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Spectra-Tek

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Mercury 2e

Mercury 2e Terminal User Manual

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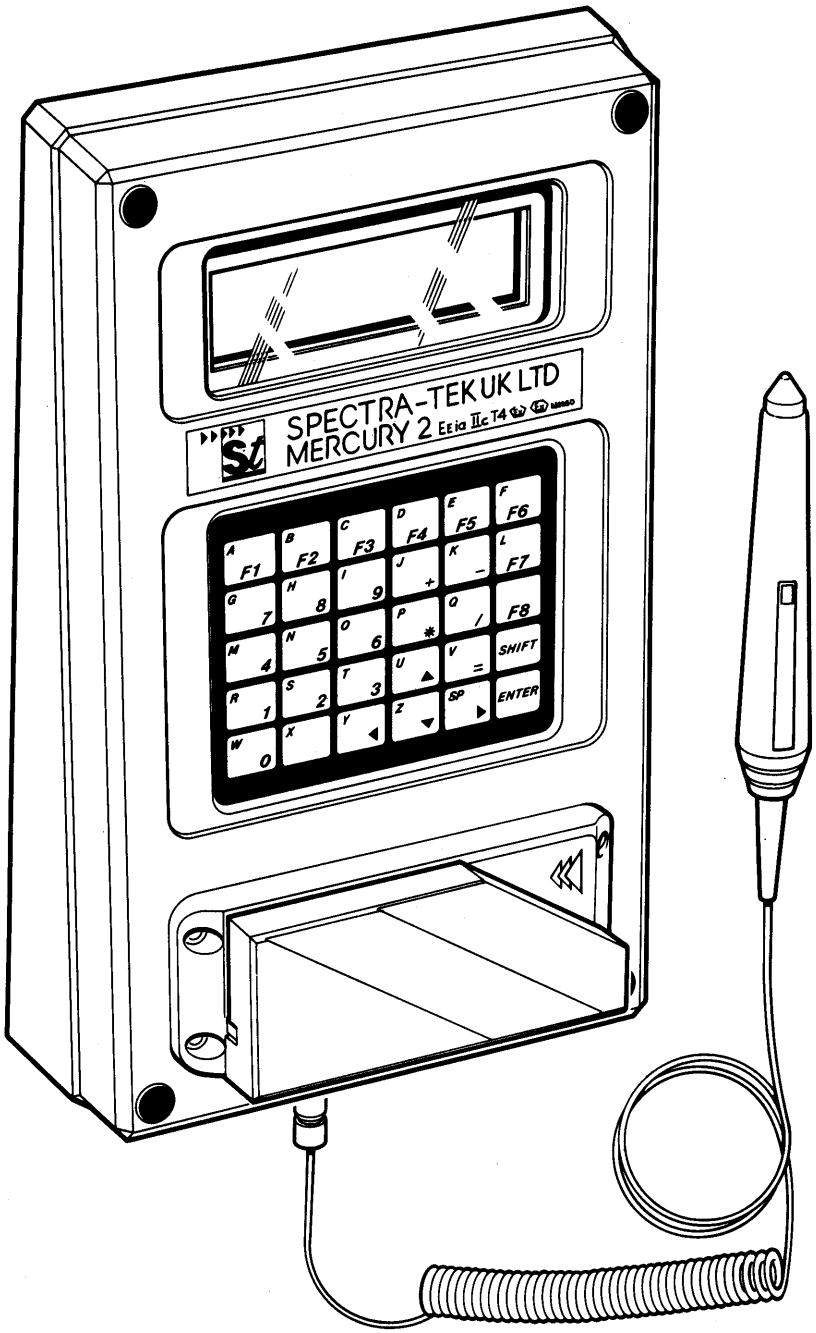
Contents

Mercury 2e Terminal
with Security card
Reader and
Bar-code wand



Introduction

The Spectra-Tek Mercury 2e is a robust operator interface for use within a remote computer or microcomputer system. The terminal is ideal for use in Petrochemical, Pharmaceutical, Paint and other industries, where low-cost, high performance Intrinsically Safe operation is mandatory. The Mercury 2e is simple to install and incorporates a set-up facility for system configuration.

Weather proof to IP65 standard, the Mercury 2e is approved for intrinsically safe operation for group IIC gases within a zone 0 hazardous area. Power and communication are connected via an intrinsically safe interface module mounted in a safe area. The interface module provides RS232/422/485 communications for point to point or multi-drop systems.

The Mercury 2e comprises a high contrast liquid crystal display, a tactile, alphanumeric keypad, dedicated socket for an optional reader and external contact status inputs. Communications use standard 7 or 8 bit ASCII characters and transmit inputs from the keypad or data from a bar-code wand, bar-code laser scanner or security card reader.

The Mercury 2e terminal and IS interface module may also be used in any non-hazardous industrial location, where the advantages of galvanic isolation or multidrop communication features are required.

An optional non-intrinsically safe version of the Mercury 2e, which does not require an IS interface module, may be used in a safe area. This version provides RS232 communications only, and is powered by an external 12 V supply.

Nomenclature and Conventions

In this manual, ASCII single characters which are either control or non-visible codes (Hexadecimal 00 - 1F, 20 and 7F) are indicated by enclosure in < >, for example, <ESC>.

Character strings which are indivisible sequences are shown between quotation marks, for example, “<ESC> [2 J”.

In the ASCII 7 and 8 bit code sets used by Mercury 2e, a character is represented by two digits, each in the range hexadecimal 0 to F. For example, <SP>, the space character is defined (20_H).

Installation

Mercury 2e System

Mercury 2e Terminals are approved for operation within a hazardous area when connected to a R007 intrinsically safe interface module. They may also be used within a safe area using an RS232 interface.

The Intrinsically Safe Interface Module provides mutual galvanic isolation between 24 V d.c. power, the I.S. hazard area connection and the host communication ports. These connections to the Mercury 2e Terminal allow a cable length of up to 1 kilometre. The communication ports provide for RS232 and differential transmit and receive terminals for RS422/485, with tri-state control.

Card Reader

The security card reader is factory fitted in place of the removable front panel and is secured by four socket head bolts. A 32 bit binary number contained on the customer card is read when the card is passed through the card reader and the information is made available to the host computer for a system response.

Bar Code System

The bar code wand connects to the Mercury 2e Terminal via a single, weather-proof input socket located on the bottom of the unit. A weather-proof blanking plug connected to the input socket, protects the socket when the wand is removed.

The bar-code laser scanner is a separate unit wired to the Terminal. Installation is covered in the IS3000 Laser Scanner Manual.

Sitting the Mercury Terminal

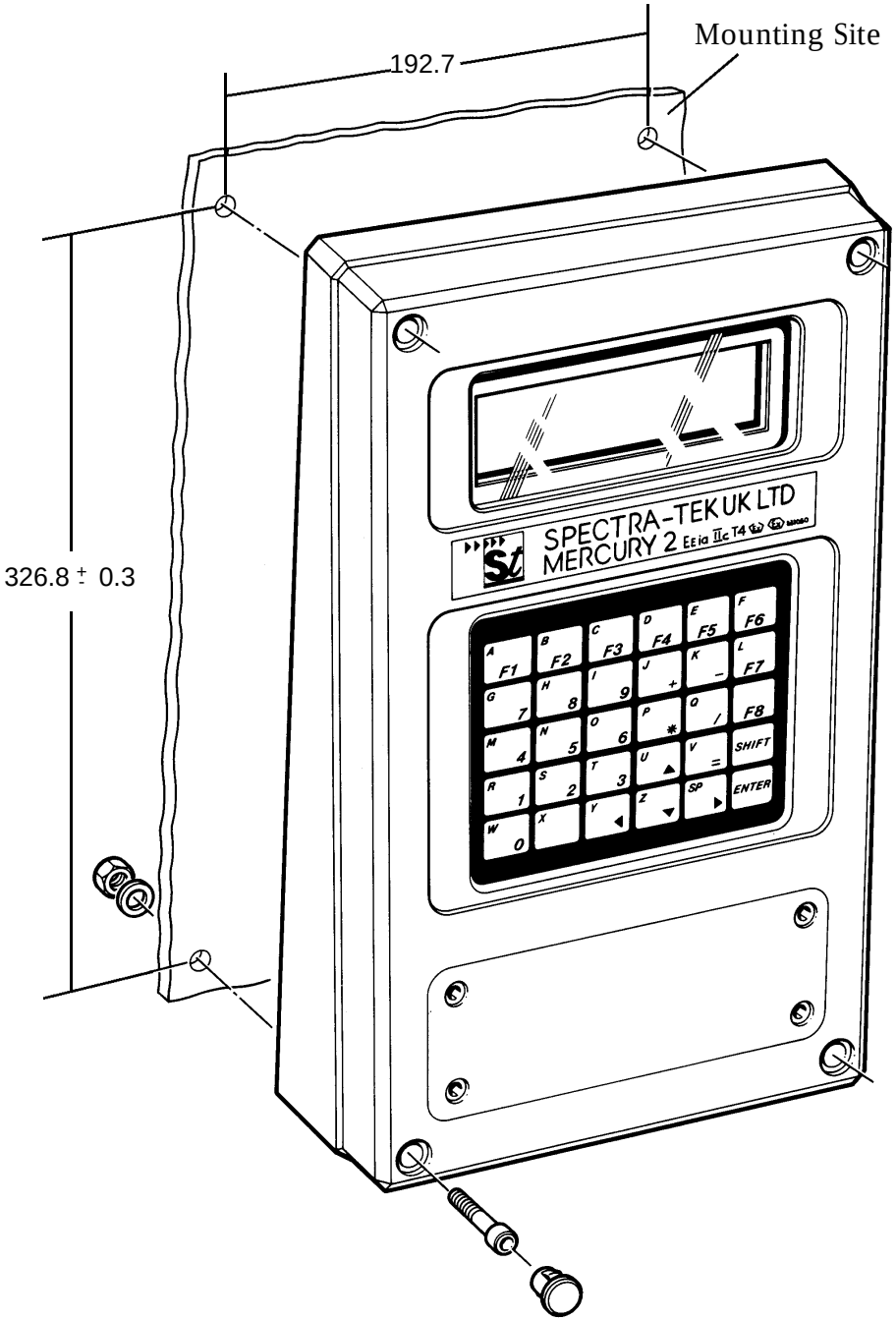
For your safety remember to implement all relevant precautions and procedures. In the United Kingdom installations must comply with BS5345, part 4.

The Mercury terminal is weather-proof to IP65, so it can be installed outside as well as under shelter or indoors.

Mount the terminal in a vertical position on an even surface, strong enough to support its weight of 5.5 kg.

Position the unit so that the LCD and Keypad are convenient for the operator, usually at eye level. Note that, in strong direct sunlight, display clarity and service life may be reduced.

Fig. 2 Mounting the Mercury 2e Terminal



Mounting Procedure

1. Check that the connection panel cover or security card reader is secured to the face of the Terminal; this prevents any dust or water from entering the unit. Unplug the bar-code wand and make sure the protective cap is fitted on to the bar code reader input socket on the underside of the unit.

2. Remove the plastic protective plugs covering the four corner mounting holes by pushing the plugs from behind. Retain the plugs in a safe place. It is not necessary to remove the back of the terminal.

3. Place the Terminal against the surface on which it is to be mounted at the correct position and height for operator use and mark the position of the four mounting holes using the dimensions given (see Fig 2). Drill, and plug if necessary, the mounting holes on the mounting surface.

4. Place the Terminal against the mounting surface and secure the Terminal using 4 off M5 cap head screws (26 mm shank) or similar.

5. To avoid electro-chemical corrosion of the aluminium case, the fixing bolts and nuts should be thoroughly greased.

6. Check that the Terminal is securely fastened to the mounting surface and re-insert the plastic protective plugs into the four corner holes.

Connections

Intrinsically Safe Connections

Power and communication connections to the Mercury 2e Terminal are made via the R007 intrinsically safe interface module. The IS interface module should be installed in a safe area. The cable screen should be connected to J5 pin 5 within the Mercury 2e

▲ WARNING **Power must be disconnected before connecting or inspecting the IS interface module.**

Connecting the I.S. Interface Module

No intrinsically safe earth is required as the unit is galvanically isolated.

Mount the IS interface module on to a DIN standard (DIN 46277), 35mm transverse symmetrical rail. Alternatively secure the IS module by 2 off x 4 mm screws through the red latches in the base; the latches must be sprung out to their extended positions.

For the complete inter-connection diagram see Appendix G.

The inter-connection cable between the safe area IS Interface Module and the hazard area Mercury 2e Terminal requires four cores, which may be either two twisted pairs or a quad. Where a quad is used, diagonally opposite cores should be paired to reduce any communications cross-talk. Each pair is restricted to the following maximum parameters:

Loop Resistance	40 Ω
Capacitance	142 nF max.
L/R Ratio	33 µH /Ω
Inductance	0.6mH

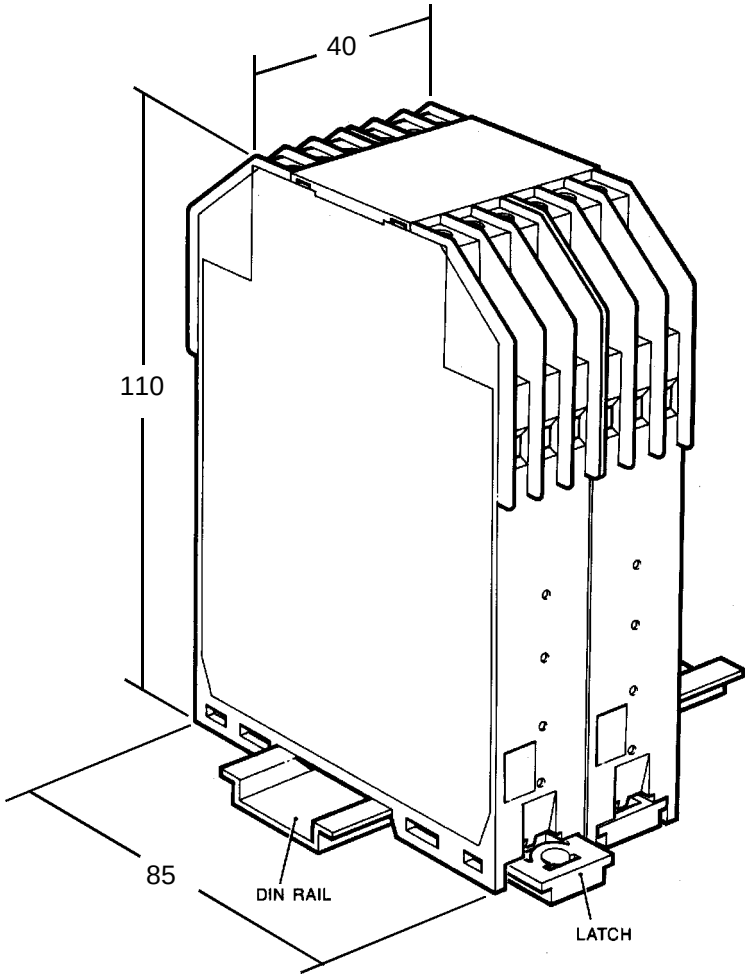
For example, a $1mm^2$ quad cable has approximately the following parameters:

Resistance	38 Ω/km (loop)
Capacitance	55 nF/km
L/R Ratio	12.5 µH/Ω
Inductance	0.48mH/km

For a cable length of 1km, this would satisfy safety and operating requirements.

The wiring schedule for the IS interface module is listed in Appendix E.

Fig. 3
I.S. Interface Module



Connecting the Mercury Terminal

After installing the intrinsically safe interface module, you can proceed to connect power and communication wiring to the Mercury Terminal.

For the cable entry into the Mercury Terminal, fit a suitable insulated cable gland (M20) on the four core or twin twisted pair cable.

Connecting to the Terminal Blocks

The terminal connection blocks are protected by a cover, or the card reader if fitted. Remove the cover by unscrewing the four retaining screws.

Power and communication connections are made to terminal block J5, pins 1 to 4 . The cable screen is connected to pin 5.

“Simple Equipment Interface” (Digital Inputs) connections are located at J1, pins 1 to 5. When the host computer queries the digital input status, a short duration 5V 1 KΩ source whetting signal senses whether an external contact is open or closed.

The Simple Equipment Interface digital inputs are intrinsically safe and have the following safety description.

Vout	= 29.4 V	Iout	= 66.4mA
Wout	= 0.262W		
Cext	= 0.11µF	Lext	= 8.4mH
L/Rext	=135µH/Ω		
Ceq	= 0	Leq	= 0

The common connection J1 pin 5 is at a logic 0 V. Only volt free contacts are permitted for use with these digital inputs.

Connecting a Terminal in a Safe Area

For non intrinsically safe connections, specify the Mercury 2e General Purpose RS232 option to be fitted on the terminal. Operation in Multi-drop mode is not possible on RS232 levels.

External 12V power connections on the Mercury terminal are located at terminal block J4, pins 1 and 2. The current is typically 45mA.
Note that no connections should be made to the J5 terminal block.

Communication to the Mercury Terminal is made via an RS232C interface on terminal block J3, pins 1 to 4. The RS232 interface connections to the Mercury Terminal are listed in Appendix E.

Connecting the Card Reader

Unscrew the caphead socket screws retaining the cover below the Terminal keypad. Plug in the 5-pin plug to J2. Fit and screw the card reader into place, ensuring that the O ring is correctly seated.

Connecting the Bar Code System

The Bar-code wand plugs into the small socket on the underside of the Mercury 2e Terminal.

The bar-code laser scanner requires wiring in.
For connection details, see the separate Laser Scanner manual.

Cleaning the Mercury Terminal

The body of the terminal is finished in epoxy paint. The display window is polycarbonate and the keypad surface is polyester. These may be cleaned with soapy water. Difficult grease deposits may be treated with most solvents.

In a hazardous area, avoid rubbing dry plastic surfaces with cleaning cloths, as there is a small spark hazard by triboelectric charge generation. This risk can be overcome by using moist cleaning processes. The keypad carries a reminder of this risk.

Powering Up

With no local switch, the Mercury terminal receives power when the IS interface module in the safe area is connected. On connection, a beep sounds and the initialisation routine starts. Model number and software version are detailed on the LCD, then the cursor appears and the keyboard mode is indicated in the bottom right corner.

Automatic Message Recall

A feature of the Mercury 2e terminal is the automatic Message Recall. Immediately after powering up and the Spectra-Tek version message has been displayed, the Terminal automatically recalls Message No. 1. For example, this may be a string of text or an escape sequence to set keyboard mode.

Point-to-Point Mode

The single Terminal dumb mode is the default mode of operation, with simple transmission of characters to the host computer on keypress, and display of received characters.

Multi-drop Mode

Up to fifteen Mercury terminals can be installed a single multi-drop operation. The multi-drop system uses the IS Interface Module as the tri-state controlled communication port.

Communications

Configurable in set-up mode, selected communication options are held in non-volatile RAM. Set-up mode may be password protected.

Set up

In Set-up mode, the Mercury 2e is configurable for system operation and communication with the host computer. Setup is selected from the keypad only and, while in setup mode, no characters are transmitted by the terminal. Parameters and options are listed on the Setup menu.

Access Setup by pressing **Shift** four times, then **Enter** . (On the S500 keyboard. the **Shift** key is invisible and is located below the 'F4' key and to the left of the '4' key.) The first parameter and variable of the Setup menu is displayed on the bottom line of the LCD. If no security code has been enabled, options can be selected and set. If the Security Code has been enabled, the prompt on the LCD asks for a six figure security code. If no code is entered, the options menu can be viewed but not configured (V3.1 and above).

Setting options

Use the ⬆ and ⬇ keys to move the cursor to the required parameter, and the keys ⬅ ➡ to select an option. (On the terminal automation keyboard, the ⬆ ⬇ ⬅ ➡ keys are not indicated. The user must use **H,T,M,O** instead.)

Continue selecting parameters and options until the configuration of the terminal is complete. Press **Enter** , and the selected options are entered into NVRAM.

Parameters and options available are listed in Table 1 and described below. Default settings on cold start appear in bold.

Cold Start

Performing a cold start will restore all default settings and erase any stored messages. A Cold Start can be performed in one of three ways:-

1. Power on with link 4 on PCB set to left hand position (ie '1')

2. Power on holding down the two leftmost and two rightmost keys on the bottom row.

3. In Setup mode,, press the bottom left key (ie 'O', STOP, VIEW ALARM). This will display the message "Cold Start? NO". Pressing the same key will toggle between "Cold Start? NO" and "Cold Start? YES". If "YES" is shown, pressing **Enter** will cause the machine to pause and then perform a cold start. To return to setup mode, press **Enter** when "NO" is displayed.

Table 1

Set-Up Mode Menu

Parameter	Options
Baud rate	50, 150, 300, 600, 1200, 2400, 4800, **9600** .
Word Length	7,**8**.
Stop Bits	**1**,2.
Parity	**None** , Odd, Even, Mark, Space.
Rx Xon/Xoff	Enabled, **Disabled** .
Tx Xon/Xoff	Enabled, **Disabled** .
BEL Length	**0.05s** , 0.1s, 0.2s, 0.4s, 0.8s, 1.0s.
Beep Loudness	1 to **3** Stars * to ***.
Key Click	Off, **70ms** .
Full Stop Key Transmit	**Full Stop** , Comma.
F8/BS Key Transmit	**<BS>**, {F8}.
Rubout Key Transmit	**<BS>**, <DEL>.
Keyboard Modes	**N U L**, N U
Security Code	Enabled, **Disabled** .
Telemetry Address	**1** to 15.
Telemetry Mode	**Point-to-Point** , Multi-drop, Modbus.
Block Structure	**Enabled,** Disabled.
Multi-drop acknowledge	Enabled, **Disabled** .
Software Version	Indicates Version Number.

Parameters & Options Explained

Word Length

For communication and operation, Mercury 2e can be set to use 7 or 8 bit ASCII codes. When communicating in 8 bit format with operating mode set to 7 bit, the receiving Mercury ignores the top bit (D7). When the Mercury is transmitting, the top bit is set to zero.Note that the enhanced character set of 256 codes is only available when communication and operation are both set to use 8 bit mode.

Rx Xon/Xoff

When enabled, the Mercury 2e sends an Xoff and Xon to prevent the receive buffer being over-filled. If disabled, over-running the terminal's receive buffer may result in characters being lost. This option is automatically disabled in multi-drop mode.

Tx Xon/Xoff

When enabled, the Mercury 2e stops or restarts sending data from its transmit buffer in response to Xoffs and Xons. If disabled, then the host computer may over-run its input. This option is automatically disabled in multi-drop mode.

Block Structure

When disabled, data normally sent in Blocks (see pg 29) is sent as raw data (ie with no <STX>, Addr, Func, ID, DMY, CSUM or <ETX> characters as shown on pg 30)

Security Code
The default security code is 000000. The six digit security code is programmed into the Mercury terminal from the host computer. If the security code option is enabled, the operator has to enter a matching code at the keypad to access Set-up configuration.

Multi-drop / Modbus Modes
In multi-drop mode the host computer (the master device) transmits strings and commands to its population of Mercury 2e Terminals (slave devices) with an address, data and message terminator structure. The Modbus option only appears if a Modbus upgrade code has been purchased.

Telemetry Address
When Multi-drop Mode is enabled, a unique Telemetry Address must be set for each Mercury 2e Terminal. Fifteen Unique addresses, 1 to 15, are available. Address “0” is reserved for broadcast operation when the same message is sent to all slave devices simultaneously.

Multi-drop Acknowledge
When Enabled, an acknowledgement reply is sent in response to every valid received message of matching address except a broadcast.

Local Echo

Local Echo mode is a facility to help in checking that the keyboard, barcode or card reader is functioning correctly. When set, all keypresses, readings or swipes echo the transmitted characters to the screen. The characters are displayed in current screen mode, and at current cursor coordinates, so the screen display should be set to the appropriate mode before Local Echo is set. Local Echo toggles on and off by pressing **F1** (or START BATCH 1 on the terminal automation keyboard), when in Setup.
In Local Echo mode, the terminal continues to communicate with the host. Press **Enter** to return to normal set-up mode.

Digital Inputs

Pressing **F6** (or START BATCH 6 on the terminal automation Keyboard), while in the set-up mode gives a single line display showing the state of the digital inputs in real time. Press **Enter** to return to normal set-up mode.

Display Test

Pressing **F3** (or START BATCH 3 on the terminal automation Keyboard), while in setup mode, performs a display test. The screen will go black, then white, and the terminal will automatically exit setup mode and return to normal operation.

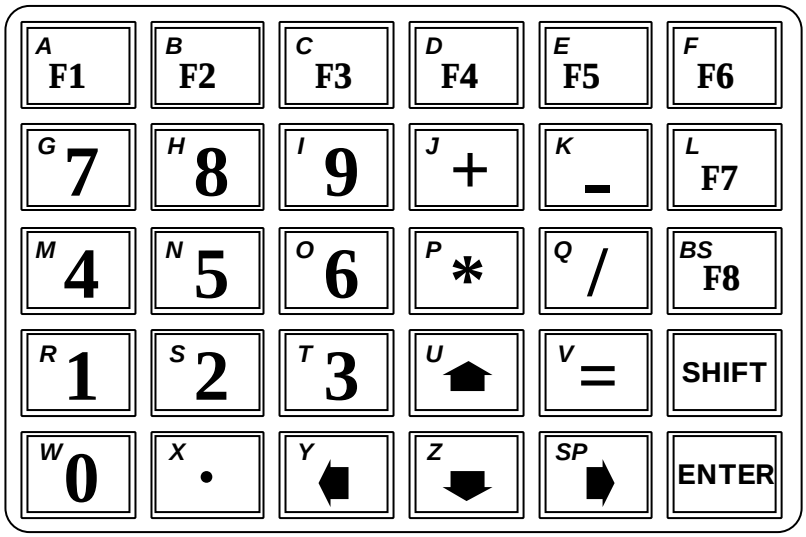
Liquid Crystal Display

In character display or text mode, the LCD offers a display of eight lines high by 40 characters long. Using standard size characters, linewrap is automatic and operates in page format. So after a character has been placed at the end of line eight, in the bottom right corner of the LCD, the cursor goes to the top of the screen again, overwriting line 1. Graphics mode display is detailed on page 33.

Keypad

The keypad is programmed for standard or customised key set. A click is audible each time a key is pressed, and confirms operation. Standard keypad layout is illustrated in Figure 4, showing numeric/ command symbols in larger type and alphabet keys in smaller type.

Fig 4
Standard Keypad Layout



There are three keyboard modes - Upper case characters (U), Lower case characters (L) and Numeric/Command (N). The current keyboard mode, U, L or N, is shown in the bottom right corner of the LCD.

Press **Shift** to display the next keyboard mode. Press **Shift** again for the next keyboard mode. A third **Shift** keypress returns the display to the original keyboard mode.

The capability to change keyboard mode using the Shift key can be disabled/enabled from the master device (see page 27).

A full list of standard characters for each keyboard mode, together with their hexadecimal values, are shown in Table 2.

Table 2
Keystroke Characters

KEY	Alpha Upper-Case	Lower-Case	Numeric
A F1	A (41_H)	a (61_H)	F1 (1B,4F,50_H)
B F2	B (42_H)	b (62_H)	F2 (1B,4F,51_H)
C F3	C (43_H)	c (63_H)	F3 (1B,4F,52_H)
D F4	D (44_H)	d (64_H)	F4 (1B,4F,53_H)
E F5	E (45_H)	e (65_H)	F5 (1B,5B,31,37,$7E_H$)
F F6	F (46_H)	f (66_H)	F6 (1B,5B,31,38,$7E_H$)
G 7	G (47_H)	g (67_H)	7 (37_H)
H 8	H (48_H)	h (68_H)	8 (38_H)
I 9	I (49_H)	i (69_H)	9 (39_H)
J +	J ($4A_H$)	j ($6A_H$)	+ ($2B_H$)
K -	K ($4B_H$)	k ($6B_H$)	- ($2D_H$)
L F7	L ($4C_H$)	l ($6C_H$)	F7 (1B,5B,31,39,$7E_H$)
M 4	M ($4D_H$)	m ($6D_H$)	4 (34_H)
N 5	N ($4E_H$)	n ($6E_H$)	5 (35_H)
O 6	O ($4F_H$)	o ($6F_H$)	6 (36_H)
P *	P (50_H)	p (70_H)	* ($2A_H$)
Q /	Q (51_H)	q (71_H)	/ ($2F_H$)
BS F8	<BS> (08_H)	<BS> (08_H)	F8 (1B,5B,32,30,$7E_H$) **or** <BS> (08_H) *
R 1	R (52_H)	r (72_H)	1 (31_H)
S 2	S (53_H)	s (73_H)	2 (32_H)
T 3	T (54_H)	t (74_H)	3 (33_H)
U	U (55_H)	u (75_H)	^ (1B,5B,41_H)
V =	V (56_H)	v (76_H)	= ($3D_H$)
SHIFT	SHIFT	SHIFT	SHIFT
W 0	W (57_H)	w (77_H)	0 (30_H)
X .	X (58_H)	x (78_H)	. ($2E_H$) **or** , ($2C_H$)*
Y	Y (59_H)	y (79_H)	< (1B,5B,44_H)
Z	Z ($5A_H$)	z ($7A_H$)	V (1B,5B,42_H)
SP	SP (20_H)	SP (20_H)	> (1B,5B,43_H)
ENTER	ENTER ($0D_H$)	ENTER ($0D_H$)	ENTER ($0D_H$)

* if selected in Setup menu

F keys in numeric mode, and Enter in all modes, can be programmed to send user-defined strings.

Receiving Data

The Mercury 2e can operate in text or graphics display mode or a combination of text and graphics 'screens'. Receiving data in text or Character Display Mode is described below. Graphics mode is described on page 33.

Character Display Mode

The Mercury 2e receives and transmits commands in 7 or 8 bit ASCII characters. (See page 19). The enhanced character set is only available when both communication and operation of Mercury 2e are set to 8 bit mode. Note that in 7 bit transmission, only codes (00_H) to ($7F_H$) are used.

In 8 bit mode, Mercury can receive 256 unique data codes. The first 32 codes control the operation of the terminal and so are not displayed. The next 128 codes are displayable on the LCD, except for <DEL> ($7F_H$). The codes used in 8 bit transmission, (00_H) to ($9F_H$), with their respective Hexadecimal values and standard ASCII names, are given in Table 3.

Table 3 Standard ASCII Names of Control Codes

Lower nibble(x)	Upper nibble									
Hex	$0(x)_H$	$1(x)_H$	$2(x)_H$	$3(x)_H$	$4(x)_H$	$5(x)_H$	$6(x)_H$	$7(x)_H$	$8(x)_H$	$9(x)_H$	A- $F(x)_H$
0	<NUL>	<DLE>	<SP>	0	@	P	`	p	Ç	É	
1	<SOH>	<DC1>	!	1	A	Q	a	q	ü	œ	
2	<STX>	<DC2>	“	2	B	R	b	r	é	Æ	
3	<ETX>	<DC3>	#	3	C	S	c	s	â	ô	
4	<EOT>	<DC4>	$	4	D	T	d	t	ä	ö	
5	<ENQ>	<NAK>	%	5	E	U	e	u	à	ò	
6	<ACK>	<SYN>	&	6	F	V	f	v	å	û	
7	<BEL>	<ETB>	‘	7	G	W	g	w	ç	ù	
8	<BS>	<CAN>	(	8	H	X	h	x	ê	ÿ	
9	<HT>	<EM>	)	9	I	Y	i	y	ë	ö	
A	<LF>	<SUB>	*	:	J	Z	j	z	è	ü	
B	<VT>	<ESC>	+	;	K	[	k	{	ï	¢	
C	<FF>	<FS>	,	<	L	\	l	|	î	£	
D	<CR>	<GS<	-	=	M	]	m	}	ì	¥	
E	<SO>	<RS>	.	>	N	^	n	~	Ä	Pt	
F	<SI>	<US>	/	?	O	_	o	<DEL>	Å	ƒ	

In 8 bit mode, Hexadecimal $A0_H$ to FF_H are available for users to download as customised characters.

The effect of each standard ASCII character is given in Table 4.

Table 4
Control
Character Actions

Character String	Action
<NUL> <SOH> <EOT> <ENQ> <ACK> <HT> <SO> <SI> <DLE> <DC2> <DC4> <NAK> <SYN> <ETB> <EM> <SUB> <FS> <GS> <RS> <US>	These characters terminate escape sequences and are not displayed
<STX> <ETX>	Codes to start and stop blocks.
<BEL>	Sounds Beeper.
<BS>	Back Space.
<LF> <VT> <FF>	Line feed.
<CR>	Carriage Return.
<DC1>	Xon. Causes Terminal to continue transmitting.
<DC3>	Xoff. Causes Terminal to stop transmitting.
<CAN>	Cancels Escape Sequence.
<ESC>	Introduces Escape Sequence.
<EM>	Special Terminator for messages
<IND>	Processed as “down arrow” key.
<DEL> ($7F_H$)	Terminates any escape sequence which is in progress.

Escape Sequence

Each character can act as a standalone control code as above, or can be combined in strings to create escape sequences that offer further control and data transmission opportunities.

To combine characters into strings, the <ESC> control code must begin all sequences. The <ESC> ($1B_H$) code indicates to the unit receiving data that the following string should be considered together.

Sequences transmitted by Mercury 2e cannot be interrupted and other blocks or keyboard inputs will be buffered until the first sequence is transmitted in its entirety.

Mercury is configured to respond to defined escape sequences transmitted by the host computer, and these are listed below with their actions. Table 5 lists escape sequences that control the cursor and screen. Table 6 gives escape sequences that create commands.

Table 5
Cursor/Screen Control Strings in Text Mode

Action	**Character String**
Clear Display	"<ESC> [2 J" (on enabled screens)
Clear To End Of Line	"<ESC> [K"
Set Graphic Display Mode	"<ESC> [? 2 z"
Set Character Display Mode	"<ESC> [? 3 z"
Make Cursor Visible	"<ESC> [? 25 h" (Text mode only)
Make Cursor Invisible	"<ESC> [? 25 l" (Text mode only)
Move Cursor	"<ESC> [Pr ; Pc H" *
New Line	"<ESC> E"
Cursor Down	"<ESC> D"
Cursor Up	"<ESC> M"
Save Cursor Position	"<ESC> 7" (Text mode only)
Restore Cursor Position	"<ESC> 8" (Text mode only)
Home Cursor (1,1) Top Left	"<ESC> [? 6 l"

*Pr and Pc define the location to which the cursor moves, being respectively row and column numerals in ASCII code. With Row 1 as the top of the screen and row 8 at the bottom, the number is interpreted as modulo 8 thus if Pr equals 16 then the cursor moves to row 8. Similarly, with Column 1 as the left side of the screen and Column 40 on the right, the number is interpreted at modulo 40. Thus if Pc equals 84 then the cursor moves to column 4.

Table 6

Command Escape Sequences

Action	Character String
Set Security Code (where Pa, Pb, Pc are two digit ASCII coded numerals to create 6 digit security code - see page 20)	"<ESC> [? 1 ; Pa; Pb ; Pc z"
Select 7 bit ASCII mode	"<ESC> [= 1 l"
Select 8 bit ASCII mode	"<ESC> [= 1 h"
Sample Digital Inputs	"<ESC> [? 4 z"
Set Up Message For Later Recall (where Pn is a two digit ASCII numeral defining message identifier, value 1 to 99.)	"<ESC> [? 7 ; Pn z DATA <EM>"
Recall Message	"<ESC> [? 8 ; Pn z"
Send Next Queued Block	"<ESC> [? 9 ; 1 z"
Re-Send Last Sent Block	"<ESC> [? 9 ; 2 z"
Delete all stored Messages	"<ESC> [? 10 z"
Store To NVRAM	"<ESC> [? 11 z"
Set Keypad To Numeric Mode	"<ESC> (<"
Set Keypad To Upper-Case Mode	"<ESC>) <"
Set Keypad to Lower-Case Mode	"<ESC> * <"
Enable bar code in one shot mode	"<ESC> [? 15 ; 1 z"
Disable bar code	"<ESC> [? 15 ; 2 z"
Enable bar code	"<ESC> [? 15 ; 3 z"
Enable card reader in one shot mode	"<ESC> [? 15 ; 4 z"
Disable card reader	"<ESC> [? 15 ; 5 z"
Enable card reader	"<ESC> [? 15 ; 6 z"
To configure bar-code reader	"<ESC> [? 14 z DATA <EM>"
Redefine <STX> character (where p is a single character to be defined)	"<ESC> [? 16 ; 1 z p <EM>"
Redefine <ETX> character (where p is a single character to be defined)	"<ESC> [? 16 ; 2 z p <EM>"
Restrict keyboard to U and N modes	"<ESC> [? 17 ; 1 z"
Allow keyboard U, N and L modes	"<ESC> [? 17 ; 2 z"
Change junction of <FF> character to Clear Screen	"<ESC> [? 21 ; 1 z"
Revert Junction of <FF> character to line feed	"<ESC> [1 ; num }"
Select text page number	"<ESC> [1 ; num }"

Specifying Screen Mode

Up to three separate screen pages can be controlled at a time from the host computer, to display two text pages and a graphics image. The screen pages can be individually controlled to display text only, graphics only or a combination of text with graphics. The following specify screen mode:

Text and graphics off	"<ESC> [? 20 ; 0 z"
Text on, graphics off	"<ESC> [? 20 ; 1 z"
Graphics on, text off	"<ESC> [? 20 ; 2 z"
Text and graphics on, with the screens logically ORed	"<ESC> [? 20 ; 3 z"
Text and graphics on, with the screens logically XORed	"<ESC> [? 20 ; 4 z"
Text and graphics on, with the screens logically ANDed	"<ESC> [? 20 ; 5 z"

Disabling Keyboard or Keyboard Mode Selection

Keyboard entry is disabled / re-enabled from the host computer by transmitting the escape sequence:

Disable Keyboard	"<ESC> [? 2 h"
Enable Keyboard	"<ESC> [? 2 l"

Using **Shift** key to change the keyboard mode can be disabled / re-enabled from the host computer by transmitting the escape sequence:

Disable Shift Key	" <ESC> [? 13 z"
Enable Shift Key	" <ESC> [? 12 z"

Set-up menu, however, can be entered as before by pressing **Shift** four times, then **Enter** .

NOTE: When **Shift** is disabled, the ULN mode indicator is not displayed on the screen.

Pin Number

Version 3v2e and above have two further escape sequences to enable and disable the 'PIN Mode'. When enabled, any text entered in the Composed Text Input will be shown as a dot character '.', but will be transmitted to the host as the actual text that was entered. Enabling 'PIN Mode' has no effect in point-to-point mode.

'PIN Mode' disabled (i.e text visible) " <ESC> [? 2 4 ; 0 z"
'PIN Mode' enabled
(i.e text shown as dot characters '.') " <ESC> [? 2 4 ; 1 z"

e.g.

'PIN Mode' status	Text entered via keyboard	Text shown on display	Text sent To host
Disabled	1234567890	1234567890	1234567890
Enabled	1234567890	.....	1234567890

User-Definable Characters

There are 96 ASCII two-digit codes available for users to assign to escape sequences that are frequently required. These are hexadecimal $A0_H$ to FF_H (see Table 3) and available in 8 bit mode only. The sequence to define a character is as follows:

"<ESC> [? 19 ; **num** z **data**"

num is ASCII number of the character being defined (between 160 and 255). **data** gives 8 bytes of data which must be supplied as ASCII characters. For Pixel to ASCII character conversion table, see page 33.

User-Definable Keys

Redefine a Function key or **Enter** with up to 8 ASCII characters, placed in the following sequence at **data**.

"<ESC> [? 23; Pn z **data** <EM>"

Pn is the number of the key being redefined. Numbers 1 to 8 redefine **F1** to **F8** respectively, and 9 redefines **Enter** .

Messages

Messages, in the form of characters or escape sequences that are sent to the Mercury, can be recalled for display many times (see Table 6).

A total of 7,000 characters may be stored as messages in RAM. Each message is assigned an identifying value between 1 and 99. A message should not be allocated to an identifier already in use.

The codes in the message can be any visible or control character, except <STX>, <ETX> and <EM>, or the escape sequence for “Set Up Message for Later Recall”. It is possible to create a message string to recall other messages.

Storing Messages

On transmission to the Mercury, messages are stored temporarily in Static Random Access Memory (SRAM). A message may be recalled as often as required, but it is lost if the power is removed from the Mercury 2e Terminal. If the command “Store to NVRAM” is sent after the message, then the contents of the SRAM are copied to the Non-Volatile RAM (NVRAM) to ensure preservation in case of power failure.

If the Mercury 2e Terminal is turned off and subsequently turned on, it copies the contents of NVRAM into SRAM, restoring any messages down-loaded up to the time the last “Store to NVRAM” command was sent. If the set-up mode is entered and left, the contents of SRAM are copied to NVRAM automatically.

Blocks

Blocks are strings of data in a fixed format which cannot be interrupted, obtained from a read of digital inputs, or from a bar code read or a card swipe. The format distinguishes the data string from keypad-entered data.

Point to Point Transmission

Transmission of messages in point-to-point configuration is immediate, i.e. at every key stroke, or promptly after a card-read or bar-code swipe. The control codes and escape sequences described in this section are available, with the exceptions noted.

Transmitted messages follow the format:

<STX> ADDR FUNC ID DATA DMY CSUM <ETX>

<STX> Start Transmission (02_H)

ADDR A two byte address field, set up in Telemetry Address with value 1 to 15. For multi-drop mode see page 32. This is always 01 in point to point mode.

FUNC Determines type of information being transmitted with a single byte character. For messages transmitted from the Mercury 2e terminal this is always "D" (44_H), and "R" (52_H) for messages received by the Mercury 2e terminal.

ID Identifies source of data from a single byte:

"B" (42_H) data from Security Card swipe
"C" (43_H) data from Bar Code Reader
"E" (45_H) data from digital input read.

Other ID codes are available in Multi-drop mode. (see page 32)

DATA Information being sent from the identified source:

data from Security Card swipe as 32 bits, encoded into 8 bytes of ASCII hexadecimal;

data from Bar Code Reader, printable as it stands;

data for Digital input reader as a single byte.

DMY Single character, usually (00_H); but if this would result in the following CSUM byte being a control character, the DMY is set to (20_H).

CSUM A single byte checksum character, which is the 7 bit negated algebraic sum of all the characters in the string from <STX> to DMY inclusive.

<ETX> End Transmission character (03_H) (see Table 4)

Examples of messages are given in Appendix C.

Multi-Drop Telemetry

In multi-drop mode the master device polls the slave Mercury 2e Terminals. Up to 15 Terminal systems can transmit to a single host computer via a single twisted pair cable utilising RS485 levels (two pairs if RS422 is used). The Multi-drop master initiates all communications and the slaves can only reply when requested.

Multi-drop operation is supported over the RS485 and tri-state controlled RS422 communications link between I.S Interface Modules. So these must be installed even if operation is in non-hazardous areas.

Multi-Drop Mode Screen

The Mercury 2e LCD screen in multi-drop mode operates in the standard page format, with the exception that the eighth line is used as the editing area for composing blocks. To avoid deletion of data being composed on Line 8, host operators should use lines 1 to 7.

In the case of the host computer transmitting a Clear Screen escape sequence, in Multi-drop mode, lines 1 to 7 of the Screen are cleared. Line 8 is not affected.

On Line 8, an alpha-numeric keypress causes the character to appear on the bottom line of the screen at column 6. Up to 30 characters can be composed into a message. To edit use the back space key, <BS> (F8 in N mode). When complete, press **Enter** to queue the message for transmission.

If a function key is activated while a message is being composed, the function code is added to the block buffer ahead of the message, without affecting the composition of the message.

Messages are block-based and therefore indivisible. So the software handshaking facility Xon/Xoff is automatically disabled if Multi-drop Operation is selected in the Setup menu (see Table 1).

The Mercury terminal does not inhibit received characters being displayed on the 8th line of the screen. So a message being composed may be overwritten on the screen, although it will still be composed correctly into a block.

Block Format

The block format for messages in multi-drop are similar to that for Point-to-Point mode, and are received as well as transmitted:

<STX> ADDR FUNC ID DATA DMY CSUM <ETX>

These fields are described on page 30. The following fields have additional options in multi-drop mode as follows:

ADDR — Mercury 2e Terminal can be set to respond to any address in range 1 to 15 in the Setup menu. Address 00 is reserved for broadcast to all slave terminals.

ID — In addition to the codes B, C and E described in Point-to-Point Mode, a single byte defines the block source as follows:

"A" (41_H) block from operator keyboard entry

"D" (44_H) block from keyboard function key (F1 to F8)

DATA — Format differs slightly for sending or receiving data blocks. Block data received by the Mercury 2e can be up to 128 bytes long, containing visible characters and escape sequences.
Block data transmitted by the Mercury 2e includes one of the above ID bytes or the "Multi-drop Acknowledge" block (see Setup menu on page 19). No acknowledgement is sent if the received block was a broadcast.

Sending Block

A key or series of keys pressed on the terminal are stored into an output buffer on the keypress **Enter** . The master unit reads the output buffer on a FIRST-IN, FIRST-OUT basis. The escape sequence to send the next buffer is defined in Table 6 on page 26.

Examples of typical sequences and how they are composed are given in Appendix C.

Graphics Display Mode

To select Graphics with Text or Graphics alone, see page 27. Note that on Mercury terminals with text only, the enhanced software described below is not available.

Graphics Display

In Graphics mode, display is made up of 64 rows of 40 columns. Each column position is a ‘tile’ made up of 6 pixels across by 1 pixel in height.

No cursor is visible in graphics mode. As a tile is written, a virtual cursor is incremented. The virtual cursor has its own set of coordinates allowing access to graphics without corrupting text currently displayed.

Coordinates are defined by the byte number and row number, calculated from the top left corner of the display. With one byte equating to 6 pixels, simple or bitmap images are positioned horizontally from the 6 pixel boundaries.

Graphics may be downloaded as a bit-map image from off-line Graphics Converter Software, available from Daniel Europe Ltd, or designed directly on the display. See page 35 for examples of simple graphics and their design.

Each tile is individually accessible, and each pixel pattern is uniquely mapped to an ASCII character, defined in Table 7 below. In the table a **O** represents a clear, OFF state pixel, and a • represents a pixel in the energised, ON state. The pixel pattern is read left to right.

Table 7
Graphics Mode Pixel Data

OOOOOO	SP	O•OOOO	0	•OOOOO	@	••OOOO	P
OOOOO•	!	O•OOO•	1	•OOOO•	A	••OOO•	Q
OOOO•O	"	O•OO•O	2	•OOO•O	B	••OO•O	R
OOOO••	#	O•OO••	3	•OOO••	C	••OO••	S
OOO•OO	$	O•O•OO	4	•OO•OO	D	••O•OO	T
OOO•O•	%	O•O•O•	5	•OO•O•	E	••O•O•	U
OOO••O	&	O•O••O	6	•OO••O	F	••O••O	V
OOO•••	'	O•O•••	7	•OO•••	G	••O•••	W
OO•OOO	(	O••OOO	8	•O•OOO	H	•••OOO	X
OO•OO•	)	O••OO•	9	•O•OO•	I	•••OO•	Y
OO•O•O	*	O••O•O	:	•O•O•O	J	•••O•O	Z
OO•O••	+	O••O••	;	•O•O••	K	•••O••	[
OO••OO	,	O•••OO	<	•O••OO	L	••••OO	\
OO••O•	-	O•••O•	=	•O••O•	M	••••O•	]
OO•••O	.	O••••O	>	•O•••O	N	•••••O	^
OO••••	/	O•••••	?	•O••••	O	•••••	_

Cursor and Screen Control Codes

In Graphics Mode, Cursor/Screen Control codes differ slightly from those in Character Display Mode. Table 8 lists the escape sequences and actions that result in when Graphics Mode.

Table 8
Cursor/Screen Control in Graphics Mode

Action	**Character String**
Clear Display	"<ESC> [2 J"
Set Graphic Display Mode	"<ESC> [? 2 z"
Set Character Display Mode	"<ESC> [? 3 z"
Move Virtual Cursor *	"<ESC> [Pr;PcH"
Virtual Cursor Down and to Start of Line	"<ESC> E"
Virtual Cursor Up	"<ESC> D"
Virtual Cursor Down	"<ESC> M"
Select standard character size	"<ESC> [? 3 z"
Select larger character size (Graphics mode only)	"<ESC> [? 3 Z"

* Pr and Pc define the tile to which the cursor should move, being respectively row and column numerals in ASCII code. Tile row 1 is the top of the screen and tile row 64 is the bottom, so Pr refers to the row location of the tile to where the virtual graphics cursor will move. Tile column 1 is at the left side of the screen and tile column 40 at the right, so Pc refers to the column location of the tile.

Control Codes

The remaining Control character strings listed in Table 6 on page 26 for Character Display Mode apply equally in Graphics Mode.

The facility to draw a line or box is not available in the text-only version of Mercury 2e. The fully enhanced Mercury 2e is capable of handling downloaded bitmap images generated off-line, as well as these simple line and box drawings.

Draw Line

A line can be drawn at any angle using the following sequence:

<ESC> [? 18 ; 4 ; **x1** ; **y1** ; **x2** ; **y2**

where **x1** (pixel number) and **y1** (row number) give the pixel coordinates of the start of the line, and **x2**, **y2** give the pixel coordinates of the end of the line.

Draw a Solid Box

To draw a solid box, use one of the following sequences.

Solid black box <ESC> [? 18 ; 2 ; **x1**; **y1** ; **x2** ; **y2** z

Solid white box <ESC> [? 18 ; 3 ; **x1**; **y1** ; **x2** ; **y2** z

where **x1** (pixel number) and **y1** (row number) give the pixel coordinates of the top, left corner, and **x2**, **y2** give the pixel coordinates of the bottom, right corner of the box.

Downloading a Graphic Bitmap Image to Screen

When downloading a graphics bitmap image, enter the position and size of the image in the following sequence.

<ESC> [? 18 ; 1 ; **x1** ; **y1** ; **wdth** ; **hgt** z data

where **x1** (byte number) and **y1** (row number) are the coordinates of the top left corner, and **wdth** and **hgt** give the width (in bytes) and height (in rows) of the image.

Optional Equipment

Card Reader

Operated by passing a customer card through the reader, a successful read is indicated by a beep. In point-to-point mode, transmission to the host computer is immediate. In multi-drop mode the data is stored in the output buffer. The message format is determined by the byte structure setting, selected during set-up, and comprises an escape prefix, function code, data and return. For sequences controlling the card reader, see page 26.

Bar Code Wand Reader

The bar code reader is operated by wiping the head of the wand over the item bar code. The tip should be in contact with the bar-code surface and the wand may be wiped in either direction. A successful read of the bar code is indicated by a beep. For escape sequences controlling the bar-code reader see page 26.

Laser Scanner

Installation and operation of the Bar-code laser scanner is covered in a separate manual. Operation results in the same action as described for the Bar Code Wand.

Specification

Mercury 2e Terminal

(Part No.R004/e-IS.)

Physical Data

Overall Dimensions:		
Height	370 mm.	
Width	227 mm.	
Depth:	(with card reader)	97 mm.
	(without card reader)	67 mm.
Weight	5.5Kg.	
Colour	Cobalt Blue.	
Paint type	Epoxy.	

Performance Data

DISPLAY	
Type	Supertwist, Liquid Crystal. Reflective filters.
Colour	Black on silver
Character Mode:	40 characters, 8 lines 6 x 8 dot character cell ; 128 pre-defined and 96 downloadable ASCII characters in 8 bit mode; 96 ASCII character set in 7 bit mode. Character height 4.2 mm.
Graphics Mode	240 x 64 graphic pixels, forming 2560 tiles. Character cell height 4.2 mm or 12.7 mm.
Keypad	Sealed membrane switches. Polyester outer layer, with tactile response. Damp wipeable for clean/sterile environments. 30 keys including 8 functions. Option for Audible sounder via membrane selected in Setup.
Keyboard modes	Upper Case (U), Lower case (L), Numeric/Command (N).
Digital Inputs	4 whetted inputs for external contacts or I.S. “simple apparatus”.
Protocol	Based on VT 100.
Communication	To and from the host computer in full or half duplex, using standard asynchronous 7 bit or 8 bit ASCII characters.
Communications speed	50 – 9600 baud.

Buffers	Incoming buffer 2048 characters long. Xon-Xoff control selected in Setup. Xoff sent to host computer when buffer is within 10 bytes of being full. Xon sent when Terminal buffer is within 5 characters of being empty. In multi-drop mode, Xon-Xoff control is disabled.
User Memory	8K NVRAM for rapid recall of user graphics or characters.
	Data is the binary value of the 5 readable inputs biased by $20_{H.}$
Digital Inputs	D7 Always a zero. D6 Always a zero. D5 Always a one. D4 Card presence indicator. Bit is a “1” if card in slot D3 Digital input 4. This bit is a “1” if a contact is closed. D2 Digital input 3. This bit is a “1” if a contact is closed. D1 Digital input 2. This bit is a “1” if a contact is closed. D0 Digital input 1. This bit is a “1” if a contact is closed.
Inputs identified by ID	“A” (41_H) Operator keypress “B” (42_H) Security Card “C” (43_H) Bar Code reader “D” (44_H) Function key “E” (45_H) Digital Input
Multi-Drop Mode	Maximum of 15 terminals may be multidropped via IS interface modules.
Multi-Drop Protocol	Spectra-Tek proprietary, based on ANSI-X3.

Environmental Conditions

Operating Temperature	-20 to 50°C
Storage	-20 to 60°C
Protection	IP65 Standard. (Ingress protection: 6 dust, 5 water-jet).
Certification	EEx ia IIC T4.
Sira Safety Services Ltd.	SCS No Ex90C2016 X.
Quality Assurance	BS5750 Part I.P

Non-I.S. Mercury 2e Terminal

(Part No. R004/e-GP)

The non-IS terminal has similar specifications to IS Terminal. Unit may be used as a stand alone safe area Terminal powered by a 12 V, 1 Watt supply, with an RS232 port. Not intrinsically safe because of the voltages used with the RS232 port.

Security Card Reader

(R005-CR)

Performance Data

Principle of Operation	Wiegand Effect. Comprises permanent magnets and sensing coil.
Card Code	32 bit binary plus start and stop bits (16 bit customer location plus 16 bit card number).
Intrinsic Safety	Card reader is certified for use with Mercury 2e Terminal (see Appendix A.)

Environmental Conditions

Operating Temperature	-20 to 50° C.
Storage	-20 to 60° C.
Protection	IP65 Standard. (Ingress protection: 6 dust, 5 water-jet).

Bar Code Interface

(Part No. R008-WO) Installed with Mercury 2e

Readable Codes (automatic)	Code 39 (3 of 9) Extended code 39 Code 128 UPC/EAN/ JAN Interleaved 2 of 5 Codabar (NW7).
Decode Direction	Interface interprets codes read in either direction.

Bar Code Wand (Part No. R008-WAND)

Performance Data

Cable	1m coiled cable with waterproof connection.
Optical Resolution	0.19 mm.
Tip Material	Replaceable Sapphire.
Intrinsic Safety	The bar code wand is certified for use with the Mercury 2e Terminal as an associated apparatus, EEx ia IIC T4 SCS No.Ex90C2016X (see Appendix A).
Scan Speed	10 to 120 cm per second.

Environmental Conditions

Operating Temperature	-20 to 50° C.
Storage	-40 to 75° C.
Protection	IP64 Standard.

I.S. Interface Module

(Part No. R007-IS) Installed in Safe Area

Physical Data

Overall Dimensions

Height	110 mm.
Width	85 mm.
Depth	40 mm.
Weight	250 grams (approx.).
Material	Plastic
Colour	Green.
IS Terminals	20 V, 100 ohm nominal, galvanically isolated.
IS Cabling	See page 10
Mounting	35mm transverse rail DIN 46277 or by screws on 90 mm centres.
Power	20-32 V d.c. 2W maximum. Nominal 80mA at 24V.
IS Earth	Not Required.
Isolation	3 mutually galvanically isolated ports.
Communications	RS232, RS422 and RS485 (see Appendix F).
Intrinsic Safety	Mounted in safe area, SCS No. Ex90C2017

Environmental Conditions

Operating Temperature	0 to 40° C.
Storage	-20 to 60°C.
Humidity	95% non-condensing.
Protection	IP 20.
Location	Safe Area.

Appendix A

Certificates of Conformity for the Spectra-Tek UK Limited Mercury 2e and R007 Intrinsically Safe Interface Module are given overleaf.

1. CERTIFICATE OF CONFORMITY

2. SCS No: Ex 90C2016X (Re Issue)

3. This Certificate is issued for the electrical apparatus:

   Mercury 2

4. Manufactured by:

   Spectra-Tek UK Ltd
   Swinton Grange
   Malton
   North Yorkshire
   YO17 0QR

5. and submitted for certification by:

   The Manufacturer.

6. This electrical apparatus and any acceptable variation thereto is specified in the schedule to this Certificate and the documents therein referred to.

7. Sira Certification Service being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18 December 1975 (76/117/EEC) certifies that the apparatus has been found to comply with the Harmonised European Standards:

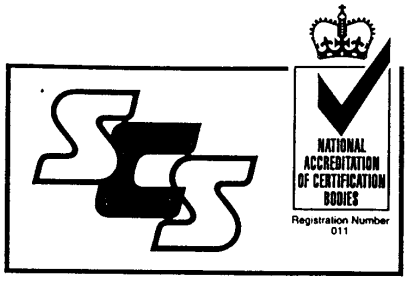
   BS 5501:Part 1:1977 (EN 50 014)
   BS 5501:Part 7:1977 (EN 50 020)

   and has successfully met the examination and test requirements which are recorded in a confidential Test Report.

8. The apparatus marking shall include the code:

   EEx ia IIC T4 Tamb max = 50°C

SIRA CERTIFICATION SERVICE



Certificate SCS No: Ex 90C2016X (Re Issue)

9. The supplier of the electrical apparatus referred to in this Certificate has the responsibility to ensure that the apparatus conforms to the specification laid down in the schedule to this Certificate and has satisfied the routine verifications and tests referred to therein.

10. This apparatus may be marked with the Distinctive Community Mark specified in Annex II to the Council Directive of 16 January 1984 (84/47/EEC).

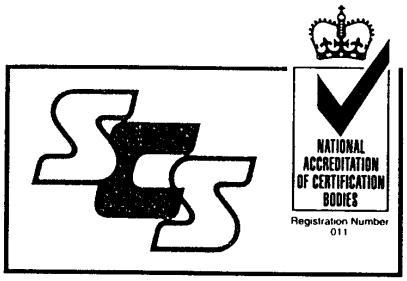
Date: 19th August 1994 **File No:** P/0059/00

I D Knott BSc CEng
MIMechE MInstMC
CHIEF EXECUTIVE

Sira Certification Service
Saighton Lane
Saighton
Chester
CH3 6EG
Great Britain

The use of this apparatus will normally be the subject of National Legislation and/or Installation Codes.

This certificate and its schedules should always be reproduced in its totality.



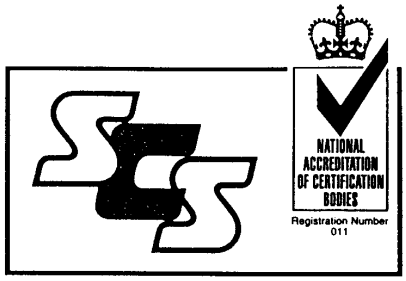
CERTIFICATE OF CONFORMITY

NUMBER: Ex 90C2016X (Re Issue)

DATED: 19th August 1994

APPARATUS:

The Mercury 2 Unit is a fixed piece of equipment and comprises a cast aluminium enclosure with a Liquid Crystal Display and membrane keyboard. The unit contains a card reader and an optional printed circuit board. The unit is intended to be connected to simple apparatus, such as switches via terminal block J1.

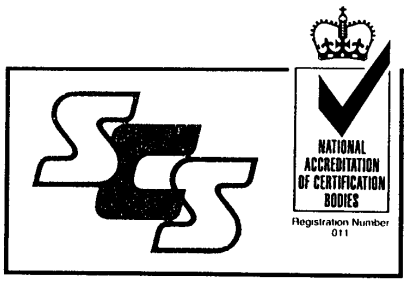


CERTIFICATE OF CONFORMITY

NUMBER: Ex 90C2016X (Re Issue)

DATED: 19th August 1994

DRAWING NUMBER	SHEET	REV	DATE	DESCRIPTION
P05020DR2	1 to 3	0	25 Jan 91	Circuit diagram
P053009F	1	5	12 Apr 91	Parts List
P053009F	2	5	12 Apr 91	Parts List
P053041D	1	0	21 Nov 90	Component ident.
P053041D	2	0	21 Nov 90	Track layout component side
P053041D	3	0	21 Nov 90	Track layout solder side
P053007C	2	4	05 Mar 91	PCB modification
P053007C	1	4	05 Mar 91	General assembly
R005010C	1	2	26 Jul 89	Card reader assembly
R008005D	1	3	28 Feb 91	Bar code reader
R008010D	1	1	07 Aug 90	Bar code socket assembly
R004069D	1	4	12 Apr 91	Keyboard assembly
R005018D	1	1	07 Mar 89	Card reader coil
R004067D	1	3	04 Apr 91	Display modification
R004074B	1	4	16 Apr 91	General assembly
R004074B	2	4	16 Apr 91	General assembly
P053015D	1	2	24 Oct 90	Transformer T1 on PCB P053-2
R0040166	1	2	04 Feb 91	Approval label
R005016C	1	2	12 Apr 91	Card reader/proximity switch wiring schematic



CERTIFICATE OF CONFORMITY

NUMBER: Ex 90C2016X (Re Issue)

DATED: 19th August 1994

CONDITIONS OF CERTIFICATION

1. This Certificate has been reissued so as to include the references EN50 014 and EN50 020 which were omitted from SCS Certificate of Conformity Ex 90C2016X dated 19th April 1991. It applies retrospectively to Products covered by that Certificate. The Certificate has been reissued on 19th August 1994 to correct a typographical error.

2. The use of the Sira Certification Service Mark is subject to the regulations applicable to the holders of SCS Certificates. Like regulations also apply to the marking of the name of the Certifying Body and this Certificate Number.

3. For the purpose of a System assessment the following parameters of the two separate intrinsically safe circuits may be used.

   J5 Pins, 1, 2, 3 and 4

V max in	=	19.34V	Ceq	=	0
I max in	=	254mA	Leq	=	0
W max in	=	1.07W	V out	=	1.2V

   J1 Pins, 1, 2, 3, 4 and 5

V out	=	29.4V	C ext	=	0.11 micro Farads
I out	=	66.4mA	L ext	=	135 micro Henrys/ohm
W out	=	0.262W	Ceq	=	0
			Leq	=	0

SPECIAL CONDITIONS OF USE

4. Only simple apparatus as defined by clause 1.3 of BS 5501:Part 1:1977 may be connected to terminals J1 pins 1 to 5.

5. Excepting (6) below, this equipment may only be used in conjunction with equipment complying with the requirements of Certificate No. SCS No. Ex 90C2017.

6. The Mercury 2 unit may be used in conjunction with a bar code wand which may be unplugged. Only the type bearing SCS No. Ex 90C2016X may be used.

CERTIFICATE OF CONFORMITY VARIATION

CERTIFICATE NUMBER: Ex 90C2016X **DATE:** 10th May 1993 (Re-issue)

VARIATION NUMBER: 1 (ONE) **DATE:** 14th July 1994

VARIATION:

To permit a change to the design of the Mercury 2.

DRAWINGS:

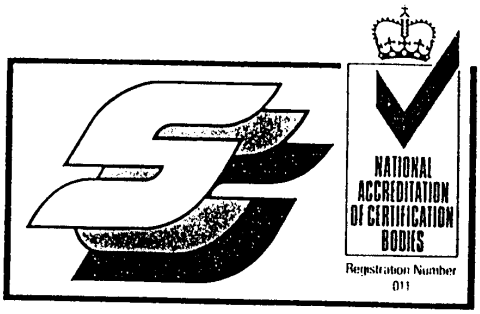
Document Number	Sheet No.	Issue	Date	Description
P053'007'C	1	6	13 Jun 94	GENERAL ASSEMBLY DRAWING
P053'009'F	1	8	28 Jun 94	MERCURY 2 TERMINAL SIRA PARTS LIST
P053'009'F	2	8	28 Jun 94	MERCURY 2 TERMINAL SIRA PARTS LISTS
P053'020'D	1	2	26 Apr 94	MERCURY II SCHEMATICS
P053'020'D	3	2	26 Apr 94	MERCURY 2 SCHEMATICS POWER SUPPLY AND COMMUNICATIONS

CERTIFICATE OF CONFORMITY VARIATION

CERTIFICATE NUMBER: Ex 90C2016X **DATE:** 10th May 1993 (Re-issue)

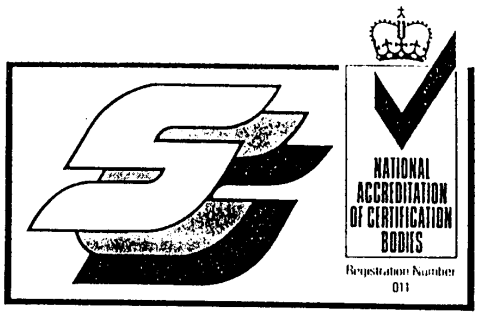
VARIATION NUMBER: 1 (ONE) **DATE:** 14th July 1994

Document Number	Sheet No.	Issue	Date	Description
P053'020'D	2	2	26 Apr 94	MERCURY 2 SCHEMATICS CARD READER, WAND, DIG I/O. ETC.
P053'041'D	1	2	13 Jun 94	MERCURY 2 COMPONENT IDENT
P053'041'D	2	2	13 Jun 94	MERCURY 2 COMPONENT COPPER
P053'041'D	3	2	13 Jun 94	MERCURY 2 SOLDER COPPER
R004'067'D	1	4	27 Apr 94	DISPLAY MODIFICATION DETAILS
R004'074'B	1	6	14 Sep 93	MERCURY 2 TERMINAL G.A.
R004'074'B	2	6	14 Sep 93	MERCURY 2 TERMINAL G.A.
R005'016'C	1	3	29 Apr 92	CARD READER/ PROXIMITY SWITCH WIRING SCHEMATIC



CERTIFICATE OF CONFORMITY VARIATION

CERTIFICATE NUMBER:		Ex 90C2016X		**DATE:** 10th May 1993 (Re-issue)
VARIATION NUMBER:		1 (ONE)		**DATE:** 14th July 1994
Document Number	**Sheet No.**	**Issue**	**Date**	**Description**
R008'010'D	1	3	29 Apr 92	BAR CODE READER SKT CABLE ASSY. DETAILS



CERTIFICATE OF CONFORMITY VARIATION

CERTIFICATE NUMBER:	Ex 90C2016X	**DATE:** 10th May 1993 (Re-issue)
VARIATION NUMBER:	1 (ONE)	**DATE:** 14th July 1994

ADDITIONAL CONDITIONS:

1. For the purposes of a system assessment, connector strip PL4 on the Mercury 2 has the following parameters.

			Group	Co	L/Ro
U_o	=	5.88V	IIC	12.5µF	33µH/Ω
I_o	=	254mA	IIB	98.5µF	99µH/Ω
P_o	=	1.07W	IIA	313µF	264µH/Ω
C_i	=	30.5µF			
L_i	=	0			

2. Connectors PL3 and PL4 must not be used at the same time.

File No: PS/0774/00
ST&C Report No: R/510/2909/B

p.p. **I D Knott BSc CEng MIMechE MInstMC**
CHIEF EXECUTIVE

1. CERTIFICATE OF CONFORMITY

2. SCS No: Ex 90C2017 (Re Issue)

3. This Certificate is issued for the electrical apparatus:

R007 I.S. Interface Module

4. Manufactured by:

Spectra-Tek UK Ltd
Swinton Grange
Malton
North Yorkshire
YO17 0QR

5. and submitted for certification by:

The Manufacturer.

6. This electrical apparatus and any acceptable variation thereto is specified in the schedule to this Certificate and the documents therein referred to.

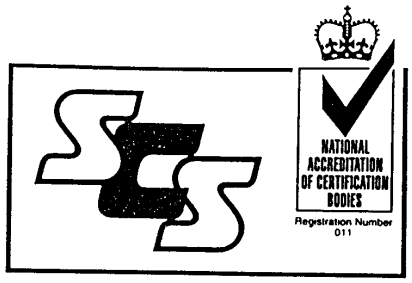
7. Sira Certification Service being an Approved Certification Body in accordance with Article 14 of the Council Directive of the European Communities of 18 December 1975 (76/117/EEC) certifies that the apparatus has been found to comply with the Harmonised European Standards:

BS 5501:Part 1:1977 (EN 50 014)
BS 5501:Part 7:1977 (EN 50 020)

and has successfully met the examination and test requirements which are recorded in a confidential Test Report.

8. The apparatus marking shall include the code:

[EEx ia] IIC Tamb max = 50°C



Certificate SCS No: Ex 90C2017 (Re Issue)

9. The supplier of the electrical apparatus referred to in this Certificate has the responsibility to ensure that the apparatus conforms to the specification laid down in the schedule to this Certificate and has satisfied the routine verifications and tests referred to therein.

10. This apparatus may be marked with the Distinctive Community Mark specified in Annex II to the Council Directive of 16 January 1984 (84/47/EEC).

Date: 19th August 1994 **File No:** P/0059/00

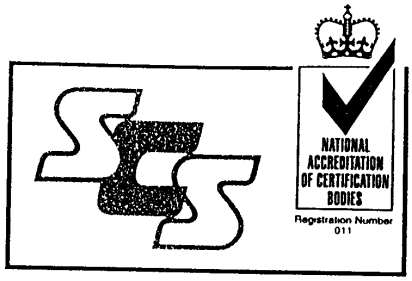
Ian D Knott

I D Knott BSc CEng
MIMechE MInstMC
CHIEF EXECUTIVE

Sira Certification Service
Saighton Lane
Saighton
Chester
CH3 6EG
Great Britain

The use of this apparatus will normally be the subject of National Legislation and/or Installation Codes.

This certificate and its schedules should always be reproduced in its totality.



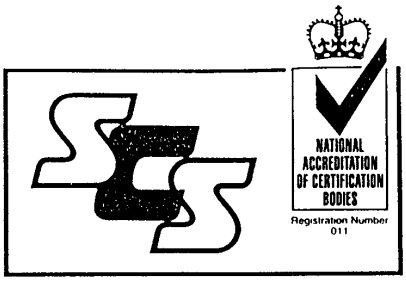
CERTIFICATE OF CONFORMITY

NUMBER: Ex90C2017 (Re Issue)

DATED: 19th August 1994

APPARATUS:

The R007 unit is intended to be located in the non-hazardous area and provides galvanically isolated power and data lines for connection to the hazardous area. The unit comprises two printed circuit boards, both fully coated with insulating lacquer. Safety is achieved using infallible transformers and opto-isolators. The complete assembly is mounted inside a plastic box sized approximately 100 x 90 x 40mm which is intended for rail mounting.

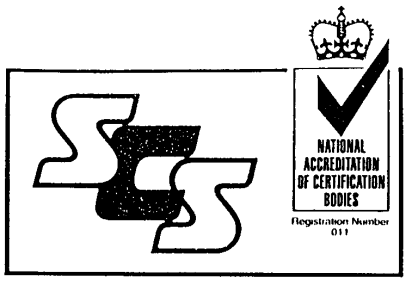


CERTIFICATE OF CONFORMITY

NUMBER: Ex 90C2017 (Re Issue)

DATED: 19th August 1994

DRAWING NUMBER	SHEET	REV	DATE	DESCRIPTION
P053044D	1	0	20 Feb 91	Circuit Diagram
P053045D	1	0	20 Feb 91	Circuit Diagram
P053029F	1	3	12 Apr 91	Parts List
P053039F	1	1	27 Sep 90	Parts List
P053042E	1	2	21 Nov 90	Ident. for P053021 R3
P053042E	2	2	26 Jan 91	Track layout component side
P053042E	3	2	20 Feb 91	Track layout solder side
P053043E	1	2	21 Nov 90	Ident. for P053031 R3
P053043E	2	2	21 Nov 90	Track layout component side
P053043E	3	2	21 Nov 90	Track layout solder side
P053027E	1	3	26 Nov 90	General assembly
P053037E	1	3	26 Nov 90	General assembly
P053028D	1	4	28 Feb 91	Assembly for soldering wires to T3.
P053038D	1	4	28 Feb 91	Assembly for solder wires to T1.
R007032D	1	2	09 Oct 90	Transformer PCB P053021
R007035D	1	4	12 Oct 90	Winding details for transformers PCB P053031
R007007D	1	1	04 Sep 90	Terminal block
R007008D	1	1	04 Sep 90	Terminal block
R007034D	1	2	12 Oct 90	Choke
R007001D	1	2	28 Feb 91	General arrangement
P053030E	1	0	21 Nov 90	18 Way Samtec Assembly
R007002B	1	2	19 Feb 91	Assembly instruction
R007011E	1	3	16 Apr 91	Certification label



CERTIFICATE OF CONFORMITY

NUMBER: Ex 90C2017 (Re Issue)

DATED: 19th August 1994

CONDITIONS OF CERTIFICATION

1. This Certificate has been reissued so as to include the references EN50 014 and EN50 020 which were omitted from SCS Certificate of Conformity Ex 90C2017 dated 19th April 1991. It applies retrospectively to Products covered by that Certificate. The Certificate has been reissued on 19th August 1994 to correct a typographical error.

2. The use of the Sira Certification Service Mark is subject to the regulations applicable to the holders of SCS Certificates. Like regulations also apply to the marking of the name of the Certifying Body and this Certificate Number.

3. The non-hazardous area terminals should not be fed from anything that has or contains a voltage in excess of 250 V rms ac or 250V dc.

4. For the purpose of a system assessment the following parameters may be used.

V max out	=	19.34V
I max out	=	254 mA
W max out	=	1.07W
Ceq	=	15.4nF
Leq	=	0
CExt	=	284 nF
L/R Ext	=	33 micro Henrys/ohm
Tamb max	=	50°C

Appendix B

References

1 Hand Book of Reliability Data (4), British Telecom.

2 BS5501 Equipment for potentially explosive atmospheres.

Appendix C

Using Mercury 2e in Multi-drop Mode

Examples of how to use the Mercury 2e escape codes to complete actions are given below. Take a few minutes to familiarise yourself with the method for designing blocks and messages, or graphic images.

Text Transmission

This example runs through the method to send a text message to a Mercury's display. The text used in this example is the word "TEST".
Using the format of a block, we can examine how it is composed:

"<STX> ADDR FUNC DATA DMY CSUM <ETX>"

<STX> character always starts a block and is sometimes known as the Control B character. The terminal needs to receive the character Hex value (02_H).

ADDR
Before any transmission is made, determine the destination terminal address. This address is set manually in the Set-up mode on the terminal and is a number between 1 and 15. The ADDR field is a two byte field. So if the destination terminal address is 1, then the field must contain 01.

FUNC
The FUNC byte is a "D" (44_H) for messages transmitted from the Mercury 2e terminal and "R" (52_H) for messages received by the Mercury 2e terminal. In this example this byte must be "R".

DATA
A field of variable length, this contains the "message" to be transmitted whether it is text or a control character string. In this example the word "TEST" is being transmitted.

CSUM

To calculate the CSUM for the above example;
Take the Hex value of the Characters and add them all together. The codes are listed on page 23.

<STX>		(02_H)
ADDR	01	(30, 31_H)
FUNC	R	(52_H)
DATA	TEST	(54,45,53,54_H)
DMY	<NUL>	(00_H)

Sum of above codes 02+30+31+52+54+45+53+54+00 = $01F5_H$

01F5 in Hex = 111110101 in Binary
'AND' the above with ($7F_H$) = 1110101
Negate the above (two's complement) by inverting all bits and add 1 = 0001011 = ($0B_H$)

This value is less than (20_H), which is a control code and so the process needs to be repeated with DMY = (20_H). This results in a new checksum having the value ($6B_H$), which translates to the character "k".

<ETX>
The <ETX> character always ends a block and is sometimes known as the Control-C character. The terminal needs to receive the <ETX> character that has the value (03_H).

To transmit the word "TEST" to the terminal at address 01, the following string needs to be sent:

"<STX> 0 1 R T E S T <SP> k <ETX>"

Read the Block Buffer

Using the format described above, the Master sends a block to read the output buffer on a Mercury 2e terminal with Multi-drop address 01 as follows:

<STX>		(02_H)
ADDR	01	($30,31_H$)
FUNC	R	(52_H)
DATA	"<ESC> [? 9 ; 1 z"	($1B,5B,3F,39,3B,31,7A_H$)
DMY	<NUL>	(00_H)

The checksum can be calculated to be (77_H), which is the ASCII code for the letter "w".
The block to be sent to the terminal takes the form;

"<STX> 0 1 R <ESC> [? 9 ; 1 z <NUL> w <ETX>"

The Re-send Last Block command (see page 26) allows the buffer to be read repeatedly.

Read Digital Inputs

The Control Character String to read the Digital Inputs in Multi-drop mode is:

"<ESC> [? 4 z"

Using the method demonstrated above, the block to be sent in multi-drop mode becomes;

"<STX> 0 1 R <ESC> [? 4 z <NUL> h <ETX>"

This action causes the status of the external contacts to be copied into the output buffer. It is possible to incorporate a Block Read instruction into a single block command by putting into the DATA field both the Control String to read the digital inputs and the Control String to read the block buffer.

Multi-Drop Acknowledge Mode

If the destination terminal is set up with Multi-drop Acknowledge Enabled then the Mercury 2e terminal sends an Acknowledge Block back to the master. It does this on receipt of a valid Block of matching address (i.e the Multi-drop Protocol is correct) and takes the form:

"<STX> 0 1 D <NUL> Y <ETX>"

This string acknowledges that a message with the correct protocol, ie FUNC, CSUM, etc. has been received, not that the message data is recognised. So if a message is constructed with a non-existent Escape sequence in DATA yet with the correct protocol, then a Multi-drop Acknowledge is transmitted but the Mercury 2e ignores the instruction.

When the Digital Inputs are read to the block, no information is relayed back to the Master. If Multi-drop Acknowledge is enabled, however, then the acknowledge would confirm that the message was received correctly.

Appendix D

Mercury 2e Terminal Wiring Schedule

Terminal	Pin No.	Description	Application
J1 (Simple equipment I.S. interface)			
J1	1	Input 1	Digital Input
J1	2	Input 2	Digital Input
J1	3	Input 3	Digital Input
J1	4	Input 4	Digital Input
J1	5	Common	
J2 (Card reader Wiegand coil)			
J2	1	Coil (red)	Card Reader
J2	2	Coil (black)	Card Reader
J2	3	Screen	Card Reader
J2	4	P&F+	Card Reader
J2	5	P&F-	Card Reader
J3 (Non-I.S.RS232 interface)			
J3	1	0V	Non I.S. Comms
J3	2	Rx in	Non I.S. Comms
J3	3	Tx out	Non I.S. Comms
J3	4	0V	Non I.S. Comms
J4 (Non-I.S. External Power)			
J4	1	+12V	Non I.S. Power
J4	2	0V	Non I.S. Comms
J5 (I.S. interface module)			
J5	1	Tx1	I.S. Comms & Power
J5	2	Tx2	I.S. Comms & Power
J5	3	Rx1	I.S. Comms & Power
J5	4	Rx2	I.S. Comms & Power
J5	5	Screen	Cable screen earth to Mercury 2e body

Appendix E

I.S. Interface Module Wiring Schedule

Pin Number	Description
1	RS-232 Rx Input.
2	RS-232 Com.
3	RS-232 TxOutput.
4	RS422/485 B+.
5	RS422/485 Com.
6	RS422/485 A-.
7	0 V Nom. Supply.
8	Not Used.
9	+24 V Nom. Supply.
10	RS422/485 B+.
11	RS422/485 Com.
12	RS422/485 A-.

Field connections to Mercury 2e

13	Tx2.
14	Not Used.
15	Tx1.
16	-
17	Not Used.
18	-
19	Rx2.
20	Not Used.
21	Rx1.

Appendix F

Communications with the R007 Interface Module

RS422/485 and RS232 ports share a common 0V rail which is totally floating.

RS422 Tx drivers are tri-state devices which remain in a state of high impedance until data transmission, when they are asserted; this allows multi-drop operation. In point-to-point mode, RS422 drivers are constantly active, i.e. never in Hi-Z state.

Multi-drop communications are provided via RS422 or RS485. To connect RS485 to the Interface Module, the Tx+ and the Tx- terminals should be paralleled with the Rx+ and Rx- terminals respectively. See Appendix E.

The IS Interface Module R007-IS is used as the tri-state communication port. See Appendix E for the wiring schedule.

The transmitters require a high impedance state and a protocol to ensure that only one transmitter is allowed to drive the 'bus' at any one time. To avoid contention, the transmitter is enabled in the marking state (see Fig. 5).

Once a message has been completely transmitted, there is a period of time before the transmitter is tri-stated (high impedance state). This period depends on the baud rate (see the table below). The master device must wait for this period before enabling its transmitter once more.

Tri-state disable times at various baud rates

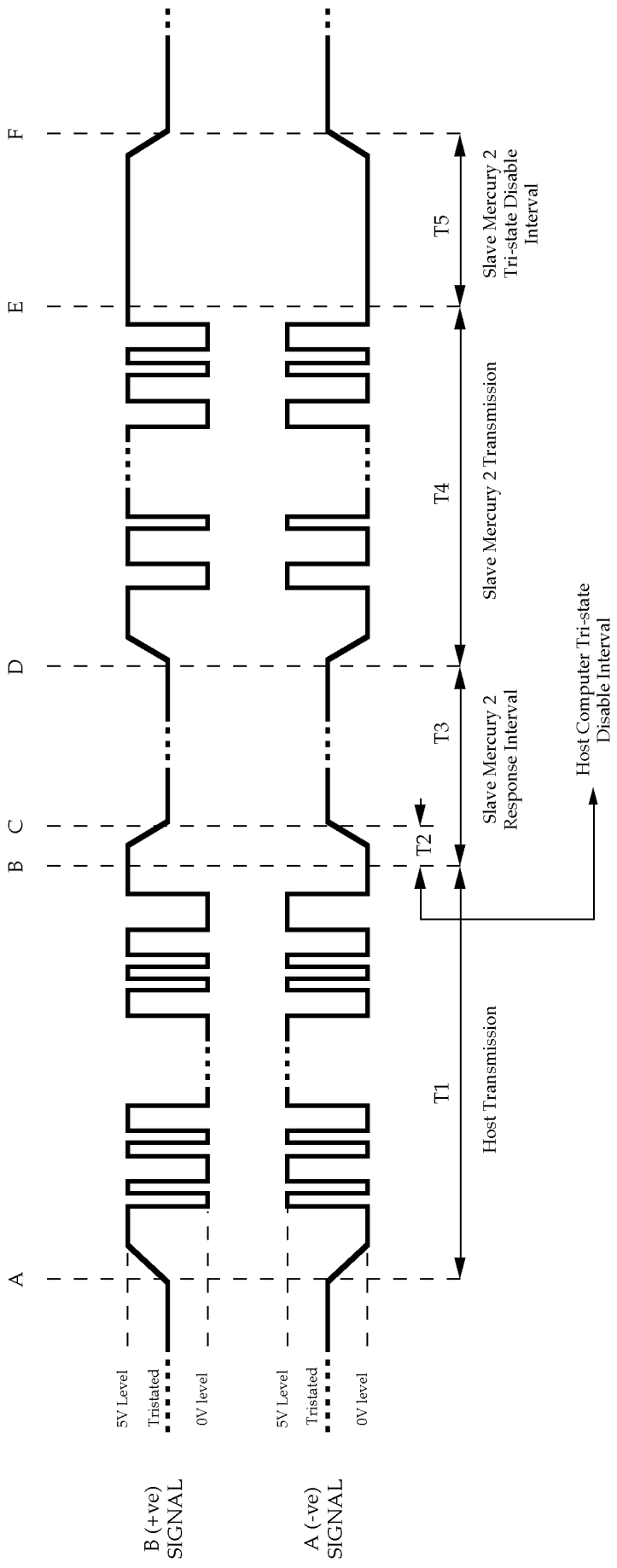
Baud Rate	Time in milliseconds
50	300
150	120
300	60
600	35
1200	25
2400	20
4800	20
9600	20

RS485 Signal Levels

Fig. 5 illustrates signal levels on Multi-drop RS 485 lines.

At time A, the Host computer has determined that the RS485 link is not being used (previous polled message has been received) and enables its transmitter. The B signal then moves from its Hi-Z state to the marking level, a high level. At the same time the A signal moves from its Hi-Z state to the marking level, a low level. The Host then sends out its message. This occupies the time interval T1.
At time B, the Host has sent the stop bit for the final character, <ETX>. The Host can now disable its transmitter and at time C the line returns to its Hi-Z state. The interval T2 is determined by the Host, but it should be short enough to ensure that the bus is tri-stated before the slave replies.
The interval T3 is the response time of the slave Mercury 2e, which has a typical time of 20ms, an absolute maximum time of 50ms and and a minimum time of 10ms.
At time D, the slave Mercury 2e has enabled its transmitter and started to transmit the message requested by the Host. Interval T4 depends upon the message length and baud rate.
At time E the slave Mercury 2e has transmitted the stop bit of the final character, <ETX>. At time F the slave disables its transmitter to the Hi-Z state. The interval T5 is determined by the Mercury 2e system, and its maximum time is shown in the table on page 83.

Fig 5.
Signal Levels on Multi-Drop RS485 Lines



Appendix G

Please select from the list to view these drawings

INTRINSICALLY SAFE INSTALLATION

1. Typical Wiring, Mercury 2e System (P053’120’D)
2. Full-Duplex, Multi-drop RS422 Master-Slave Wiring (P053’127’D)
3. Half-Duplex, Multi-drop RS485 Master-Slave Wiring (P053’128’D)
4. F.M. Control Drawing (P053’121’D)

Appendix H

Modbus Option Operation

The Mercury 2e Modbus interface is a factory fitted option which is specified on order. Features and operation are detailed below.

1. The Mercury 2e Modbus Terminal (MMT)

The mercury 2e Modbus interface will work in the following manner:-

1.1) The Mercury 2e terminal will be the Modbus slave device.

1.2) The Mercury 2e terminal will respond in Modbus RTU mode only.

1.3) The MMT will respond only to a fairly basic set of commands, such as those that a PLC operating as a Modbus master may produce.

1.4) Complex commands, such as graphics etc will be pre-loaded into the Mercury 2e Terminal ehilst in ANSI (VT100) mode and stored as messages in the Non-Volatile memory, and simply recalled when in Modbus mode.

1.5) After a time interval equal to 3_ characters, RTU Modbus would normally timeout and clear any input buffers. However, due to processor limitations, this timeout interval will be fixed at 0.8 seconds, which is just longer than the normal 3½ character timeout interval at 50 baud.

2. Screen Control Registers

2.1) Display Mode (Register 1)
A single Modbus register will be allocated to set the character and graphics screen modes and interactions.

0=Neither screen visible
1=Text on, Graphics off (Same coding as in ANSI Mode)
2=Graphics on, Text off
3=Text and Graphics on, screens logically ORed
4=Text and Graphics on, screens logically ANDed
5=Text and Graphics on, screens logically XORed

2.2) Set Keyboard Mode (Register 2)
1 = Uppercase
2 = Lowercase
3 = Numerical

2.3) Set Bar Code Mode (Register 3)
1 = One shot mode
2 = Disabled
3 = Enabled

2.4) Set Weigand Card Reader Mode (Register 4)
1 = One shot mode
2 = Disabled
3 = Enabled

3. Screen Control Coils

3.1) 99 coils to be allocated, each one of which will recall the stored message associated with it (Coils 1 to 99)

3.2) Clear Screen (Coil 100)
3.3) Cursor On/Off (Coil 101)
3.4) Cursor Up (Coil 102)
3.5) Cursor Down (Coil 103)
3.6) Cursor Left (Coil 104)
3.7) Cursor Right (Coil 105)
3.8) Home Cursor (Coil 106)
3.9) Clear Bar Code register input buffers (Coil 107)
3.10) Clear Weigand register input buffers (Coil 108)
3.11) Clear Composed Text register input buffers (Coil 109)
3.12) Enable/Disable Latching Function keys (Coil 110)
3.13) Clear Latched Function key register(Coil 111)

NOTE on 3.12 and 3.13...

Two extra coils have been added, one to enable/disable the latching mode, and the other to clear any latched values. By default, the function key register operates exactly as before, i.e. the register is automatically cleared when read. If the latching mode is enabled (by turning of coil 110), the register is not cleared automatically.

To clear the register, you must turn on coil 111 (which both clears the register and resets coil 111 back to the OFF state).

Coil 110	OFF = Latching mode disabled
	ON = Latching mode enabled
Coil 111	ON = Clear latched register, set coil 111 to OFF

e.g.

Example with latching mode disabled	
Action	Comment
Power-on	Coil 110=OFF-> Latching mode disabled
Read register 2 => 0x0000	No function keys pressed
Press F1, F2, F3	
Read register 2 => 0x0007	Register automatically cleared
Read register 2 => 0x0000	
press F5, F6	
Read register 2 => 0x0030	Register automatically cleared
Read register 2 => 0x0000	

Example with latching mode enabled	
Action	Comment
Power-on	
Turn on coil 110	Latching mode enabled
Read register 2 => 0x0000	No function keys pressed
Press F1, F2, F3	
Read register 2 => 0x0007	Register not cleared by read operation
Read register 2 => 0x0007	
press F5, F6	Extra function keys added to register
Read register 2 => 0x0037	Register not cleared by read operation
Read register 2 => 0x0037	
Turn on coil 111	Clear latch register
Read register 2 => 0x0000	

4. Registers For Writing Data To The Screen

There are several ways of achieving this aim, as any one method may be simpler for some users than other methods.

4.1) Blanket coverage of the screen (Registers 10 to 169).
The Mercury 2e screen supports 8 rows of 40 characters, 320 character positions in total. Each pair of character positions is assigned a single Modbus register (160 registers in total). Of the Modbus register, D0-D7 represents the right hand character ASCII value and D8-D15 represents the left hand character of the pair.

4.2) Cursor Positioning (Register 170)
A single Modbus register is allocated to the cursor positioning function. D8-D15 is the X co-ordinate and D0-D7 is the Y co-ordinate.

4.3) 16 bit unsigned integer (Register 200)
A single Modbus register is allocated which, when written to, displays at the current cursor position the value written as an unsigned number in the range 0 to 65535.

4.4) 16 bit signed integer (Register 201)
A single Modbus register is allocated which, when written to, displays at the current cursor position the value written as a signed number in the range -32768 to 32767. Note that positive numbers have no leading plus sign, whereas negative numbers have a preceding minus sign.

4.5) 96 bit Packed Data Floating Point number (Registers 202 to 207)
6 registers will be allocated which, when written to, display at the current cursor position the value written as a Packed Data FP. The lowest numbered Modbus address field of the pair contains the bits <95:80> and the highest numbered register holds the bits <15:0>. The conversion occurs when the higher numbered Modbus register is written to.

The format of the number displayed is as follows:-

-X.XXXXXXE-XX

i.e. optional minus, compulsory 1 digit, optional decimal point, up to 6 optional digits, and an optional 2 digit exponent part (with optional minus sign),

e.g: 0.05 appears as 5.000000E-2
145.667 appears as 1.456670E2
-1.000 appears as -1.000000
0.0 appears as 0.0

Note: positive overrange, If number > 9.999999E99
'+overrange' displayed

positive under range, If number < 1.000000E-99
'+underrange' displayed

negative overrange, If number > -9.999999E99
'-overrange' displayed

negative under range, If number < -1.000000E-99
'-underrange' displayed

The FP format is as follows:-

	Word 5				Word 4	Word 3...0
Operand	15	14	13...12	11...0	15...0	
Type	SM	SE		3 Digit Exp	1 Digit Integer	16 Digit Fraction
Zero	0/1	0/1	xx	$000-$999	$xxx0	$00..00
+Inrange	0	0/1	xx	$000-$999	$xxx0-$xxx90	$00..01-$99..99
-Inrange	1	0/1	xx	$000-$999	$xxx0-$xxx90	$00..01-$99..99

SM = Mantissa Sign, SE = Exponent Sign

4.6) 16 bit unsigned integer in 10mm high characters (Register 208)
As paragraph 3 above, but 10mm high text characters (displayed on the graphics screen) are used.

4.7) 16 Bit signed integer in 10mm high characters (Register 209)
As paragraph 4 above, but 10mm high text characters (displayed on the graphics screen) are used.

4.8) 96 bit Packed Data Floating Point number in 10mm high characters (Registers 210 to 215)
As paragraph 5 above, but 10mm high text characters (displayed on the graphics screen) are used.

(Note that in paragraphs 9-12 : the characters sent will overwrite the current screen data, all control characters will be ignored and after a control character all subsequent data in the Modbus registers will also be ignored. This applies to all characters, and thus any string may be shortened by putting (for example) a null character after the last character to be displayed. The screen will wrap if the character string exceeds column 40 of the display. Valid character data is sent to the display when data is written to bits D0-D7 of the highest relevant Modbus register.)

4.9) A two character string without auto increment (Register 171)
A single Modbus register is used which, when written to, puts two characters on the screen at the current cursor position. The cursor position is not moved. Of the Modbus register, the high order (D8-D15) represents the left hand character ASCII value and low order (D0-D7) represents the right hand character of the pair.

4.10) An 8 character string without auto increment (Registers 172 to 175)
A quad set of Modbus registers puts 8 characters on the screen at the current cursor position when the last of the 4 register quads is written. The cursor position is not moved. Of the Modbus register, the high order (D8-D15) represents the left hand character ASCII value and the low order (D0-D7) represents the right hand character of the pair. The next Modbus register represents the next pair of character positions.

4.11) A 40 character string without auto increment (Registers 176 to 195)
This is similar to paragraph 12 but, by reserving 20 registers, allows a complete line of 40 characters to be written in one go.

4.12) A two character string with auto increment (Register 196)
A single Modbus register is used which, when written to, puts two characters on the screen at the current cursor position, and then moves the cursor position along two character positions. Of the Modbus register, the high order (D8-D15) represents the left hand character ASCII value and the low order (D0-D7) represents the right hand character of the pair.

5. Registers For Receiving Data From the Mercury 2e

5.1) Data Pending input register (Register 1)
A single resister can be read to determine if there is any valid data in the Bar Code, Card Reader or Text input registers. This single register contains 3 separate numbers, each corresponding to the number of relevant readings that are currently buffered in the Mercury 2e, waiting to be read.

D0-D3 = number of buffered text messages
D4-D7 = number of buffered Weigand card readings
D8-D11= number of buffered Bar Code readings

5.2) Function Key register (Register 2)
D0-D7 = 1 means Function Keys F1 to F8 have been pressed.
Note there is no time stamping.

5.3) Bar Code input registers (Registers 3 to 18)
A set of 16 Modbus registers are used to hold the barcode reading.
Up to 5 barcode readings may be buffered, waiting to be read. If further barcode readings are made without the buffer being read, the subsequent data is lost.
For each Modbus register, the high order (D8-D15) represents the left hand character ASCII value and the low order (D0-D7) represents the right hand character of the pair.
If the barcode is less than 32 characters long, then the Modbus register “half” following the last valid character will have the value 00 Hex, as will all the other Modbus registers in the rest of the register set.

5.4) Weigand Security card input registers
(Registers 19 and 20)
A pair of Modbus registers are used to hold the Weigand card reading.
Up to 5 Weigand card readings may be buffered waiting to be read. If further Weigand card readings are made without the buffer being read, the subsequent data is lost.
The Modbus input registers are used together to hold the 32 bit value read from the Weigand card. The lower Modbus register of the pair contains the bits <31:16> and the higher order register holds the bits <15:0>.

5.5) Composed Text Modbus input registers
(Registers 21 to 35)
A set of 15 Modbus registers are used to hold the Composed Text readings.
Up to 5 Composed Text readings may be buffered waiting to be read. If further text is entered without the buffer being read, the subsequent data is lost.
For each Modbus register, the high order (D8-D15) holds the left hand character ASCII value and the low order (D0-D7) holds the left hand character ASCII value. If the Composed Text is less than 30 characters long, then the Modbus register “half” following the last valid character will have the value 00 Hex, as will all the other Modbus registers in the rest of the register set.

5.6) Modbus Inputs (single bit reads) (Coils 1 to 5)
5 off single bit Modbus inputs that reflect the digital input status of the Mercury 2e.

Mercury 2e Example Modbus Messages

The following examples are given as a guide in helping set up the Modbus option of Mercury 2e.

To recap:

- The Mercury terminal will be the Modbus slave device
- Only standard Modicon RTU Modbus is supported
- The default serial port settings are 9600, 8, N, 1
- Complex commands, such as graphics images and backdrops, should be preloaded into the Mercury and stored as messages. These can be recalled when in Modbus mode.
- Due to processor limitations, the Modbus timeout interval has been fixed at 0.8 seconds.

The Mercury 2e will respond to the following Modbus functions:

1	READ OUTPUT STATUS (1)	1-109
2	READ INPUT STATUS	1-5
3	READ OUTPUT REGISTERS (1)	1-4, 10-196, 200-215
4	READ INPUT REGISTERS	1-35
5	FORCE SINGLE COIL	1-109
6	PRESET SINGLE REGISTER	1-4, 10-196, 200-215
7	READ EXCEPTION STATUS	
8	LOOPBACK TEST (2)	
15	FORCE MULTIPLE COILS	1-109
16	PRESET MULTIPLE REGISTERS	1-4, 10-196, 200-215

Notes

1. Since there is no way of reading back any of the output registers or output coils, function codes 1 and 3 always return zeros.

2. Function code 8 currently only supports Diagnostic Code 0 (Return Query Data).

Example 1 - Read Digital Inputs (uses Function 2)

Read the status of digital inputs 1 to 5 (ie. input coils 1 to 5) from slave device number 1.

Query Message	01	02	00	00	00	05	B8	9B
Reply Message	01	02	01	10	A0	44		

Example 2 - Read Data Pending Input Registers (uses Function 4)

Read the Data Pending input register (input register 1) from slave device number 1.

Query Message	01	04	00	00	00	01	31	CA
Reply Message	01	04	02	00	00	B9	30	

Example 3 - Clear the Screen (uses Function 5)

Clear the screen (ie. force output coil 1000 on slave device number 1.

Query Message	01	05	00	63	FF	00	7C	24
Reply Message	01	05	00	63	FF	00	7C	24

Example 4 - Display 16bit Unsigned Integer in 10mm Font (uses Function 6)

Display the 16bit value 12345, in 10mm high characters (output register 208), on slave device number 1

Query Message	01	06	00	CF	30	39	6D	E7
Reply Message	01	06	00	CF	30	39	6D	E7

Example 5 - Read Pending Barcode reading (uses Function 4)

Read the result of the buffered barcode swipe (input registers 3 to 18) on slave device number 1

Query Message	01	04	00	02	00	10	50	06
Reply Message	01	04	20	35	31	31	31	31
	31	32	35	31	33	37	00	00
	00	00	00	00	00	00	00	00
	00	00	00	00	00	00	00	00
	00	00	00	CF	8F			

Note the barcode swiped was 51111125137

Example 6 - Loopback Test (uses Function 8 Diagnostic Code 0)

Perform a simple loopback test, with data $FACE) on slave device number 1

Query Message	01	08	00	00	FA	CE	23	3F
Reply Message	01	08	00	00	FA	CE	23	3F

Example 7 - Preset Multiple Registers

Place the message “HELLO” at the top, left corner of the display (output registers 10 to 12 of slave device number 1

Query Message	01	10	00	09	00	03	06	48
	45	4C	4C	4F	00	17	9F	
Reply Message	01	10	00	09	00	03	50	0A

Parts Ordering Codes

	Part No
IS Mercury 2e Terminal	R004/e-IS
Non IS Mercury 2e	R004/e-GP
IS Mercury 2e (text only)	R004/e-TO/IS
Non IS Mercury 2e (text only)	R004/e-TO/GP
IS Interface Module	R007-IS
Wiegand Card Reader	R005-CR
Bar Code Interface Kit (exc. wand)	R008-WO
Bar Code Wand	R008-WAND

More Information

Information on Spectra-Tek products is available from the main Sales Office.

Other Spectra-Tek Products

IS3000 Laser Scanner
ISP3000 Laser Scanner

Sentinel 500 - Liquid Turbine Flowcomputer

- Gas Orifice Flowcomputer

- Bi-directional Prover

Autoload II - integrated terminal automation system

Pipeline Automation Systems

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