑ Water-Hazardous ❑ Toxic ❑ Caustic ❑ Flammable ❑ Biohazard

We have:

❑ Checked that it is free from these substances ❑ Flushed out and neutralised all surfaces

I confirm that there is no risk to humans or environment through any residual contaminant on this product.

Signature: ..... Date: .....