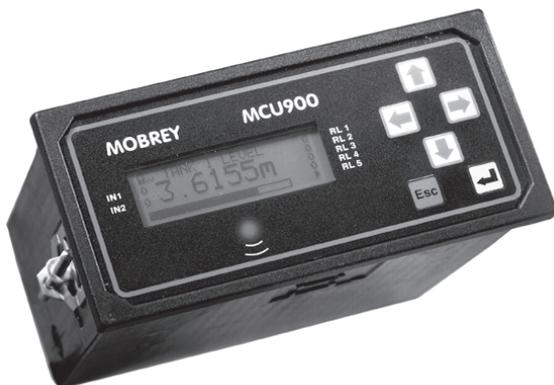# Mobrey

MCULOG Series industrial transmitter control unit

MCU900 is the generic name used in this manual for the MCU900 range of control units comprising :-

MCU901
MCU902
MCULOG

mobrey

www.emersonprocess.com

EMERSON
Process Management

Safety Precautions

The following safety precautions should be observed before using this product or working on the attached cables.

This MCU900 product is intended for use by qualified personnel who recognise shock hazards and are familiar with the safety precautions required to avoid possible injury. Read the operating information carefully before using the product.

The types of product users are:

Responsible body: This is the individual or group responsible for the use and maintenance of equipment, and for ensuring that operators are adequately trained.

Operators use the product for its intended function. They do not require access to the electrical connections within the control box, and would normally only operate the external keypad and monitor the display.

Maintenance personnel perform routine procedures on the product to keep it operating, for example, checking the line voltage or checking electrical connections, replacing mains fuses etc.

Service personnel are trained to work on live circuits, and perform safe installations and repairs of products. Only properly trained service personnel may perform installation and service procedures. However, the only serviceable part in MCU900 is the mains cartridge fuse.

Users of this product must be protected from electric shock at all times. Product users must be trained to protect themselves from the risk of electric shock.

MCU900 Control Units are double insulated and do not require a mains earth.

Periodically inspect the connecting cables for possible wear, cracks, or breaks.

The fuse must only be replaced with same type and rating for continued protection against fire hazard.

To clean the instrument, use a damp cloth with a mild, water based cleaner. Clean the exterior of the instrument only. Do not allow liquids to enter or spill on the instrument.

WARNING - If this equipment is used in a manner not specified by Rosemount Measurement, the protection provided may be impaired. The MCU900 is regarded as permanently installed equipment and as such a double pole switch or circuit breaker must be included in the installation. This should be in close proximity to and not obstructed by the equipment. This must be marked as its disconnecting device.

Disconnect supply before removing cover.

The IP rating is only achieved when unit is correctly assembled with supplied parts and suitable cables. Customer supplied glands must be suitable for application.

Under no circumstances must voltages higher than those stated in this manual be applied.

The installation of the MCU900 and its associated power cables must be such that tank overflow, local flooding or pump failure do not cause these to be submerged or subject to flows of water. Sensors and sensor cabling can be submerged without hazard to equipment operators when correctly connected as described in this manual.

Explanation of symbols: ⚠️   = Refer to manual

The I.S. earth terminal, marked   ⏚   must be connected to an external Intrinsically safe earth for all hazardous area systems.

CHECK THAT THE POWER SUPPLY IS SUITABLE BEFORE SWITCHING POWER ON.

Internal adjustments can select mains 115 Volts AC power, which makes the equipment unsuitable for 230V AC supplies. Check this Voltage selection switch is suitable set for the available power supply.

HAZARDOUS AREA SYSTEMS :-
  Where the MCU900 is connected to a transmitter located in a hazardous area, additional instructions apply. Refer to page 6 and safety instruction leaflet IP2030/SI.
  The symbol ⟨Ex⟩ in the text of this manual refers the reader to page 6 and safety instruction leaflet IP2030/SI   as relevant.

CONTENTS : SECTION 1

Footnote :-
In this manual the following terms are used which refer to trademarks from other manufacturers:

HART: is the protocol adopted for the MCU900 SMART Communications.
HART is a registered trademark of the HART Communications Foundation and is a mnemonic For Highway Addressable Remote Transducer.

1.0   Product Introduction

MCU900 is the generic family name for a range of industrial transmitter control units, providing a wide range of control functions and a visual display of the measured variable. There are two mounting styles available; a tough IP65 Wall mounting control unit for either indoor or outdoor installation, and a Panel mounting control unit designed for direct mounting in a control panel. The controller will accept a 4-20mA signal from a self-powered transmitter or can provide 24V dc power to the transmitter if required.

A HART transmitter, powered from the MCU900, can be connected to the MCU900 and all Universal plus some Common Practice commands will be implemented.

The MCU900 may be connected to a 4-20mA transmitter installed in a hazardous area. However, the MCU900 is designed for mounting in a non-hazardous (safe) area.

Control functionality is provided by the 5 SPCO voltage free contact relays in the MCU900. There is also an isolated 4-20mA signal out.

For applications where the functionality of the MCU900 is linked to other external events, 2 digital input ports are provided to accept contact closure signals.

The MCU900 is simply programmed using the 6 key membrane keypad on the front of the unit. Menu structured programming is employed, with the display assisting the user with dynamic help text.

1.1. Control Unit Functions

Using either a standard 4-20mA input or a digital HART input from a transmitter, the MCU900 control unit will provide the following functions :

• Calculation and display of the MCU900 Primary Variable (PV).
The user can choose this to be the reading coming from the transmitter, which may be a depth or distance measurement from a HART ultrasonic transmitter or may be a mA reading from a pressure transmitter, or some other value calculated by the MCU900 based on the transmitter input, which could be a level, distance, contents or flow reading. A totaliser function is also included.
The MCU900 is factory programmed with a set of standard volumetric and flow equations to convert a level signal to contents or flow, and also has a 21 point user programmed look-up table for non-standard applications.
MCU902 units calculated the difference, sum or product of 2 separate 4-20mA inputs.
MCULOG units have a 4800 event on board logging capability.

• 4-20mA signal out from the MCU900 control unit.
The MCU900 current output is usually proportional to the displayed PV, and is displayed in bargraph form on the display (0-100%).

• Relay control functions.
There are 5 freely assignable relays. Relay 5 is a fault relay by default, which may be assigned to control duty if required. The other 4 relays are available for the user to programme to operate at chosen values of the displayed PV, or other calculated values.
The MCU900 is factory programmed with a selection of popular pump control routines for wet well and sump control, along with energy saving over-rides.

• Voltage free (digital) contact input
Up to two voltage free contact closure inputs may be connected, allowing external over-ride of control unit functions if desired.

• Programming a transmitter from the MCU900 control unit
As the MCU900 will communicate digitally with any HART compatible transmitter powered by the MCU900, it is possible to programme a HART transmitter using the MCU900 keypad.
Full communication with Mobrey HART ultrasonic transmitters, allowing access to all transmitter parameters is supported, whilst Universal and some Common Practice commands of other HART transmitters is possible in accordance with HART protocol.

2.0 Mobrey MCU900 Series Controller

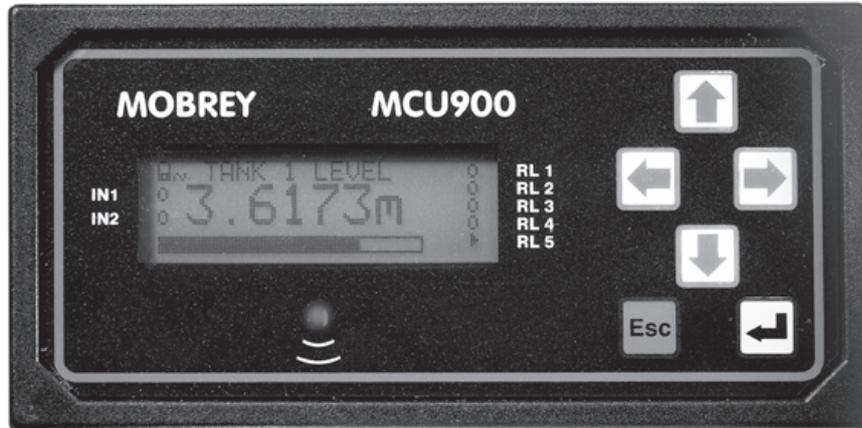### 2.1 Display and Keypad
   (Model MCU900P shown)

Figure 1 : MCU900 keypad and LCD display

Note : The keypad, display and operation are common to both Wall and Panel mounting options.

The MCU900 display is fully field configurable and may be customised to suit the requirements of the user.

Typically the 4 line display is as shown in Figure 2, The top line shows whether the programme lock is open together with the time display. The actual measurement, the MCU900 Primary Variable (PV) is displayed in the centre using double height characters. The lower line shows a bargraph representation of the 4-20mA current output of the control unit, proportional to the PV, 0-100%.
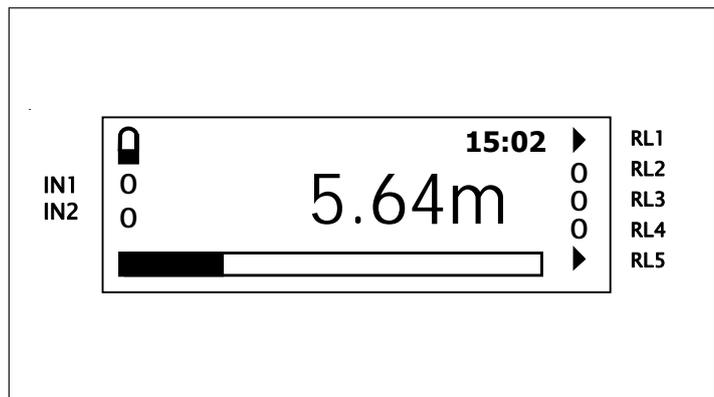
Figure 2 : Typical MCU900 liquid crystal display

Additional flags on the display show the status of the five relay outputs, RL1 to RL5, and of the digital control inputs into the MCU900.

Keypad Operation :

There are 6 buttons on the MCU900 front panel. The four ARROWS allow navigation around the programming menu and the " ESC" and "↵ " buttons allow movement from one screen to the next. By pressing "ESC" repeatedly, the screen will always return to the normal display as shown in Fig 2. Movement through the menu structure using the arrows is shown by the titles being "highlighted", ie reversed to show white letters on a dark background. The LCD is backlit for operator convenience. (This can be turned off if required).

Some basic introductory programming details are given in Appendix 1, whilst full programming and operating instructions are given in manual IP2030/RM. Quickstart manuals, are also available, covering use of the MCU900, MCU902, MCULOG and MCU90F with a Mobrey ultrasonic transmitter(s).

2.2 Type Numbering System

MCU   Mobrey Control Unit

901   Standard model
902   Differential model
LOG   Logging model
90F   Open channel flow model

WX   Wall mounting
PX   Panel mounting

-A   ATEX certified, 115V ac/230V ac mains powered
-A24   24V dc powered

2.3 Safety Data

Type numbers   See above
Certificate number   BAS00ATEX7064 and BAS01ATEX7225X
ATEX Coding
(EU Directive 94/9/EC)   ⟨Ex⟩ II [1] G D

Cenelec Coding   [EEx ia] IIC -40°C ≤ Ta ≤ 55°C

Safety Parameters

Terminal 1 (24V) w.r.t. terminal 2 (Iin) Terminal 1 (24V) w.r.t. terminal 3 (Earth)	Terminal 2 (Iin) w.r.t. terminal 3 (Earth)
U_i = 0 U_o = 28V I_o = 120mA P_o = 0.82W L_i = 0.2mH C_i = 0.6nF	U_i = 30V I_i = 120mA L_i = 0.1mH C_i = 0.6nF U_o = 6.51V (Cap. charging only) I_o = 0 P_o = 0

The capacitance and either inductance or inductance to resistance ratio L/R of the cable and equipment connected to the intrinsically safe output terminals must not exceed the following values :

Group	Capacitance	Inductance	or	L/R Ratio
IIC	0.082*µF	1.2mH		42 µH/Ω
IIB	0.65µF	10.9mH		172 µH/Ω
IIA	2.15µF	21.9mH		346 µH/Ω

* 0.082µF of which total C_i of the hazardous area apparatus connected must not exceed 0.020µF.

Terminal 2 (I_{IN}) w.r.t. Terminal 3 (Earth) must be treated as a 6.51V source. The 6.51V is considered as being the theoretical maximum to which a capacitive load across these terminals could become charged through leakage through internal series blocking diodes. This voltage does not contribute to the short circuit sparking risk of any external source connected to these terminals.

2.4   Electrical Specifications

Cable Entry   5 x Ø 20mm, (3 blanking plugs, 2 cable glands)

Cable connections   Cage clamp terminal block, suitable for 2.5mm^2 max cable.

Supply voltage   Switch selected :
                                Mains - 115Vac, voltage range   98Vac - 127Vac   50-60Hz
                                Mains - 230Vac, voltage range 196Vac - 254Vac   50-60Hz
                                DC - 24Vdc, voltage range 15Vdc - 30Vdc

Power consumption   Mains - 10VA at nominal supply voltage
                                Mains - 18VA Max.
                                DC - 9W max

Fuse   Mains - 200mA (T) 5 x 20mm 250V

Transmitter input   4-20mA (Earth referenced in MCU900)
                                CAT 1 30V dc Max.

Digital inputs   Unit accepts two trigger input signals.
                                (Voltage free contact closure)   See "WARNING"
                                                                                  in section Safety
Relay Outputs   5 x SPCO Relays, rated 5 Amp at 250 Vac Resistive   Precautions on
                                Please refer to section 3.7 for safety use.   Page 2

Current Output   4-20 mA isolated into 1kΩ max.
                                If externally powered then max. voltage is 30Vdc

DC Power Output   24V DC for transmitter, 25mA max. load

HART   HART digital communications to transmitter

3.0   MCU900 Control Unit Installation

The control unit must not be mounted in areas where an explosion hazard exists.

⟨Ɛx⟩   If connecting the MCU900 to a 4-20mA transmitter located in a hazardous area, refer also to instructions on page 6 and in safety instruction leaflet IP2030/SI.

Refer also to the important safety precautions detailed at the start of this manual.

3.1   Environmental Specification

Ambient temperature   -40°C to 55°C

Max Altitude   2000m

Max Humidity   100% RH

Electrical Safety   Conforms to EN61010-1

Installation Category   III Supply voltage <127Vac
                             II Supply voltage <254Vac

Pollution Degree   2

3.2   MCU900W Wall Mounting models

The control unit housing is rated IP65. It is suitable for mounting outside, but this should be above any flood level, away from any overflow water path, and away from direct sunlight. Do not mount the MCU900W on a structure that is subject to vibration, or in a position where damage may be caused by impact, thermal stress or liquid ingress.

The mass of the MCU900W is 1.4kg. To conform with safety requirements, the wall on which the MCU900W is mounted should be capable of supporting 4 times this weight.

It is not necessary or advisable to remove the lid to the upper part of the box, containing the LCD and keypad.There are no user serviceable parts inside. The control unit must not be modified in any way. Mount the unit on a suitable wall or structure using the 3 fixing points as shown in figure 3. The most convenient way is to position the central top fixing first, then hang the control unit on this. Use a spirit level to ensure the unit is horizontal, then mark the two lower fixing positions on the wall. (These are accessible once the terminal cover is removed).

The MCU900W is supplied with IP65 Nylon cable glands for connections to the field mounted transmitter and the mains power supply. MCULOG has an additional connector which is used to download logged data.

It is the responsibility of the user to ensure that cable glands and connection to the MCU900W is in accordance with local or national standards.

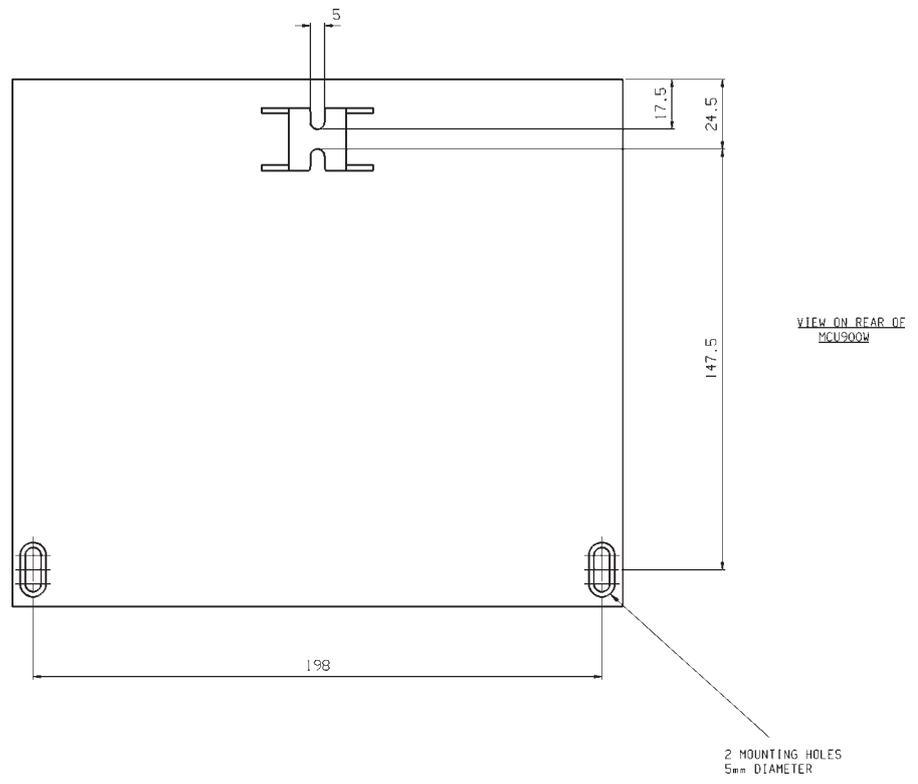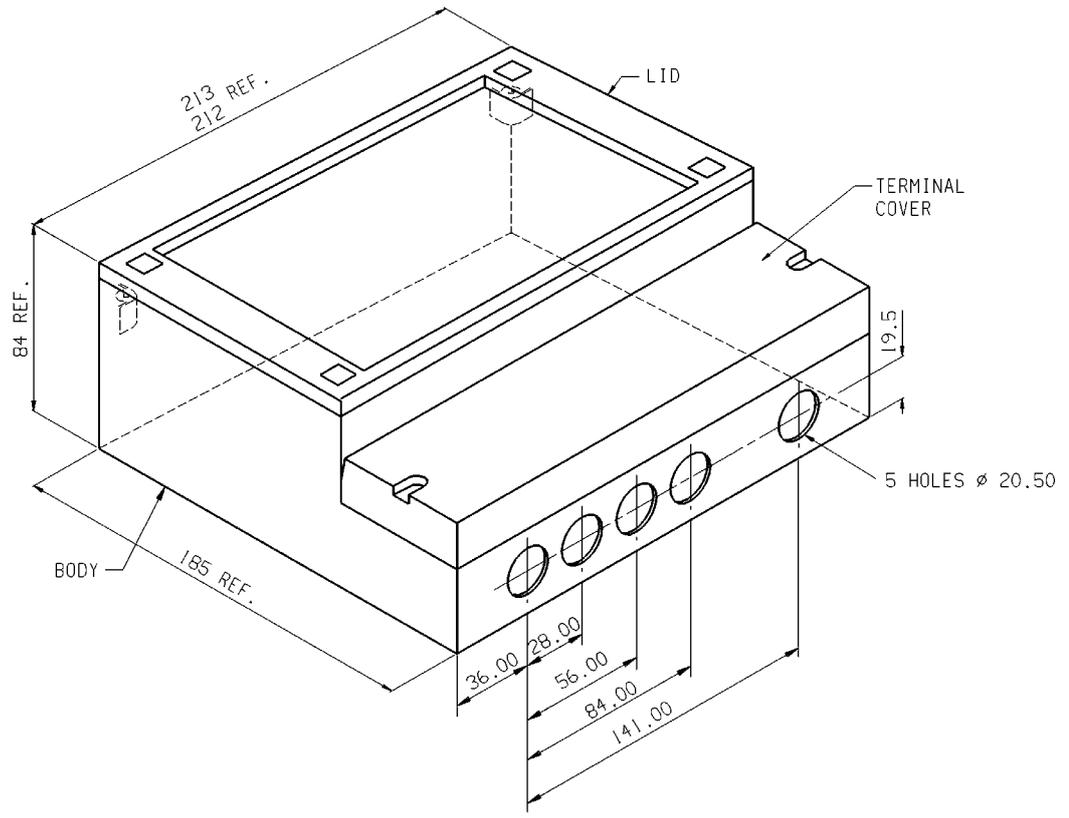LID

TERMINAL
COVER

213 REF.
212

84 REF.

19.5

5 HOLES ⌀ 20.50

BODY

185 REF.

36.00 28.00

56.00

84.00

141.00

5

17.5

24.5

VIEW ON REAR OF
MCU900W

147.5

198

2 MOUNTING HOLES
5mm DIAMETER

Figure 3 : MCU900W Control Unit Dimensions

3.2.1 Electrical Connections : MCU900W Wall mounting models ⟨Ex⟩

All field wiring connections are accessible by removing the lower terminal cover, which is secured by two screws. Note that it is the responsibility of the installer to observe all local regulations and approval requirements, and to ensure wiring is suitable for the load current and the insulation is suitable for the voltage, temperature and environment of the installation. Obtain and check any hazardous area work permits required before applying power to the MCU900. On no account should the mechanical barriers separating the terminal area from the main enclosure and the transmitter terminals from the other terminals be removed or modified.

The diagram below shows the layout of external connection terminals: all terminal blocks are suitable for wires 0.5mm^2 to 1.5mm^2 (2.5mm^2 for mains terminals). Insulation should be stripped back 7mm.

Two cable glands, rated IP65 and suitable for cable with outside diameter 4mm to 7mm, are supplied for use with the mains supply and transmitter cable. The three other connection positions are supplied with M20 blanking plugs. All glands and plugs are supplied in a separate plastic bag. The installer must fit these, or suitable equivalents, in place of the transit red-caps, to ensure weatherproofing of the MCU900. Note that the white sealing washers supplied with the all cable glands and blanking plugs must be fitted on the outside of the enclosure under the gland or blanking plug. It is the responsibility of the user to ensure suitable cable glands or conduit connections are used when wiring to the MCU900 to maintain the enclosure integrity. The 5 cable entry positions are pre-drilled to accept M20 cable glands. MCULOG has a data download socket factory fitted in one of the positions.
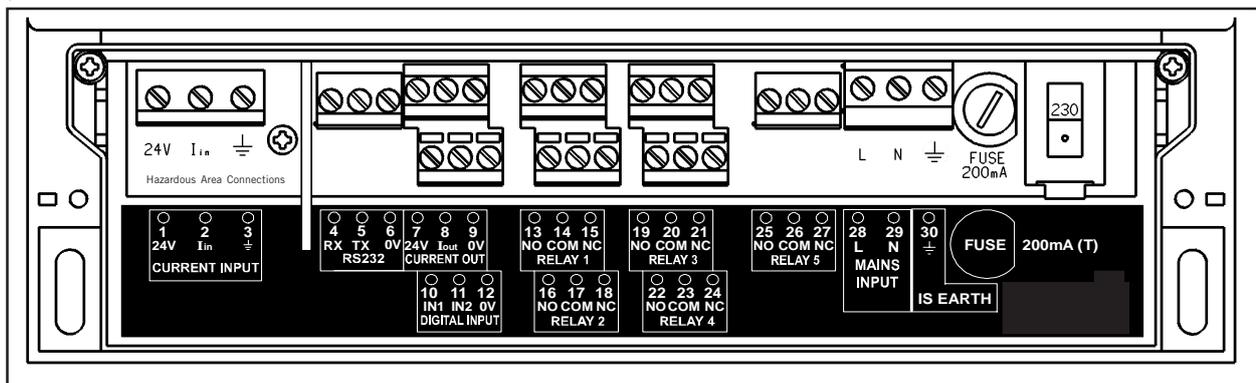
Figure 4:   Connection Terminal Layout (mains version shown)

Note that not all of the terminals are labelled on the pcb - a wiring label is positioned in the box.

The transmitter connections are on the left side of the terminal enclosure.

The I.S. Earth (Terminal 30) must be connected to an Intrinsically Safe Earth if the transmitter connected to terminals 1 and 2 is located in a hazardous area.

Terminal	Function	Layout
1	Loop supply	24V
2	Current Input	Iin
3	Screen	⏚
4-6	RS232	RX-TX-0V
7-9	Current Output	24V- Iout-0V
10-12	Digital Input 1 & 2	IN1-IN2-0V
13-15	Relay 1	NO-COM-NC
16-18	Relay 2	NO-COM-NC
19-21	Relay 3	NO-COM-NC
22-24	Relay 4	NO-COM-NC
25-27	Relay 5	NO-COM-NC
28-29	Mains Input	L-N (mains version only)
30	IS Earth	⏚
31	Negative	- (DC version only)
32	Positive	+ (DC version only)

3.3.   MCU900P Panel mounting models

Do not mount the MCU900P on a panel that is subject to vibration, or in a position where damage may be caused by impact, thermal stress or liquid ingress.

The MCU900P control unit is rated IP40 and is designed for panel mounting in a weatherproof environment. An optional fascia overlay hood is available which improves the IP rating to IP65 (See appendix 1).

A Rack mounting kit is available which allows mounting of an MCU900P in a standard 19" rack. Up to two control units can be mounted in one rack; each MCU900P requires a mounting kit. (See appendix 1).

Where 3 or more MCU900P control units are fitted in the same cabinet or panel, ensure that there is adequate air circulation to aid cooling. It is recommended that an air circulation fan be fitted.

The MCU900P requires at least 165mm clearance behind the mounting panel to avoid fouling.

Once mounted, all wiring is made at the rear of the unit using the two part terminal blocks provided.

A pre-wired logged data download socket suitable for front panel mounting is provided with MCULOG control units.

3.3.1 – Mounting in the panel

Mount the control unit on a panel with thickness between 1.5mm to 10mm, ensuring the panel is strong enought to support the 1.2kg weight of the MCU900.
Ensuring there is enough clearance behind the chosen position in the panel (165mm min.), cut a slot 138mm long by 68mm high (i.e. landscape or horizontal slot) in the panel and remove any rough edges.

Unpack the two screw clips provided. Identify the moulded lugs in the moulded recesses on each side of the control unit (ignore the recesses on the top and bottom of the control unit).
Holding the screwdriver slot end of the threaded spindle of one of the screw clamps and looking at the rear of the control unit, locate the screw clip frame on the side of the control unit and see how the 4 steel lugs of the screw clamp frame locate on the moulded lugs of the control unit. Gently pull the screw clamp such that the lugs engage with each other. (see Figure 5).

Figure5

Remove the screw clamp and slide the control unit into the panel, ensuring that the panel seal provided is in place behind the control unit bezel.

Re-fit the screw clamps, one on each side of the control unit and tighten with a screwdriver to clamp the control unit in place against the panel.

Figure 6 : MCU900P Control Unit dimensions (mains unit shown)

> **Panel mounting details**
> **Panel cut-out: 138mm x 68mm**
> **Allow 165mm clearance behind panel**

MOBREY MCU900

IN1
IN2

RL1
RL2
RL3
RL4
RL5

Esc

← 144.8 (5.7") →

173

156

2

8

65.8

72.4

FUSE
200mA(T)
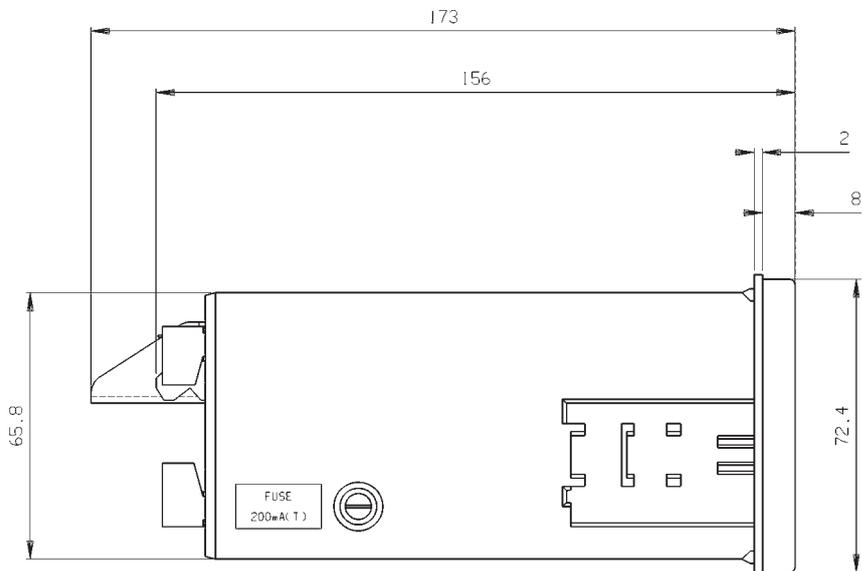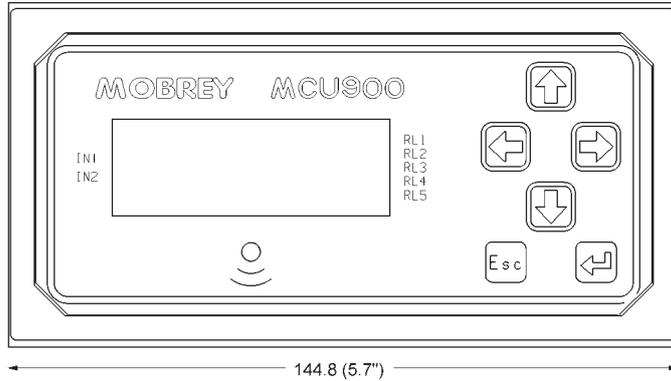
Logged data download socket : MCULOG control units only.
Drill a hole Ø in the panel at a suitable location such that the socket flying leads can be wired to terminals 4, 5 and 6 at the rear of the MCU900P.
See page13 for wiring instructions.

3.2

11.85

20.5 Ø

VIEW ON REAR OF
MCU900P

| 1 | 3 | 2 |

13 14 15 16 17 18 19 20 21
NO C NC NO C NC NO C NC
RELAY 1   RELAY 2   RELAY 3

CURRENT INPUT
1 24V   3 ⏚   2 Iin

IS EARTH 30

DIGITAL INPUT   RS232   CURRENT OUT   RELAY 4   RELAY 5
IN1 IN2 OV   RX TX OV   24V Iout OV   NO C NC   NO C NC
10 11 12   4 5 6   7   8   9   22 23 24   25 26 27

MAINS INPUT
L 28 N 29

10 11 12 4 5 6 7 8 9   22 23 24 25 26 27   230V   28 29

74.7

144.8
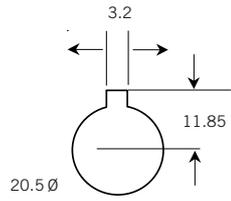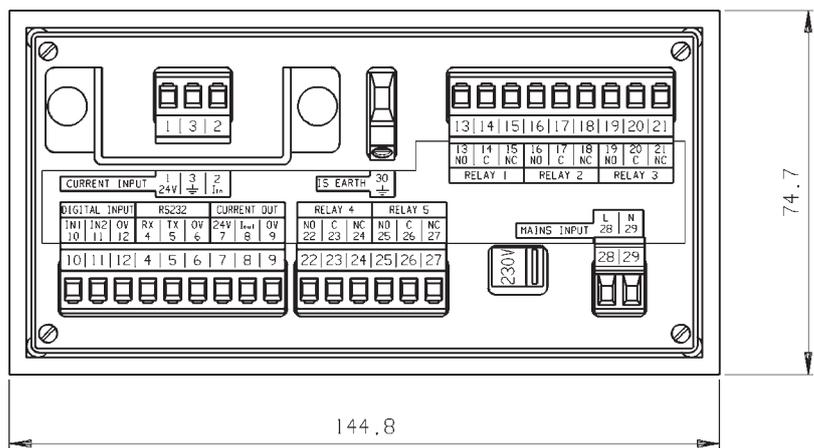
3.3.2 Electrical connections : MCU900P Panel mounting models. ⟨ε x⟩

All connections are made at the rear of the control unit using the two part terminal connectors provided. Note that it is the responsibility of the installer to observe all local regulations and approval requirements, and to ensure wiring is suitable for the load current and the insulation is suitable for the voltage, temperature and environment of the installation. Obtain and check any hazardous area work permits before applying power to the MCU900.

Figure 7 below show the layout of the terminal connections. Terminal blocks are suitable for wires 0.5mm^2 to 2.5mm^2. Insulation should be stripped back 7mm.

Note the protective shield surrounding the transmitter connection terminals (1 –3). On no account must this shield be damaged or removed as it is an integral part of the Intrinsically Safe design of the MCU900P.

The I.S. Earth (Terminal 30) must be connected to an Intrinsically Safe earth if the transmitter connected to terminals 1 and 2 is located in a hazardous area.
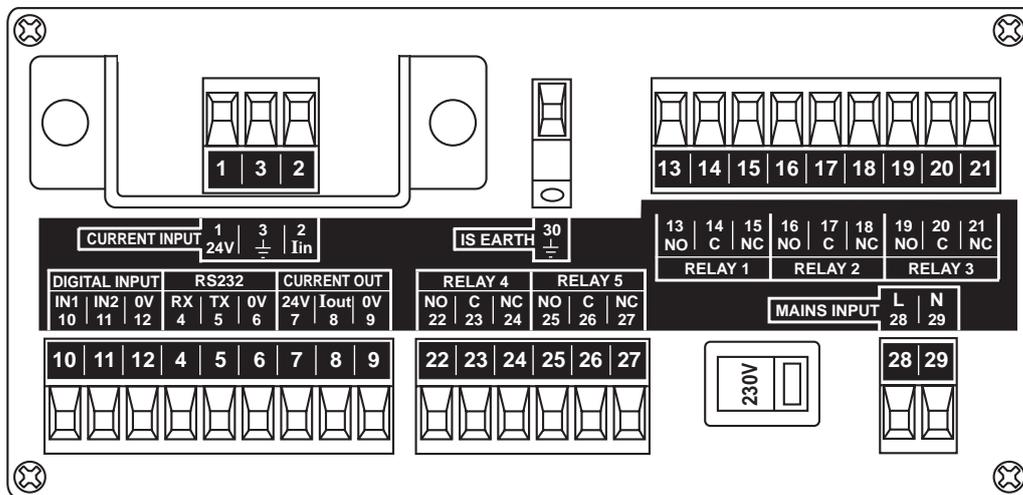
Figure 7

Connection descriptions

Terminal	Function	Layout
1	Loop supply	24V
2	Current Input	Iin
3	Screen	⏚
4-6	RS232	RX-TX-0V
7-9	Current Output	24V- Iout-0V
10-12	Digital Input 1 & 2	IN1-IN2-0V
13-15	Relay 1	NO-COM-NC
16-18	Relay 2	NO-COM-NC
19-21	Relay 3	NO-COM-NC
22-24	Relay 4	NO-COM-NC
25-27	Relay 5	NO-COM-NC
28-29	Mains Input	L-N (Mains version only)
30	IS Earth	⏚
31	Negative	– (DC version only)
32	Positive	+ (DC version only)

Data download socket MCULOG control units only:-

Connect the flying leads from the pre-wired socket provided as follows :-

- 4 - White   RX
- 5 - Red   TX
- 6 - Black   0V

Note that the plug/socket connectors are polarised to prevent inter changeability and incorrect connection.

3.4 Notes on transmitter installation and cabling ⟨Ex⟩

Connection of a transmitter to the MCU900 does not confer Intrinsic Safety on the transmitter. It is the responsibility of the user to ensure any transmitter installed in a hazardous area is suitable for use and certified accordingly for use in the hazardous area. The installation should be in accordance with a recognised code of practice.

Check the parameters of the installed system of MCU900, transmitter, any loop devices and interconnecting cable to ensure compliance with the individual product certificates and technical data (Refer to page 6).
Particular attention must be given to the cable and the transmitter to ensure that the total capacitance and inductance limits stated in the MCU technical data in Section 2.3 are not exceeded.

Cable joins are allowable in cabling to the transmitter provided that the joint is made within an IP20 (minimum) enclosure suitable for the environment, and that the wiring withstands a test voltage of 500V r.m.s. to earth.
The maximum length of cable permissible between the transmitter and MCU900 is determined by the limits imposed by the intrinsically Safe certificates of the instruments.

No other outputs from the MCU900 must be routed through a hazardous area unless protected by an additional I.S. Barrier.

It is the responsibility of the user to ensure that any transmitter is installed in accordance with the manufacturer's instructions supplied with the transmitter.

Cable between the MCU900 and the transmitter should be twisted pair shielded with the shield connected to terminal 3 marked "⏚" in the MCU900. The shield should be left unconnected at the transmitter unless there is a terminal specifically provided for this purpose.

Cable runs should be separate from any high voltage or mains cables to avoid crosstalk or interference.

Multicore cable may be used provided that other cores carry only low voltage (24V dc nom) signals and each pair of cores is individually shielded.

Loop powered transmitters must be connected to terminals 1 - 3 as shown below : (Note different arrangement of terminals in MCU900W and MCU900P).
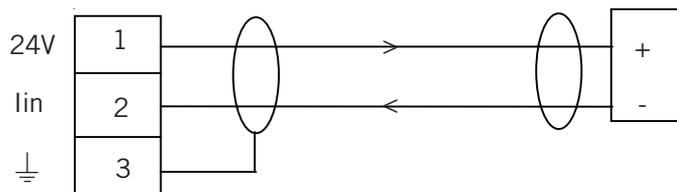
Figure 8

The MCU900 is able to provide 24V dc to a transmitter with a max load of 25mA.
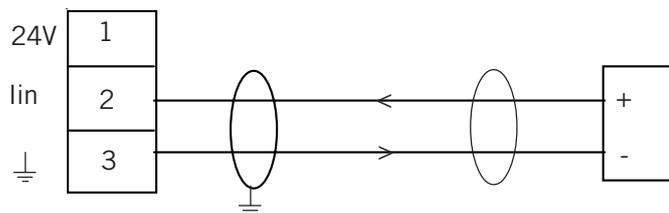Separately powered transmitters must be connected to terminals 2 and 3 as shown below :

Figure 9

3.4.1
Special notes for connecting HART transmitters (including MSP900SH-A transmitters) to the MCU902
Control Unit.

The MCU902 Control Unit takes the input from two HART transmitters and will perform various calculations
to create the sum, difference or product of the two inputs.
The transmitters must be HART compatible for the MCU902 to operate correctly.

Connection of the transmitters to the MCU902 may be by cabling both transmitter cables into the MCU902
using the cable glands provided, or may be on a single cable using one of the cable glands provided, with
the two transmitters connected to this cable in a suitable local junction box.
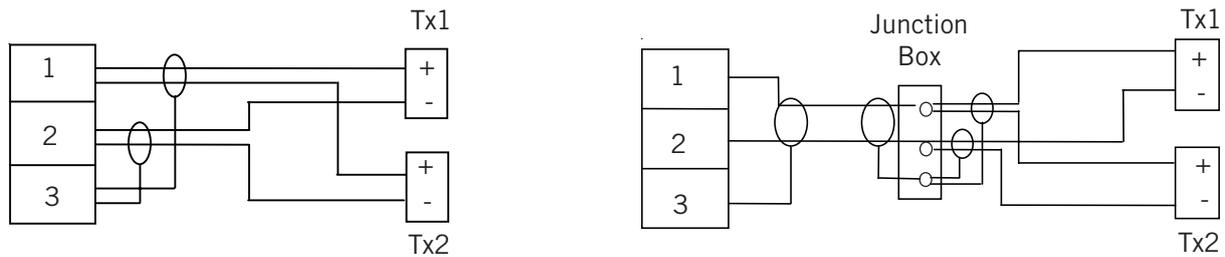
MCU902 to transmitter connection

For correct operation, each transmitter must be changed to "multi-drop" mode so that they can
communicate with the MCU902 through a common connection. Each transmitter must therefore have it's
poll address changed from the factory default address of "0" to a unique address. The MCU902 is used to
achieve this, but this requires that the transmitters be connected in sequence as detailed below :-

a)   With the power supply turned off, connect the first transmitter to terminals 1-3 in the MCU902
        control unit.
b)   Check that the power selector switch is set to the correct voltage (115 or 230 V ac) on mains unit
        and turn the power supply on.
c)   The MCU902 will detect the transmitter and automatically change the poll address of the
        transmitter from "0" to "1". This transmitter will also be automatically allocated to Channel 1 of the
        MCU902.
        Note, the MCU902 control unit may also offer the user the opportunity to set the bottom reference
        of the MSP900SH-A transmitter at this point, which may be done or ignored by pressing the "Esc."
        Key.
d)   Turn the power supply off and connect the second transmitter, either at the same terminals 1-3 as
        the first transmitter or at a local junction box, such that both transmitters are now connected.
e)   Turn the power supply back on and the MCU902 will once again search for and detect any
        transmitters connected. Once the second transmitter is found, the MCU902 will automatically
        change the poll address from "0" to "2", and the transmitter will also be automatically allocated to
        Channel 2 of the MCU902.
        Note, the MCU902 control unit may also offer the user the opportunity to set the bottom reference
        of the MSP900SH-A transmitter at this point, which may be done or ignored by pressing the "Esc."
        Key.

Installation of the transmitters is now complete.

3.5 Power connection

If the MCU900 is powered by mains AC power, select the AC voltage as 230V or 115V using the voltage selector slide switch.
If dc powered ensure the supply is adequate (15 - 30Vdc). Do not exceed 30Vdc.

A switch or circuit breaker should be installed in close proximity to the instrument, and labelled as such.

Although the MCU900 meets all European standards for surge immunity on power and signal lines, it is recommended that lightning suppressors, such as made by Telematic Ltd., are fitted if local conditions make this advisable.

3.6 Earthing ⟨Ɛx⟩

MCU900 control units are double insulated and DO NOT require a mains earth.

DO NOT connect a mains earth to terminal 30.

Terminal 30 is provided for use as an Intrinsically Safe (or functional) earth connection which MUST be used when a transmitter is mounted in a hazardous area and is connected to terminals 1 & 2.

Terminal 3 is to be used for connection of the shield of the twisted pair transmitter cable when the MCU900 is powering the transmitter. See Fig. 8 and 9. Note that this shield should be left unconnected at the transmitter end unless there is a terminal provided specifically for this purpose.

3.7. Relays

The 5 voltage free contact relays are grouped in the following configuration :

MCU900W Wall Mount Control Unit	MCU900P Panel Mount Control Unit
Relay 1 & 2 - Group 1	Relay 1, 2 & 3 - Group 1
Relay 3 & 4 - Group 2	Relay 4 & 5 - Group 2
Relay 5 - Group 3	

The relay NO-C-NC labels represent the relay terminals in the de-energised state.

Note that, whilst each relay is individually double insulated, their arrangement is such that insulation between relays in the same group is standard or 'basic' insulation.
Care must be taken in order to avoid the risk of electric shock. It is not allowed to use relays in the *same Group* to control circuits with both mains and dc or low voltage circuits.

3.8   Current Output

The current output may be connected in internally powered mode or loop-powered mode.
See connections in Fig 10 below.

In Loop-powered mode an external power source is required. A minimum of 2.5V is required across
terminals 7 and 8 for correct operation. The external voltage must not be more than 30V dc.

Internally powered   **Loop powered**
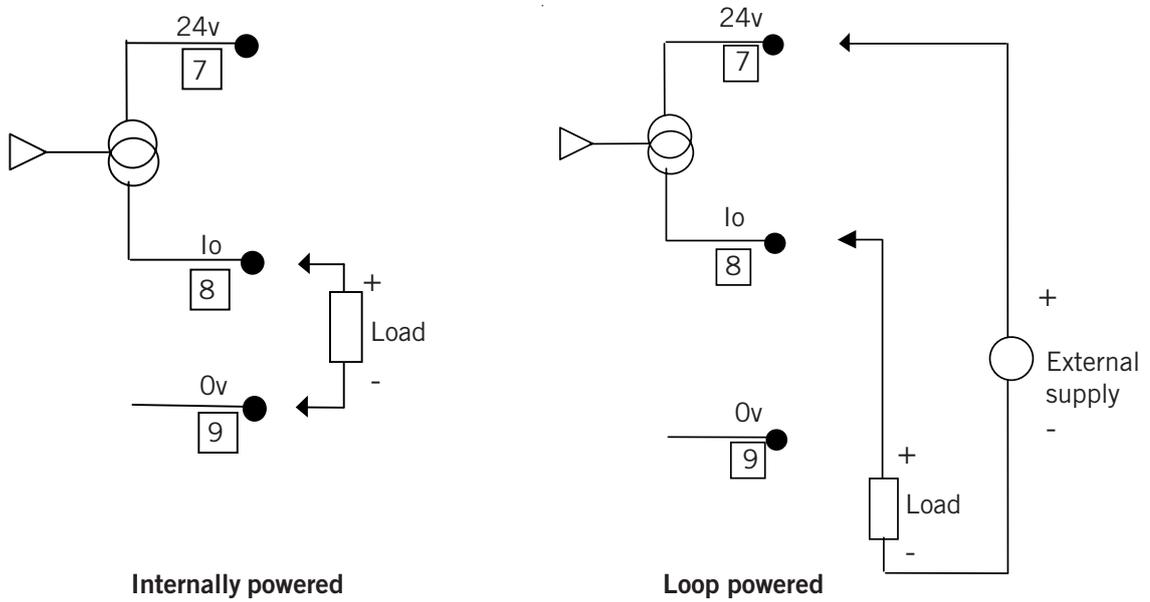
Figure 10 : Alternative current output configurations

3.9   Digital Control Voltage free contact inputs

There are 2 trigger inputs IN1 and IN2. The digital trigger input is connected as shown below:
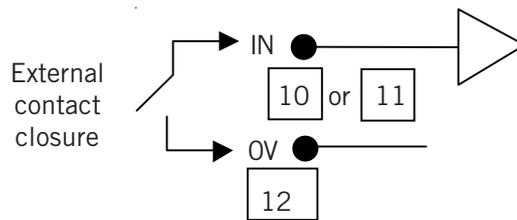
Figure 11 : Connection for external trigger input

3.10 RS232

The RS232 connections (Terminals 4-6) may be used for exchanging data with a PC or handheld device. The configuration of the Control Unit may be read or modified using an application such as Mobrey H-Conf401 running on a PC.

For the MCULOG, the logged data is downloaded from the RS232 port via a socket connection provided, using Mobrey LogView running on a PC.

    4   Rx
    5   Tx
    6   0V

4.0 Maintenance / Inspection

CONTROL UNIT
No maintenance is required beyond occasional cleaning of the enclosure with a damp cloth. Solvents or bleaches should not be used. Do not modify or attempt to repair the unit.

Check lid and glands are tight, also check unit for damage and if damaged do not use.

5.0. Accessories

Rack mounting kit for MCU900P Panel Mounting models.

Comprises one pre-cut aluminium panel, dimensions 128.5mm high x 213mm wide x 2.5mm thick pre-drilled and supplied with 4 captive screws and bushes to allow fitting in a standard 19" Rack. (3U x 42HP) Specify Rosemount Measurement part number MSP-RMK1 (one per MCU900P)

IP65 Hood for IP65 sealing of MCU900P Panel Mounting models.

Comprises a transparent hood which is positioned over the fascia of the MCU900P and which is secured in place when the control unit is clamped into the panel. Note that 2 extra clamps/clips are required as detailed below.

Contact Bopla Gmbh and order :-
1 off hood   NGS74GHN – 37007400
1 off pair of mounting clips   NGS-NK – 37003000

Bopla GmbH   Tel: (49) 05223 969000
                             Fax: (49) 05223 969100
                             www.bopla.de for a list of local agents and distributors.

APPENDIX I

Introduction to programming the MCU900

The following few pages give a brief introduction to programming the MCU900. More detailed information is given in the Reference Manual IP2030/RM, available from Rosemount Measurement or by download from the Mobrey brand pages at the website www.emersonprocess.com.

A1 The MCU900 keypad and menu navigation

The 4 red/white arrow keys are used to move around the menu structure, and the yellow enter key to confirm data input. The red Esc key allows a backward step to the previous screen.

Practice now using the keypad to customise the system settings in the MCU900. You may like to set the date, time and language of the display.

- Press the enter key to display the Main Menu.
- Press the down arrow once to highlight "SETUP" and press the enter key. (Note the beep which confirms each key press)
- Select "MCU CONTROL UNIT" and press the enter key to reveal the "SETUP" menu.
- Use the down arrow to move down the list. Note that there are more than the three items shown in the list, as indicated by an arrow pointing down in the lower right of the screen. Highlight "SYSTEM" and press the enter key.
- The SYSTEM menu comprises 6 items. Press the down arrow several times, or the right arrow once, to highlight "SETTINGS" and press the enter key.
- Select "Time" and press the enter key. You may now edit the time if appropriate.
- Press the enter key which will highlight the first "hours" digit. Use the up and down arrows to select the correct value then press the right arrow to move to the next digit. Continue until the time shown is correct, then press the enter key to save the time shown. Press Esc to jump back to the "SETTINGS" screen and select another setting to customise as appropriate, for example, display language.
- Once the MCU900 has been customised to your satisfaction, press the Esc key repeatedly to return to the main display screen.

A2 Programming the MCU900 for your application

The MCU900 is capable of complex control functionality, much of which is specific to certain duties. To programme the MCU900 for a specific application, it has to be told what the application is and then certain application details to allow the MCU900 to perform the necessary calculations.

To assist the user in understanding MCU900 programming, it is convenient to imagine these application specific data to be stored in memory locations called "Parameters", each of which has a unique address. Not all parameters are necessary for each application.
Programming the correct parameters for your particular application is made easy by Rosemount Measurement "Wizards", which navigate the user around the menu structure and request only the data needed for your chosen application.

You are strongly recommended to use these Wizards whenever possible.

Before the Rosemount Measurement wizards are explained in more detail, it is important that the user understands the input to the MCU900 and what is being shown on the display.

A2.1   Understanding the input to the MCU900 and what is shown on the display.

The MCU900 may be used with either a 4-20mA transmitter or a digital HART transmitter.

A2.1.1   Using a transmitter with a standard 4-20mA output.

Any transmitter with a 4-20mA output may be connected to the MCU900.
Exactly what this 4-20mA represents is a function of the transmitter. The transmitter can not be re-ranged by the MCU900.
For example, if a level transmitter designed to give a 4-20mA output over 5m is installed in a 3m deep tank, the input to the MCU900 is going to be 4-13.6mA.

When a standard 4-20mA transmitter is connected, the MCU900 will recognise the input and the PV shown on the main display will be in % of current input, where 4mA is 0% and 20mA is 100%.
Note, in the example above, the maximum current that the MCU900 will see will be 13.6mA, so the PV on the display will only ever show 60% maximum.
It is possible to scale this input in the MCU900 and give a 4-20mA output from the MCU900.

A2.1.2 Using a HART compatible transmitter

Any HART compatible transmitter can be connected to the MCU900.
The MCU900 will recognise a HART transmitter and automatically start digital communications. The PV shown on the display will be extracted directly from the transmitter, along with the associated measurement units.

You will notice a small "~" icon next to the padlock in the upper left corner of the display which shows digital communications are in operation.

A2.2 Using Rosemount Measurement Wizard assisted programming

With a transmitter connected and operating, you should now tell the MCU900 what duty it is to perform – Wet well pump control, Level measurement, Contents measurement or Flow measurement.

- Press enter and navigate to the Duty Wizard selection screen "SETUP / MCU900 CONTROL UNIT / DUTY (mode) / Duty Wizard.
- Press enter to start the duty wizard and select the duty for the MCU900
- Enter data as requested by the MCU900, which will automatically set up the input scaling and current output of the MCU900.

At the end of any duty wizard you will automatically be offered further wizards which are appropriate to you chosen application. For example, the "MCU Relay WIZARD", which allows you to set up relay control or alarm points as required, or the "TOTALISER WIZARD" relevant to open channel flow measurement and totalisation.

Further details of Rosemount Measurement Wizards are given in the reference manual IP2030/RM, available at the Mobrey brand pages on the website www.emersonprocess.com.

A2.3   Useful programming information

The following information is given to assist users in programming other popular functions of the MCU900.

A2.3.1 Password protection
The MCU900 may be protected from unauthorised programming by setting a PIN number.
Follow the path "SETUP / MCU CONTROL UNIT / SYSTEM / SETTINGS / PIN" and enter a 4 digit PIN.

A2.3.2 Configure the display
The MCU900 display may be customised to show a variety of data. The display is sectioned into 3 horizontal zones, Upper, Middle and Lower.
Follow the path "SETUP / MCU CONTROL UNIT / OUTPUT / DISPLAY" and select which part of the display you wish to customise. You may then select from a list of data which may be displayed there.

A2.3.3 Set up a digital input
Two voltage free contact inputs may be connected to the MCU900 and be programmed to cause certain actions should they activate.
Follow the path "SETUP / MCU CONTROL UNIT / DIGITAL INPUT / Digital Input 1 " and you can then customise the input to suit your requirements.

A2.3.4 Commissioning aids
The MCU900 has several useful commissioning aids on-board.
Follow the path "SETUP / MCU CONTROL UNIT / SYSTEM / TEST " and you can choose to autocycle the MCU900 over the full range of the current input without changing the transmitter input or level in a tank, trim input and output currents or use the MCU to drive a set output current into the loop.

A2.3.5 Re-setting default values
If the MCU900 is not operating as you would expect or you are unsure of some of the data you have programmed in, you can re-set the MCU900 to it's factory default condition. This action causes default values to be loaded into all of the MCU900 parameter locations. Note, all previously entered data will be overwritten or lost.
Follow the path "SETUP / MCU CONTROL UNIT / SYSTEM / DEFAULTS" and follow the instruction to load defaults.

A2.3.6 Direct parameter access
Proficient users who become familiar with the parameter numbers of the MCU900 can access parameters directly by parameter number.
Follow the path "DIRECT" and select either Pxxx or Dxxx. "D" type parameters are diagnostic parameters and are read only.
Once a parameter number is entered and displayed, the user can use the up and down keys to scroll through the full parameter list.

APPENDIX II

MCULOG Programming menu

Function Menu Option	Sub-menu Level 1	Sub-menu Level 2	Sub-menu Level 3	Par No.	Parameter Name	Units	Default
Cancel Password					Cancel Password	-	-
Go Offline ?					Go Online/Offline ?	-	-
SETUP	INPUT CHANNEL			P111	Channel 1 Input Source	-	Tx1 : PV
				P321	Current Input 1 Damping	sec	5
				P112	Channel 1 Input Offset	-	0
				P113	Channel 1 Profile	-	Scaled
				P114	Channel 1 Input Scale Factor	-	1
				P115	Channel 1 Non-Linear Data	-	0
				P116	Channel 1 Post Scale	-	1
				P117	Channel 1 Low Cut-off	as P201	AUTO
	DUTY(Mode)				Duty Wizard	-	0
		UNITS		P200	PV Units	-	%
				P201	SV Units	-	%
				P202	TV Units	-	%
				P203	FV Units	-	°C
		PV DAMPING		P210	Output PV Damping	s	0
				P240	Description	-	MCU CONTROL
				P241	Message	-	MESSAGE
				P242	Tag Number - Control Unit	-	MSP2000
		CUSTOM		P250	Start On	-	None
				P251	Stop On	-	None
				P252	Stop If	-	None
				P253	Start Time	hh.mm	07:00
				P254	Interval	hh.mm	01:00
				P255	Start Time #2	hh.mm	00:00
				P256	Interval #2	hh.mm	00:00
				P257	Max Retries	-	10
		OVERRIDES		P270	Auto Sequence Enable	-	Off
				P271	Auto Sequence Qualifier	-	0
				P272	Pump-down Relay	-	0
				P273	Pump-down Interval	hh.mm	00:00
				P274	Pump-down Duration	hh.mm	00:00
				P275	Energy Saving Start Time	hh.mm	00:00
				P276	Energy Saving Relay Select	-	0
				P277	Scum Line Prevention variance	-	0
				P278	Scum Line Prevention relay	-	0
	DIGITAL INPUT	DIGITAL INPUT 1		P340	Digital Input 1 Action	-	Free
				P341	Digital Input 1 Delay	mmm:ss	000:00
				P342	Digital Input 1 On State	-	Closed
		DIGITAL INPUT 2		P345	Digital Input 2 Action	-	Free
				P346	Digital Input 2 Delay	mmm:ss	000:00
				P347	Digital Input 2 On State	-	Closed
	OUTPUT	CURRENT OUTPUT		P400	Lower range value	as P200	0
				P401	Upper range value	as P200	100
				P402	Alarm action	-	3.6mA
		RELAY			Relay Wizard	-	0
					Reset RL Params		
			RELAY 1	P410	Relay 1 Mode	-	None
				P411	Relay 1 PV ON Point	as P200	0
				P412	Relay 1 PV OFF Point	as P200	0
				P413	Relay 1 Minimum ON Time	mmm:ss	000:00
				P414	Relay 1 Maximum ON Time	mmm:ss	000:00
				P415	Relay 1 Minimum OFF Time	mmm:ss	000:00
			RELAY 2	P420	Relay 2 Mode	-	None
				P421	Relay 2 PV ON Point	as P200	0
				P422	Relay 2 PV OFF Point	as P200	0
				P423	Relay 2 Minimum ON Time	mmm:ss	000:00
				P424	Relay 2 Maximum ON Time	mmm:ss	000:00
				P425	Relay 2 Minimum OFF Time	mmm:ss	000:00
			RELAY 3	P430	Relay 3 Mode	-	None
				P431	Relay 3 PV ON Point	as P200	0
				P432	Relay 3 PV OFF Point	as P200	0
				P433	Relay 3 Minimum ON Time	mmm:ss	000:00
				P434	Relay 3 Maximum ON Time	mmm:ss	000:00
				P435	Relay 3 Minimum OFF Time	mmm:ss	000:00
			RELAY 4	P440	Relay 4 Mode	-	None
				P441	Relay 4 PV ON Point	as P200	0
				P442	Relay 4 PV OFF Point	as P200	0
				P443	Relay 4 Minimum ON Time	mmm:ss	000:00
				P444	Relay 4 Maximum ON Time	mmm:ss	000:00
				P445	Relay 4 Minimum OFF Time	mmm:ss	000:00
			RELAY 5	P450	Relay 5 Mode	-	Fault
				P451	Relay 5 PV ON Point	as P200	0
				P452	Relay 5 PV OFF Point	as P200	0
				P453	Relay 5 Minimum ON Time	mmm:ss	000:00
				P454	Relay 5 Maximum ON Time	mmm:ss	000:00
				P455	Relay 5 Minimum OFF Time	mmm:ss	000:00
			ALARM	P490	Rising level alarm delay	mmm:ss	000:00
				P491	Relay operations	-	0
				P492	Relay operations relay select	-	Disabled
				P493	Relay runtime	hh.mm	00:00
				P494	Relay runtime relay select	-	Disabled
				P495	Pump efficiency limit	-	0
				P496	Pump Efficiency relay select	-	0
				P497	No activity delay	hh:mm	00:00
				P498	No activity relay	-	0

				Code	Description	Unit	Value
		TOTALISER			Totaliser Wizard	-	0
				P530	Totaliser Factor	-	0
				P531	Totaliser Units	-	None
				P534	Totaliser Pulse width	ms	100
				P535	Sampler Factor	-	0
		ALARM		P540	PV Out of Limits	-	None
				P541	Current Output Saturated	-	None
				P542	Logging Memory Filling	-	None
				P543	Digital Input 1 Active	-	None
				P544	Maximum number of retries	-	None
				P545	Current Input Saturated	-	None
				P547	Rising level	-	None
			RELAY	P548	Relay operations	-	None
				P549	Relay runtime	-	None
				P550	Pump efficiency	-	None
				P551	No activity	-	None
		FAULT		P560	System Fault Alarm	-	Both
				P561	Control Unit Temperature over Limits	-	None
				P562	Transmitter Fault	-	Both
		DISPLAY		P570	Display Select 1 (upper)	-	P731-Time
				P571	Display Select 2 (mid)	-	D800-PV
				P572	Display Select 3 (lower)	-	Bargraph
				P573	Decimal places	-	3
				P575	Backlight On/Off	-	On
	LOGGING				Logging Wizard	-	0
				P590	Logging interval	min	0
				P591	Fast logging select mode	as P200	0 (=Off)
				P592	Do/Do not overwrite old data	-	On
				P593	Low Memory Alarm Threshold	%	0
	SYSTEM	TEST	AUTO-CYCLE		Self Test	-	-
			DISPLAY		Display Test	-	-
			CURRENT INPUT		4mA input adjust	-	-
					20mA input adjust	-	-
			CURRENT OUTPUT	P700	4mA output adjust	-	-
				P701	20mA output adjust	-	-
				P702	Set Current	mA	0
		DEFAULTS			DEFAULTS	-	-
		COMMS		P710	Comms Address	-	0
				P711	Interface Type	-	Log download
				P712	Baud Rate	-	9600
				P713	No. of Start Bits	-	1
				P714	No. of Data Bits	-	8
				P715	Parity of Data	-	Even
				P716	No. of Stop Bits	-	1
		SETTINGS		P730	Date	-	01/01/00
				P731	Time	-	-
				P734	Date format	-	dd/mm/yy
				P735	Keypad Sound On/Off	-	On
				P737	Language	-	English
				P740	Personal Identification Code	-	0000
					Xmtr Wizard	-	0
		FIXED		D750	Model Code	-	MCU902WX-A
				D751	Serial Number - Control Unit	-	000000
				D752	Hardware Revision	-	8
				D753	Software Version	-	12
			HART	D760	Manufacturer's Code	-	(as applicable)
				D761	Unique ID	-	000000
				D762	Universal Command Revision	-	5
				D763	Transmitter Spec. Command Rev.	-	1
				D764	Preamble Bytes	-	5
				D765	Flags	-	1
MONITOR	READINGS	ANSWERS		D800	Primary Variable	as P200	-
				D801	Secondary Variable	as P201	-
				D802	Tertiary Variable	as P202	-
				D803	Fourth Variable	as P203	-
				D804	Ullage	as P200	-
				D805	% Current Output	%	-
				D806	Current output	mA	-
				D809	Rate of Change	PV/min	-
		RELAY	RELAY OPERATIONS	D811	Relay 1 Operations	-	0
				D812	Relay 2 Operations	-	0
				D813	Relay 3 Operations	-	0
				D814	Relay 4 Operations	-	0
				D815	Relay 5 Operations	-	0
				D820	Relay Status	-	-
			RELAY RUN TIME	D821	Relay 1 Run-Time	hh:mm	-
				D822	Relay 2 Run-Time	hh:mm	-
				D823	Relay 3 Run-Time	hh:mm	-
				D824	Relay 4 Run-Time	hh:mm	-
				D825	Relay 5 Run-Time	hh:mm	-
				D828	Totaliser 1 Value	P531	-
				D830	Alarm report	-	None
				D831	Fault report	-	None
	DIAGNOSTICS			D835	Digital input status	-	-
				D840	Current input	mA	-
				D842	Current input %	%	-
				D844	Temperature of Control Unit	°C	-
				D845	Time to next Pump Down	hh:mm	-
				D846	Logging Memory Free	%	-
				D848	Date of Last Change	dmy	--/--/--
				D849	Date of 1st Power-On	dmy	--/--/--
		CHANNELS		D851	Channel 1 output	P201	-
		PUMP EFFICIENCY		D861	Pump efficiency RL1	%	-
				D862	Pump efficiency RL2	%	-
				D863	Pump efficiency RL3	%	-
				D864	Pump efficiency RL4	%	-
DIRECT	Pxxx					-	-
	Dxxx					-	-

CONTENTS : SECTION 2

INTRODUCTION

1.1   System Overview

Models covered in this supplement

Control units   -   MCULOG

The MCULOG system is installed, operated and programmed in an identical manner to the MCU901 control unit. For detailed instructions as regards the installation and programming of the controller, refer to IP2042/QS and IP2030/RM respectively.
The MCULOG differs in that it has additional logging software and memory which allows it to record data related to the display, plus a data download socket.

This supplement highlights the extra Parameters used for logging and the downloading of the logged data.

Refer also to the Quickstart manual IP2042/QS for an overview of the MCULOG.

1.2   Logging Options

The controller can log whatever is displayed in the middle portion of the display. For example, if the flow rate is being displayed, then it is that which the controller will log.

The time interval at which readings are logged can be varied at minute intervals from 1 minute to 99 minutes.   The average value stored at this time is the cumulative total taken at 1-minute intervals, divided by that number of minutes.

The total number of samples which can be recorded is 4,800 at which point either the first value can be overwritten or sampling can stop.

In addition, the totalised value at midnight for the last 60 days is recorded, along with the maximum instantaneous value seen in each 24 hour period.

1.3   Data download options

Logged data is downloaded from the MCULOG using the RS232 socket provided.

There are two Rosemount Measurement devices available for downloading data :-

- Data may be retrieved from the controller by means of the Handheld MSPLOG-CK5 Psion based terminal, which may be, in turn, downloaded into a PC for further investigation/analysis (see Mobrey Log-View below) or it can simply be printed out for visual inspection/analysis.

- Mobrey Log-View is a user friendly Windows based software package which is installed on a portable PC. Log-View is supplied with a download lead which allows connection of a portable PC using the 9 pin RS232 connection to the MCULOG download terminal.

  Log-View automates data download and automatically concatonates data into a sequential file for viewing and manipulation. See data sheet IP122 for full details.

PARAMETERS ASSOCIATED WITH THE LOGGING FUNCTION

2.1   Real-time Clock   P730, P731 & P734

To allow you to recall the data over a certain period, the MCU900 controller needs to know what the time and date are. This information is entered on parameter P730, P731 and P734.

Example:

Date   P730 dd/mm/yy
Time   P731 hh : mm
Format   P734 dd/mm/yy or mm/dd/yy or yy/mm/dd

2.2   Logging Interval   P590
(default value : 0 minutes)

Set P590 to the value in minutes required between each sample to be logged.

2.2.1 Start Logging   P590

To start logging, set the logging interval P590 to any value other than 0.

If the power to the controller is lost for less than the Logging interval then the next sample will occur as planned but the average flow will be based on the information gathered in that time.

E.g.   Logging interval is set to 10 minutes. Power is lost 2 minutes into the interval and restored 4 minutes later. The flow will be averaged over 6 minutes. If the power is lost for longer than the logging interval then all the stored data will be lost. However, on restoration of power logging will re-commence.

When the controller is logging, the "LOG" icon to the lower right of the display will start flashing at about once per second. Note, the flashing rate bears no relationship to the sample rate.

2.2.2 Stop Logging   P590

If P590 is set to 0 this will stop the controller logging.

Alternatively, this may be achieved by use of the MSPLOG-CK5 or Mobrey Log-View software.

It is still possible to retrieve the data using the MSPLOG-CK5 or a PC loaded with the Rosemount Measurement software Mobrey Log-View.

Important note : When the logging interval P590 is re-set to a non-zero , all logged data is cleared.

2.2.3 Re-start logging   P590

To recommence logging, P590 must be reset to a non-zero value. All logged data is cleared by this action.

Alternatively, this may be achieved by use of the MSPLOG-CK5 or Mobrey Log-View software.

2.2.4 Re-setting the logger memory   P590

Changing the logging interval P590 from 0 to a logging interval in minutes will clear **all** logged data (i.e. the 4800 sample data, the 60 midnight totals and the maximum records of each 24 hour period).

Changing the logging interval from a non-zero interval to a new non-zero value will clear the 4800 sample data only.

2.3 Fast logging Rate Threshold   P591
(default value : 0 = OFF)

The controller can be set such that if the level/flow rate exceeds a user defined limit entered on P591, the sample rate will increase to one sample per minute.   When the level/flow rate once again drops below this limit the sample rate will revert to that defined by P590.

When the fast logging rate is in operation a flag is set, in the logged data, highlighting that this has occurred.

By having a default of 0 the fast logging rate is disabled.

2.4 Data overwrite   P592
(default value = ON)

When P592 is set to "ON", logging is continuous. When the 4800 sample memory is full, the oldest data is overwritten.

When P592 is set to "OFF", logging will cease when the 4800 sample memory is full.

If an alarm is required when the memory reaches a certain level or when it is full, refer to section 2.5

2.5 Low memory alarm   P593
(default value = 0 %)

The user may allocate an alarm to indicate when the memory **remaining** has fallen to a user defined percentage P593.

The user must then also set the action to be taken when this occurs. See 2.6 below.

2.6 Memory filling (alarm)   P542
(default = OFF)

If an alarm is required when the 4800 sample memory has only a user defined percentage remaining, the MCULOG can be programmed to give an alarm using P542.

A choice of activating a relay, driving the output current to a set level or doing both is available.

A useful feature is the ability to check the amount of memory still free. This is viewable on a Diagnostic parameter, D846, which shows the percentage of UNUSED memory.

2.7   20 Point Curve Matching   Refer to IP2030/RM

Where the use of the pre-programmed 3/2 or 5/2 flow laws is not accurate enough for the measurement of flow in a flume or over a weir, enhanced flow calculations in accordance with BS3680 : Part 4 are possible using the 20 point curve matching facility. This approach takes into account many factors associated with open channel flow measurement such as boundary layer effects, flow discharge co-efficients and liquid viscosity.

A pro-forma flow questionnaire requesting full site details and process conditions is available from Rosemount Measurement.   On receipt of the completed form, Rosemount Measurement will use dedicated software to calculate the values necessary for each of 20 points on the flow curve which are then entered into the MCULOG.

MCULOG will then give a flow readout in accordance with BS3680 : Part 4.

For applications outside the scope of Part 4, contact Rosemount Measurement.

3. DOWN LOADING OF LOGGED DATA

Logged data can be retrieved from the MCULOG using the MSPLOG-CK5 hand held communicator (HHC). This device can be used to collect data from the MCULOG, view the data and select certain data for a date/ time analysis. The logger can also be stopped and reset by this HHC. Data can be collected without stopping or resetting the logger. The HHC uses a menu driven programme, which provides easy operation of the data collection functions.

Once data has been collected it is stored in the HHC internal memory ready for down loading to a PC back at the workstation.

3.1 MSPLOG-CK5 Hand Held Communicator

3.1.1 Assembly Instructions and Connections to the MCULOG

The MOBREY MSPLOG-CK5 Hand Held communicator is supplied as a kit of items which are assembled as follows:

1. Remove the lower sliding cover of the Psion organiser completely to expose the battery compartment lid at the base of the keypad, and the two slots for Datapaks behind the right hand side of the keypad.

2. Remove the upper of the two blank Datapak mouldings and insert the pre-programmed Datapak, pressing the unit home.

3. Remove the battery compartment lid and insert the 9V battery, positive terminal first. Replace the battery compartment lid and the lower sliding cover over the base of the Psion Organiser. Leave the keyboard exposed.

4. At the top of the Psion Organiser above the LCD, slide the cover across to the right to expose the connector. Insert the Comms Link with green plug interface Unit in this slot.

5. The Comms Link Interface Unit has another socket at the top left hand side for connection of a standard Psion external power unit as an alternative to battery operation.

3.1.2. Start up

The main menu selection of the Psion Organiser is automatically amended to include the "MCULOG" option when the Datapak is fitted and clear/on pressed twice. This cannot be permanently repositioned nor deleted.

To disconnect the interface unit it is necessary to press down the catch in the top centre face of the unit to release the lock, when the interface can be pulled vertically away.

3.2 How to drive a Psion based communicator

3.2.1 Familiarity with the Psion

The Psion is supplied with several manuals to describe its function. The main keyboard functions that are important are the yellow keys. Press "ON" and see the functions of the arrows to move the cursor around the selections in the menu. Press "EXE" to see the Psion functions. Note that a short cut to selecting a menu item is to press the key with the initial letter of the required selection – for example "O" switches the unit "OFF".
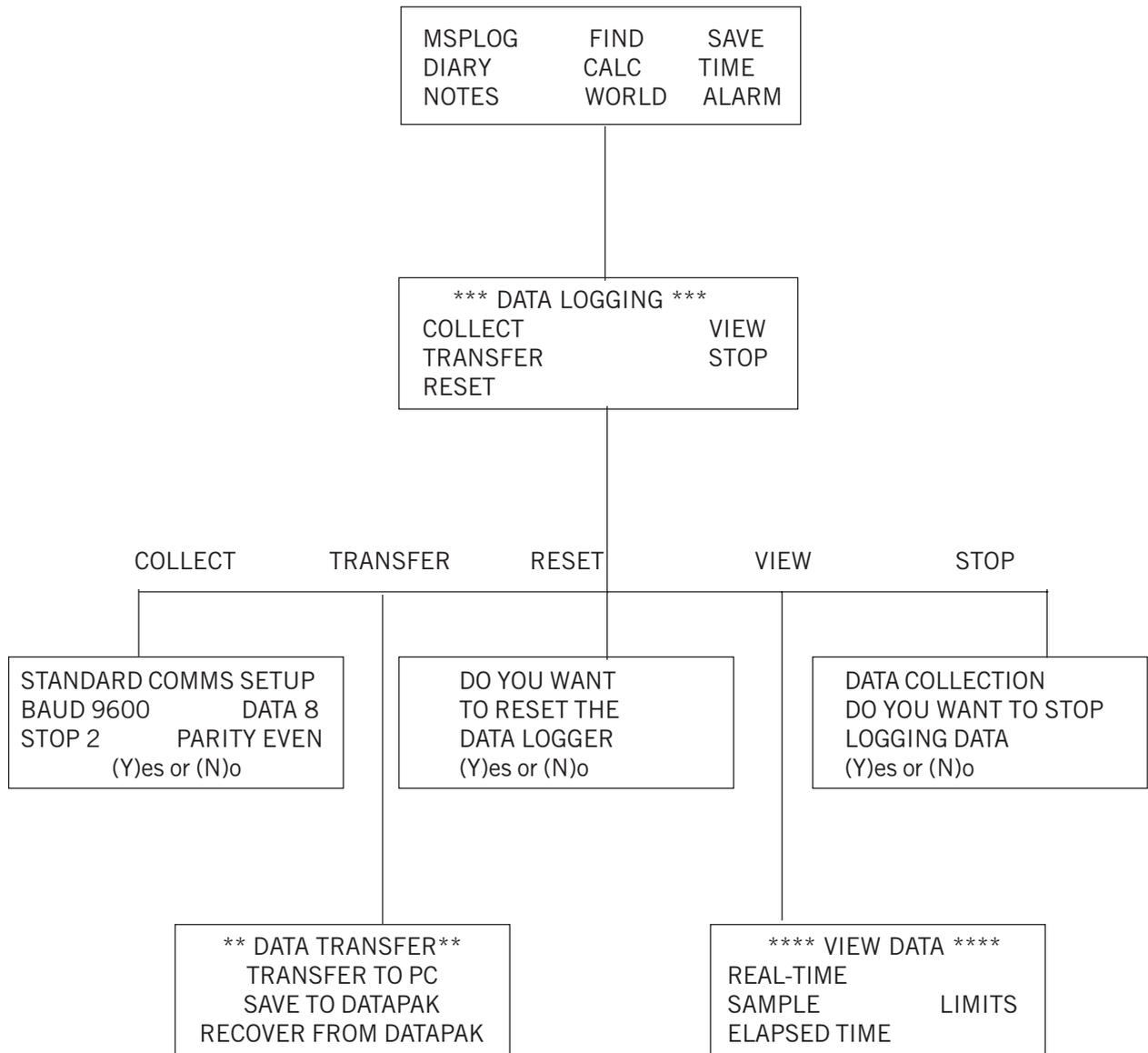
Note that if the "CALC" option is selected, the keyboard changes from the "Alphabet" marked on the keys, to the "numbers" and symbols marked above the keys. The Psion selects the expected function required of the keyboard. This function can be changed back by depressing the "SHIFT" key.

3.2.2 MCULOG Menu and programme structure

The MSPLOG-CK5 terminal recognises the MCULOG as an ultrasonic MSP based system and will refer to it at all times as "MSPLOG"

If "MSPLOG" is selected from the start up menu on the Psion, by pressing "EXE", the HHC displays the main MSPLOG menu as shown overleaf.

MSPLOG program structure for the HHC

```
┌─────────────────────────────┐
│ MSPLOG      FIND     SAVE    │
│ DIARY       CALC     TIME    │
│ NOTES       WORLD    ALARM   │
└─────────────────────────────┘
              │
┌─────────────────────────────┐
│   *** DATA LOGGING ***       │
│ COLLECT            VIEW      │
│ TRANSFER           STOP      │
│ RESET                        │
└─────────────────────────────┘
              │

  COLLECT     TRANSFER     RESET        VIEW         STOP
```

```
┌──────────────────────────┐   ┌──────────────────────┐   ┌───────────────────────────┐
│ STANDARD COMMS SETUP      │   │   DO YOU WANT        │   │   DATA COLLECTION         │
│ BAUD 9600        DATA 8   │   │   TO RESET THE       │   │   DO YOU WANT TO STOP     │
│ STOP 2      PARITY EVEN   │   │   DATA LOGGER        │   │   LOGGING DATA            │
│     (Y)es or (N)o         │   │   (Y)es or (N)o      │   │   (Y)es or (N)o           │
└──────────────────────────┘   └──────────────────────┘   └───────────────────────────┘
```

```
┌──────────────────────────┐                              ┌──────────────────────────┐
│   ** DATA TRANSFER**      │                              │   **** VIEW DATA ****     │
│    TRANSFER TO PC         │                              │ REAL-TIME                 │
│    SAVE TO DATAPAK        │                              │ SAMPLE          LIMITS    │
│    RECOVER FROM DATAPAK   │                              │ ELAPSED TIME              │
└──────────────────────────┘                              └──────────────────────────┘

      See Section 5                                              See Section 6
```

When entering any of the 'DATA LOGGING' menus the HHC display provides messages to prompt and inform you of any actions.   By using these prompt messages the use of HHC and its program structure has been made user friendly.

4. DATA LOGGING

4.1 'COLLECT' Menu

Collecting data can be achieved without stopping or resetting the logger (MCULOG). Data collected will be logged data in the sample store, and the 60 midnight totaliser values, it will delay the next sample or echo measurement by the time it takes to collect the data. It will take approximately 3 mins 30 secs to collect all 4,800 samples.

On entering the 'COLLECT' menu the first screen message is:

```
STANDARD        COMMS SETUP
BAUD            DATA 8
STOP 2          PARTLY EVEN
(Y)es or        (N)o
```

Unless the MCULOG has been specially modified for a non-standard comms set up, 'Y' should be pressed. See appendix 2 for further details on the Comms set up.

The next message to be displayed is :

```
DATA COLLECTION
DO YOU WANT TO STOP
LOGGING DATA
        (Y)es) or (N)o
```

Pressing 'Y' will stop the MCULOG from logging. Data can still be retrieved from MCULOG.

Pressing 'N' will have no effect on the LOGGER. In either case, the HHC will continue with the data collection.

If previously collected data is still present in the A: location memory, then the following message will be displayed:

```
FILE ALREADY EXISTS
ERASE
        (Y)es  or (N)o
```

Pressing 'N' will return the program to the main menu to allow this data to be saved or transferred.

Pressing 'Y' will erase the file and continue with the data collection.

The HHC then compares the space available for the data in it's a: location memory with the number of samples collected by the LOGGER and if there is not enough room to save all the data the following prompt is displayed.

```
INSUFFICIENT ROOM
TO COLLECT ALL DATA
CONTINUE
        (Y)es or (N)o
```

Pressing 'N' will return the program to the main menu. If 'Y' is pressed then the following prompt is displayed:

```
┌─────────────────────────────┐
│  START COLLECT AT           │
│  OLDEST DATA                │
│             (Y)es or (N)o   │
│                             │
└─────────────────────────────┘
```

If (Y) is pressed then as many samples of data will be stored as there is space, starting from the oldest sample.

If (N) is pressed then the program calculates how many samples it must discard so that all the data from the sample selected onwards can be saved.   The message

```
┌─────────────────────────────┐
│  FIRST xx WILL              │
│  NOT BE COLLECTED           │
│                             │
└─────────────────────────────┘
```

will be briefly displayed.

The program then prompts for the input of text to form the title for the data about to be collected.   This is saved with the data to aid its identification when down loaded to a PC.

```
┌─────────────────────────────┐
│  DATA COLLECTION            │
│  ENTER TEXT FOR DATA        │
│                             │
└─────────────────────────────┘
```

Press the EXE key after entering up to 40 characters of text.

The program will then collect the totaliser data.

If the totaliser data has been collected a message to this affect will be displayed while the sample data is collected.

If the message "TOTALISER DATA NOT AVAILABLE" is presented then either the MCULOG is an older version or the first request for totaliser data failed.   To stop collection of the data, press ON/CLEAR and then Q pressing space will then return you to the main menu.

Once the data has been collected, the HHC will ask if it's required to save the data to a Datapak – See section 5.2.

Following the data transfer prompt, the HHC will offer the opportunity to RESET the MCULOG. Answering 'Y' will reset the MCULOG clearing all the currently logged data, and setting the start date/time to the present date and time.   If 'N' is entered then the MCULOG will continue to log as initially programmed or remain stopped if this was selected on entering the 'COLLECT' functions.

4.2   Error Reporting

During collection, the data is checked and if an error is detected one of the following messages will be displayed:

```
NO RESPONSE FROM
DATA LOGGER
RETRY
(Y)es or (N)o
```

This is displayed when the first request to the logger fails to get a valid reply.   The first message sends the dates and times for the start of logging and the collection of the data.   Check the connections to the logger and that the Comms is set up for the logger you are connected too.

```
INCOMPLETE DATA FILE
CONTINUE
(Y)es or (N)o
```

This is displayed if one of the 6 messages used to send the totaliser values has been missed. Press 'N' to delete the corrupted file and return to the main menu.   Press 'Y' to continue with the collection of data. If N is pressed there is a delay to allow the MCULOG to reset to the start of the data collection sequence.

```
DATA READ ERRORS
```

This is displayed if at least one of the messages used to send the sample data has been missed or is invalid. Data collection will continue unless stopped by pressing "ON/CLEAR" and then "Q".

The value of the missing sample will be set to zero so that the correct date/time relationship of the samples is maintained.   If the missing samples had the fast logging flag set then there will be a time/date error on all subsequent samples of 1 minute less than the sample internal.
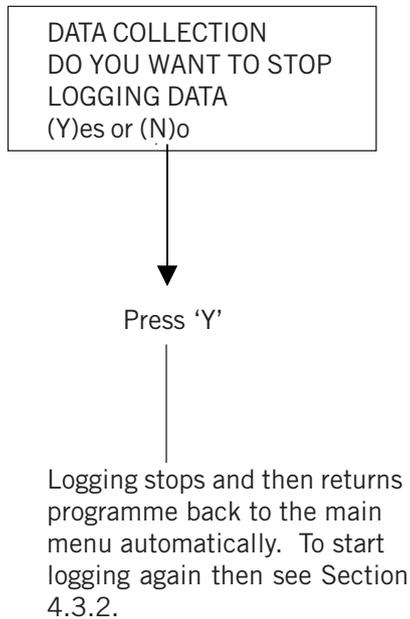
4.3   Use of LZ 64 Psion Organiser

If an LZ64 is used to collect the data it is possible to save a complete set of 4800 samples to the internal A: memory location and have room for further data.   As the memory is filled so the collection of further sets of data is slowed down.

It is recommended that data is saved to a Datapak or RAM-pack rather than the A : memory to avoid these delays, and that the HHC is only used for collecting data, as the space taken by any other files, e.g. for the diary or the note pad, will also slow down the operation of the program.

4.3.1. STOP LOGGING

Select the DATA LOGGING menu.
Select 'STOP' display

This display prompts the operator that he can stop logging. If selection of this function was in error Pressing 'N' key returns programme back to the main menu without affecting the logging operation.

```
┌─────────────────────────┐
│ DATA COLLECTION         │
│ DO YOU WANT TO STOP     │
│ LOGGING DATA            │
│ (Y)es or (N)o           │
└─────────────────────────┘
```

This display prompts the operator4 that he can stop loggin. If selection of this function was in error Pressing 'N' key returns programme back to the main menu without affecting the logging operation.

Press 'Y'

Logging stops and then returns programme back to the main menu automatically. To start logging again then see Section 4.3.2.

4.3.2. RESET LOGGER

Once data has been retrieved from the MCULOG, this data can be cleared from the logger memory. Again, as with the STOP logging function, once the RESET function has been selected from the DATA LOGGING menu, the display prompts the operator with a (Y)es or (N)o answer to ensure unintentional reset is made. Once reset, the MCULOG, logging memory is erased ready for a new logging period to start.

5.   DATA TRANSFER MENU

5.1   Transfer to PC

Transferring the stored data to a PC – this is achieved by using the HHC as the storage device which is used to transfer the data.

Included in the MSPLOG-CK5 kit are two comms link assemblies. One is used for communication with the MCULOG, and is fitted with a round connector which is plugged into the MCULOG. The second comms link cable assembly is to be used when transferring data from the HHC to the PC. It is fitted with a 25 way 'D' connector suitable for interfacing with the standard RS232 serial port on an IBM compatible PC.

The following procedure must be used to transfer the data to the PC.

Connect the HHC to the Com 1 serial port of the PC using the Comms Link provided.

To allow you to run from your PC go into Windows File Manager and create a directory, for example CL (this may be chosen to suit your process). From the A: drive, copy all of the files into this directory off the 3.1/ 2" disk.   The CL.EXE program can either be run from Windows or DOS.

Run the CL program on the PC.
Select Transfer from the 'DATA LOGGING' menu.
Select 'TRANSFER TO PC' from the transfer menu.
The HHC will prompt for a path on the PC where the data file is to be created.

N.B.   The HHC does not have a "\" key. To specify a path, use the "/" key and it will be automatically transposed as the file is opened.

If the 'EXE; key is pressed without any path being entered, the default path is to the root directory of the current disk, i.e. the root directory of the disk that the CL program was run from.

The HHC will then prompt for a file name of up to 8 characters.   The default file name is MCULOG, an extension of .PRN automatically added.

If the file selected already exists on the PC in the Directory selected, then the following message will be displayed.

```
FILE ALREADY EXISTS
ON THE PC
ERASE
(Y)es or (N)o
```

If 'N' is pressed, the program returns to the path input prompt.

If the file does not exist or 'Y' was pressed then the HHC will prompt for the number of day's data to be transferred.

If a number of days value is selected which is smaller than the number of days logged, then a minimum of that number of 24 hour periods from midnight to midnight plus the time from the last midnight to the time of the last sample will be transferred.

To obtain all the logged data, enter a large value, e.g. 999.

The data will then be transferred with this activity being indicated by a counter showing the number of data samples transferred.

After the data has been transferred the HHC will ask if you wish to erase the data it contains. This is desirable, particularly if there is a large data file present, so that other programs can be run on the HHC.

See Appendix 1 for example of printout format of data that is transferred to a PC.

See Appendix 3 for an example of how to use this data in a windows spreadsheet.

5.2 Save to DATAPAK

When retrieving logged data from the MCULOG, it is stored in the internal memory A:.

A:	The PSION internal memory.	
B:	Upper side Datapak if additional	the program must
	Datapak has been fitted.	Reside in one
C:	Lower side Datapak if fitted.	Of these locations

This data can be transferred to a Datapak or stored in the internal memory A: by renaming the files so that another set of data can be collected.

```
DATA TRANSFER
TRANSFER-TO-PC
SAVE-TO-DATAPAK
RECOVER-FROM-DATAPAK
```

On selecting the SAVE-TO-DATAPAK option on the DATA TRANSFER menu, the location where the data is to be stored must be selected.

```
SELECT PACK LOCATION
        A              B
```

This is automatically A:, if no datapak is fitted, else select from the presented menu.

```
INPUT FILE NAME
FOR SAVED DATA
7 CHARACTERS
MAXIMUM
DEMO  1
```

A file name must be given to enable it to be retrieved later.

If a file already exists under that name, then a message will be displayed informing the user.

N.B.   Do not use LOG as a file name as this is used by the HHC program.

If the location is A: then the data files are not moved but simply renamed so that they are not over written by the next set of logged data.   This also means that they are no longer available to be viewed by the Psion.

5.3 Recover from DATAPAK

To view and transfer data to a PC the data must be in special files in the internal memory of the PSION. If data has been saved to a Datapak it can be copied back using this function.

The locations can either be A: or B: or C: depending on the location of the Programme Datapak and if an additional Datapak has been fitted.   The data can be recovered from any of these store locations and then analysed with the VIEW option on the main menu or transferred to a PC.

6. VIEW MENU

6.1 Warning

If, having selected the VIEW menu, the following message may appear

```
INSUFFICENT ROOM
TO RUN ALL VIEW DATA
PROCEDURES CONTINUE
(Y)es or (N)o
```

This indicates that some of the space required for the program is currently occupied by data files in location A. Some of these must be erased or transferred (see Psion manual X files section) to safely run the view functions.   If Y is pressed then the program may crash while the data is being viewed but no data will be lost.

6.2 Real time

```
    ****VIEW DATA ****
REAL-TIME
SAMPLE            LIMITS
ELAPSED TIME
```

Enter the date and time that you wish to start viewing the logged data use   → and ← keys to move from field to field, DEL to edit data, and EDXE when all data entered.   The "ON/CLEAR" key will return you to the VIEW menu.   When View data is first selected the real time is set to the start of the logging period.

When viewing logged data the following functions are possible using the HHC keyboard. Once the real time data has been displayed – e.g.

```
DATE          19 JAN 2002
TIME             19 : 17
SAMPLE         3
VALUE          1917  FL
```

↑   up arrow moves to the previous sampled value

↓   down arrow moves to the next sampled value.

'L'   searches from the currently displayed value forward to the end of the data for the largest value.

'S'   searches from the currently displayed value forward to the end of the data for the smallest value.

'N'   provided a LIMIT has been set searches forward in time for the next vale to exceed that limit.

'ON/CLEAR' returns to the 'VIEW MENU'.

Additional information provided on view data, FL on the 4th line indicates that fast logging has been implemented, sampling every minute. LE on the 4th line indicates that a Lost Echo condition existed when the data was logged.

6.3   Sample

VIEW DATA
ENTER SAMPLE
NUMBER
194

Data samples can be directly accessed using the sample number, again the HHC display will prompt the operator for the sample number.

If a sample number larger than the number of samples in the data is entered, the sample number defaults to the last sample.


```
DATE           30 DEC 1991
TIME            23 : 48
SAMPLE         194
VALUE          23 : 48 FL
```
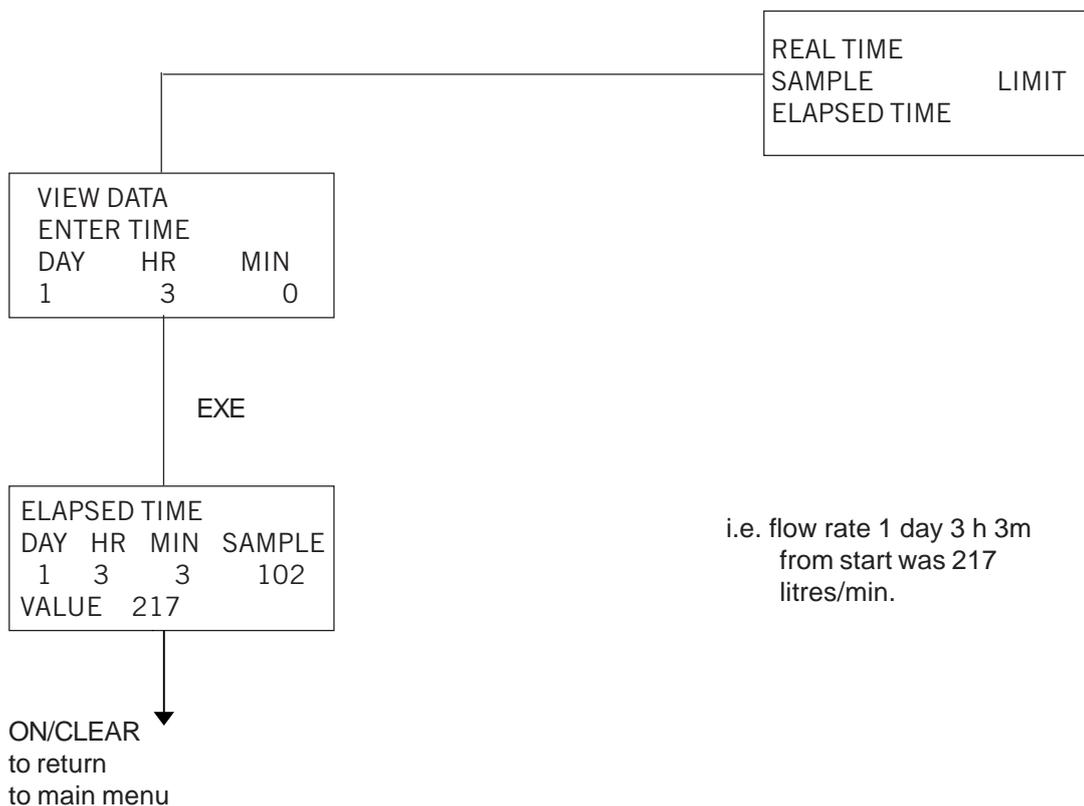

6.4   Limits

This function allows a (flow) limit to be set to enable logged data to be identified which exceeds the limit, either maximum or minimum.   Once a limit has been set the option of immediately searching from the last viewed data is presented if the 'Y' key is pressed then this search is made, 'N' returns you to the VIEW DATA menu.   If a limit has been set, then when data is viewed, pressing 'N' will start a search forward through the data and the next sample to exceed the limit will be displayed.

6.5   Elapsed Time

Using the elapsed time into logging, a specific time period can be analysed to check on the reading obtained.   When View data is first selected the elapsed time is set to the time of the last data sample.

Example:

```
                                              REAL TIME
                                              SAMPLE         LIMIT
                                              ELAPSED TIME


     VIEW DATA
     ENTER TIME
     DAY     HR      MIN
     1       3       0



              EXE


     ELAPSED TIME                    i.e. flow rate 1 day 3 h 3m
     DAY  HR  MIN  SAMPLE                 from start was 217
      1    3    3    102                   litres/min.
     VALUE  217


   ON/CLEAR
   to return
   to main menu
```

7.   Non Standard Comms Set Up

This function has been provided for MCULOG systems that have been specially modified to a comms set up different from the standard one.   This may be required so that the comms matches that used by a modem for remote access to the logged data.

The first option is to keep the present comms set up. If you have already been through the non standard set up and do not want to change any of the parameters then pressing Y will return you to the data collection procedure, with no changes made to the comms set up.   Please note that the comms set up for data transfer from the logger must be done via this program as other parameters, that are not user selectable, are configured when the comms is set up.

If N was pressed then the Baud rate is prompted for, only valid baud rates in the range 50 to 9600 are allowed.   This is followed by the parity selection menu and then the number of the data bits (7 or 8) and stop bits (1 or 2).

The comms set up is only changed if all parameters are correctly selected.

APPENDIX 1 – EXAMPLE OF DATA TRANSFERRED TO A PC

The TOTALISER value is the combination of MSP90 parameters 48 and 49. The 32 totaliser values, if available, are positioned after the header data but before the sample data.

The value being logged has a high logging rate threshold of 2.000. Each sample has its date and time of collection followed by the logged value displayed to upto 4 significant figures.

```
"MAIN INLET CHANNEL"          (Up to 40 characters of text)
"COLLECTED ", 29/02/1992,22:05
"LOGGING STARTED", 6/ 2/1992, 4:12
"SAMPLE INTERVAL",15,"MINUTES,TOTALISER",0225623
"TOTALISED FLOW",00027301,"FOR",03,"DAYS"
28/1/1992,0
29/1/1992,0
30/1/1992,0
31/1/1991,0
1/2/1992,0
2/2/1992,0
3/2/1992,0
4/2/1992,00001235          (Data not collected on or before this date)
5/2/1992,00010475          (Oldest totaliser value available)
6/2/1992,00019621
7/2/1992,00028210
8/2/1992,00037362
9/2/1992,00046921
10/2/1992,00055542
11/2/1992,00064397
12/2/1992,00073108                                         Midnight
13/2/1992,00082481                                         totals
14/2/1992,00091651                                         for
15/2/1992,00100633                                         day 1 to 32
16/2/1992,00109301
17/2/1992,00118529
18/2/1992,00127542
19/2/1992,00136642
20/2/1992,00145291
21/2/1992,00154721
22/2/1992,00163287
23/2/1992,00172951
24/2/1992,00181519
25/2/1992,00190328
26/2/1992,00199421
27/2/1992,00208438
28/2/1992,00217629
6/2/1992,4:12,2.213
6/2/1992,4:27,1.278
6/2/1992,4:42,1.375     }    Average flow over 15 minute periods
6/2/1992,4:57,1.390          (continued overleaf)
6/2/1992,5:12,1.412
```

6/2/1992,5:27,1.454
6/2/1992,5:42,1.465,,1   (,,1 - Lost echo flag)
6/2/1992,5:57,1.470,,1
6/2/1992,6:12,1.470,,1
6/2/1992,6:27,1.525,,1
6/2/1992,6:42,1.575
6/2/1992,6:57,1.610
6/2/1992,7:12,1.658
6/2/1992,7:27,1.745
6/2/1992,7:42,1.872
6/2/1992,7:57,1.912
6/2/1992,8:12,1.957
6/2/1992,8:13,2.012,1   (,1 - high logging rate flag - 1 minute intervals)
6/2/1992,8:14,2.123,1
6/2/1992,8:15,2.245,1
6/2/1992,8:16,2.346,1
6/2/1992,8:17,2.467,1
6/2/1992,8:18,2.365,1
6/2/1992,8:19,2.298,1
6/2/1992,8:20,2.234,1
6/2/1992,8:21,2.195,1
6/2/1992,8:22,2.127,1
6/2/1992,8:23,2.094,1
6/2/1992,8:38,1.999
6/2/1992,8:53,1.912
6/2/1992,9:08,1.893
6/2/1992,9:23,1.795
6/2/1992,9:38,1.742
6/2/1992,9.53,1.687
6/2/1992,10:08,1.619
6/2/1992,10:23,1.543
6/2/1992,10:38,1.498

APPENDIX 2 – DATA OUTPUT PROTOCOL FROM MCULOG

Introduction

This information is provided so that laptop computers or similar systems can be programmed to collect data from the MCULOG directly.

Physical Link

Amphenol cable mounting plug 62GB-16J8-4P (STC 058841D)

PIN B is the transmit signal from the MSPLOG
PIN C is the receive signal into the MSPLOG
PIN D is signal ground.

MCULOGPX models - (not fitted with 62GB-16J8-4P)
See connection drawing on side label.

Signal Format (Standard)

RS232 ± 9V signal
1 start bit, 8 data bits, even parity bit, 1 stop bit
9600 Baud
ASCII characters

Protocol
Only the following single character commands are valid:

Stop Logger	DC4	(14h)
Reset logger	DC2	(12h)
Collect data	XON	(11h)
Cancel data collection	XOFF	(13h)
Collect totaliser data	NAK	(15h)
Get number of samples	SYN	(16h)

The first XON received results in the header data being sent

Start date	(ddmmyyyy)
Start Time	(hhmm)
Present Date	(ddmmyyyy)
Present Time	(hhmm)
Sample Interval	(mm)
Present totaliser Value	(nnnnnnnn)
Totalised Flow Value	(nnnnnnnn)
Number of Days for Totalised Flow	(nn)

All subsequent XON characters that are not more than 5 seconds apart will cause the next data value to be sent.

Sample Value   (nnnn) (May include an extra decimal point character)
Flags   (f)

The Flag character has the values   81h   Lost Echo fault
                              Or   88h   Fast Logging rate on

If neither of these conditions is active then there is no flag character.

If NAK characters are sent after the header data has been received, then the totaliser data will be sent in the following format:

Block Number   n

Totaliser value 1	tttttttt
Totaliser value 2	tttttttt
Totaliser value 3	tttttttt
Totaliser value 4	tttttttt
Totaliser value 5	tttttttt
Totaliser value 6	tttttttt

This format is used for 5 messages with the block number being incremented from 1 to 5. On receiving a sixth NAK request the last part of the totaliser data is sent out in the following format:

Block Number	6
Totaliser value 1	tttttttt
Totaliser value 2	tttttttt
Number of totaliser values that have been saved	n
Date of last value was saved	dd
Month last value was saved	mm
Year last value was saved	yyyy

All 60 totaliser values that can be saved are sent if they have been saved.   If any have not yet been saved then there is no data sent for the value but the delimiters that separate the data are sent.

After collecting the totaliser data the sample data can then be collected by using XON character requests.

If a Syn character is sent at any time then the number of samples saved in the logger is returned as 4 digit ASCII

dd	=	2 digit day value	mm	-	2 digit month value
yyyy	=	4 digit year value	hh	=	2 digit hour value
mm	=	2 digit minute value	n	=	a single digit
tttttttt	=	8 digit totaliser value			

All data fields are separated by a TAB character (09h) and each block is terminated by a Carriage Return (0Dh).

The last data value has a SUB character (1Ah) instead of a Carriage Return as its last character.

MCULOG Series

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