User Guide

DT
Series 2

Data Terminals

Models

DT16, DT16X, DT40, DT40X

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Revision History

Issue J 2/12/97

1. Added housing details.
2. Added table of power consumption
3. Added control characters to function key messages
4. Added revision history.

DT Series Data Terminals

5 Housing types

DTN	ABS Plastic case for desk-top use.
DTX	Aluminium panel-mount, IP65 when mounted
DTA	ABS Wall or Desk-top Access Type with optional Integral Swipe Reader (DT16 only)
DTS	Stainless Steel wall or desk-top, IP65
Node	ABS box (no display or keyboard)

Rugged enclosed units with sealed membrane type or silicon rubber keyboard, or I/O Box version (without display or keyboard)

Easy to read LCD display

DT16 and DT16X have large (8mm high), clearly readable characters.

DT40 and DT40 X offer selectable character sizes: -

8 lines x 40 characters - character height 3.8mm
4 lines x 40 characters - character height 7.5mm
4 lines x 20 characters - "
2 lines x 20 characters - character height 14.75mm
2 lines x 10 characters - "
Character sizes can be mixed.

Operates directly from unregulated dc or 5vdc

Stored messages can be assigned to Function keys or decoder.

Communications:
RS232 standard
RS422/485 (2 wires/signal)
RS485 MultiDrop
Current Loop

Option Boards:
1 x aux Serial Port (Option 2)

2 x aux serial ports (Option 5)

8 x Digital Input + 8 x Digital Output + 4 x Analog Input (Option 3)

16 x Digital Input (isolated) + 4 x Digital Output (isolated) + 2 aux serial ports (Option 7)

Barcode/MagCard Decoder option
Integral Decoder permits connection of wands, scanners, or magnetic card readers.

"C" Operating system available
For use with the IAR Systems cross compiler (providing a PC-based development environment). The "C" BIOS version is a different firmware, usually configured specifically for the particular terminal to be used (to keep the BIOS small and provide maximum application code space) and is intended to allow the customer to create his own product based on IDP technology. The in-house CNC and customisation facilities can also be utilised to adapt the product.

General Description

The DT series terminals are robust, simple-to-use devices that are available in desktop or panel-mount housing, or as an I/O box without the display and keyboard. The panel mount terminals are designed to fit a standard enclosure for wall-mounting or suspension mounting.

A Bi-directional serial interface with user selectable Baud Rates from 300 to 38400 is fitted as standard. Other interface options are available by adding an internal driver board.

The DT40 LCD is temperature-compensated for constant contrast over the entire operating temperature range.

The terminals are intended for use as Operator Interfaces where previously a full screen and keyboard would have been required.

Desk-Top Terminals *(DT40 and DT16)*

The desktop terminals are available in 4 standard keyboard styles :

FM	-	Function key + Numeric Keypad	Membrane
AM	-	ABC Layout with Numeric Keypad	Membrane
QM	-	QWERTY + Function Keys	Membrane
Q	-	QWERTY	Silicon Rubber

The unregulated supply range is 9 to 15vdc @ approx. 50mA (DT40) and 25mA (DT16)

Display Backlighting (LED type) is an optional extra

Operating temperature	-10deg C to +45deg C
Dimensions	195w x 148h x 40d mm
Weight	550 grams

Panel-Mount Terminals *(DT40X and DT16X)* and Stainless Steel Terminals (*DT40S and DT16S*)

These terminals are available in 3 keyboard versions all membrane type. 2 styles have Function keys and a Numeric Keypad and there is also a QWERTY layout identical to the desk-top QM layout.

FM6	6 Function Keys + Numeric Keypad
FM17	17 Function Keys + Numeric Keypad
QM	QWERTY + Function keys.

(5 of the Function keys on the FM17 layout are located below the screen are intended for use with the "Soft-Key" label function enabling these keys to be

used for different functions under the control of the user application.)
The unregulated supply range is 9 to 30 v dc (requires 300mA @ 12vdc).
Display Backlighting (LED type) is standard.
Sealed to IP65 when suitably panel mounted.
Operating temperature -20deg C to +55deg C.
Dimensions: 220w x 190h x 55d (allow additional depth for "D" connector)
Weight 900 grams.

Features:

Direct Cursor Positioning
Reverse Image (DT40 and DT40X only)
Function Key labels (DT40 and DT40X only)
Various Character sizes (DT40 and DT40X only)
2 digital inputs + 2 digital outputs for connection to lamps/switches etc.
MultiDrop version
Supports a limited subset of VT100 commands
Foreign characters.(DT40 and DT40X only)

MultiDrop System

The MultiDrop System comprises up to 31 DT terminals and a MultiDrop System Unit, all connected together with a 2-wire screened twisted pair cable (+ power connections) such as the BELDEN 9829, with a maximum cable run of 1000m. The MSU takes care of the polling with a resilient error-checked protocol and ensures error-free collection of data from each terminal.

The MSU is based on the I/O box and has an RS232 port for connection to the host system and any data collected from the terminals is automatically passed to the host. The host may send text and control messages to the terminals. The data is incorporated in a simple message format that includes the identity of the terminal and the type of data collected (e.g. keyboard data, barcode data, I/O data etc.)

Operation of the terminals is similar to the standard terminal but there are differences:

1. Keyboard entry is terminated by the ENTER key.
2. A control command can set the terminal into different modes e.g. Local Edit, where the arrow keys move the cursor through the message for editing with the DELETE key prior to sending: Password mode where the screen echoes * instead of the keyed characters: SET INPUT STRING LENGTH to auto-terminate the keyboard entry after a presettable number of characters (40max). Generally the MultiDrop System uses messages of up to 40

characters long. The network speed is normally set at 38400 Baud.
3. Care should be taken not to exceed a maximum voltage drop of 2.5v on the 0v line (fit local power supplies if necessary).

CE Marking and EMC Compliance

This product has been tested to ensure compliance with the EC Directive for Electromagnetic Compatibility when installed according to the instructions in this guide. A Declaration of Conformity is available on request.

1.Installation

This equipment should be connected using a **screened cable with shielded connectors.** The connector hoods should connect directly to the cable screen not by way of a separate wire or "pigtail" arrangement. The screen must be adequately bonded to the host equipment.

1.1.Pin Assignments

The terminal is fitted with a 25 way "D" connector which has the following pin assignments:

NOTE: Because of the orientation of the connector the desktop terminals are fitted with a FEMALE whereas the panel mount versions are fitted with a MALE connector.

1 Ground and 0v
2 TXD
3 RXD
4 RTS
5 CTS
6 No Connection
7 Ground and 0v
8 No Connection
9 +5Vdc (+/- 0.25v) (Input or Output) Can supply up to 250mA.

Caution - The 5v supply is not reverse polarity protected. Reverse polarity will cause catastrophic damage. **Do Not** provide power to both pin 9 and pin 16 at the same time.

10 422/485 I/O Connection
11 422/485 I/O Connection
12 422/485 I/O connection
13 422/485 I/O Connection
14 Option Board I/O line
15 Barcode Decoder Input
16 Unregulated power supply + Input, protected against reverse Polarity.
17 Digital Input 1
18 Digital Output 1
19 Ground and 0v
20 Digital Input 2

21 Digital Output 2
22 422/485 I/O Connection
23 422/485 I/O Connection
24 422/485 I/O Connection
25 422/485 I/O Connection

Notes:
1 422/485 I/O connection pins connect internally to a set of connectors for plugging-in an optional driver board. This I/O Module is a small PCB assembly that fits inside the terminal and configures the I/O module pins as shown above for RS422, RS485, or Current Loop, depending on the I/O Module type installed. RS232 is always fitted but adding the I/O module does not add a second port - it is connected in parallel with the RS232 port.
For further details of the specific I/O connections refer to the relevant interface sections later in this guide.
2. Pins 1, 7 and 19 are all electrically connected together.
3. Digital inputs are rated at 5 to 30vdc referenced to 0v.
4. Digital outputs are open-collector. Do not exceed 30vdc or 50mA.
5. The connector securing screw locks are electrically connected to 0v.

1.2 Getting Started

Unpack the terminal

Decide if handshaking required so that the correct cable configuration can be made between the terminal and the host. (In all but the simplest applications it will usually be necessary to make use of handshaking)
For hardware handshaking make up the interconnection cable as per Fig 1. The terminal uses CTS and RTS for hardware handshaking.
For software handshaking make up the interconnection cable as per Fig 2. The terminal uses XON/XOFF flow control for software handshaking. When software handshake is used the CTS line must be left open circuit or connected to + (e.g. +5v from pin 9).

Note that selection of the handshake is made with parameter 7.
Set the Baud Rate, Parity and Data Word Length to suit the host system
The DT series terminal supports 7 or 8 bit data + parity.

Note that Baud Rate, Parity and Word Length are DIL switch settings.

Connect up the power supply using pin 7 for 0v and either pin 9 (for 5vdc regulated) or pin 16 (unregulated dc) for the positive supply.

Note - the 5vdc connection is not protected and excessive voltage (above 5.5v) or wrong polarity can cause catastrophic damage. The unregulated input is reverse polarity protected and will withstand up to 30vdc (DTX models) or 24vdc (DT modes)

There is no on/off switch and the terminal should power up immediately that power is applied. Shortly afterwards a sign-on screen appears with details of the model type, firmware version number and the actual settings that have been configured for the host connections. If any option boards are fitted these will also be reported.

The sign-on screen automatically erases after a few seconds. If required the sign-on screen can be skipped by setting parameter 29.

Check that the keyboard keys give a short click when operated - in normal (i.e. non-MultiDrop) mode characters will be sent to the host directly as each key is pressed. If there is no response at the host end check the settings, interconnections etc.

1.3 Connections (Normal RS232)

Fig 1

Host	DT Terminal
TX	**3**
RX	**2**
RTS	**5**
CTS	**4**
0V	**7**

Fig 2

Host	DT Terminal
TX	**3**
RX	**2**
0V	**7**

1.4 Notes when connecting to a PC.

1.4.1 Handshaking

The implementation of the handshake depends on the communications program running on the PC. It is often necessary to connect the hardware handshake signals as follows: -

PC	DT Terminal
25 way connector	
2	3
3	2
4	5
5	4
7	7

Also link together pins 6, 8 and 20 at the PC connector

PC	DT Terminal
9 way connector	
2	2
3	3
7	5
8	4
5	7

Also link pins 1, 4 and 6 at the PC connector

1.4.2. Problems sending Ctrl C from Window "Terminal" application.

When using the windows terminal application and attempting to send a z data command to set the NV data or any other command terminating with Ctrl C (03H) there may be a problem caused by the PC trapping the Ctrl C character. To resolve this problem it is necessary to change the settings in the terminal application of the PC, as follows

Go into Windows and run "Terminal"
Click on "Settings"
Click on "Terminal Preferences"
Go to the bottom box "Use Function, Arrow and Control Keys for Windows
Ctrl C should now be passed to the com-port.

1.4.3 Problems communicating with the RS232 Main Port when the RS422 Option Board is fitted.

If it is required to use the RS232 main port connections when an RS422 option board is installed, it is necessary to fit 2 resistors at the 25-way connector to ensure that the RS422 is in the correct state to permit communications:-

Fit a 1K resistor between pins 11 and 9, and another 1K resistor between pins 23 and 19.

2. Power

2.1 Desk Top Terminals (Unless fitted with Backlight Option)

The Data Terminals can operate from either of 2 different power supply voltages. DO NOT connect both supplies at the same time.

2.1.1. Regulated 5vdc @ +/- 0.25v.

Connect the +5v supply to pin 9 and 0v to pin 7 or 1 or 19. Note that the terminal is not protected against reverse polarity and that incorrect connection may cause catastrophic damage.

2.1.2. Unregulated 9 to 24vdc

Connect the unregulated +9 to +24vdc to pin 16 and 0v to 7 or 1 or 19. Pin 9 can be used to provide a power output to drive ancillary devices. A maximum of 50mA is available.

2.2 DTX, DTS, and Access Terminals, Nodes, and all backlit terminals.

2.2.1. Regulated 5vdc @ +/- 0.25v.

Connect the +5v supply to pin 9 and 0v to pin 7 or 1 or 19. Note that the terminal is not protected against reverse polarity and that incorrect connection may cause catastrophic damage.

2.2.2. Unregulated 9 to 30vdc

All terminals with LED backlit displays incorporate a switch-mode regulator and the current consumption decreases as the input voltage is increased. Connect the unregulated +9 to +30vdc to pin 16 and 0v to 7 or 1 or 19. Pin 9 can be used to provide a power output to drive ancillary devices. A maximum of 250mA is available.

2.3 Power Consumption Table

The table below shows the total current consumption for a terminal and any option fitted.

3. Setting up.
3.1 DIL switch Settings - Normal Mode

These settings are selected from the DIL switch located on the rear panel of the terminal.

3.1.1 Baud Rate:

Switches 2, 3 and 4 are used to select Baud Rate:

Switch	2	3	4	Baud Rate
Off	Off	Off		38400
On	Off	Off		19200
Off	On	Off		9600
On	On	Off		4800
Off	Off	On		2400
On	Off	On		1200
Off	On	On		600
On	On	On		300

3.1.2 Auto Newline On/Off

Switch 5 selects autonewline ON/OFF:

Switch 5 ON : Auto selected
OFF: Auto OFF

Auto newline affects the way the terminal responds to a received CR character. With autonewline selected the cursor will line feed to the next line. If auto is off the cursor will simply return to the beginning of the current line.

3.1.3 Local Echo On/Off

Switch 6 selects local echo ON/OFF:

Switch 6 ON: Local Echo selected
OFF: Local Echo OFF

Local echo allows characters entered on the keyboard to be displayed locally. (Normally the host will echo back the characters it receives so the terminal operator knows that the terminal is connected - in this case do not select local echo or there will be 2 characters displayed for each key entry.)

3.1.4 Parity

Parity is selected by switches SW7 and SW8:

Switch	7	8		Parity
	Off	Off	|	Odd
	On	Off	|	Even
	Off	On	|	None
	On	On	|	None

3.1.5 Word Length

Word length is selected by switch 1:

Switch 1	**ON:**	**8 Bit**
	OFF:	**7 Bit**

3.2 DIL Switch Settings - MultiDrop Mode

These settings are selected from the DIL switch located on the rear panel of the terminal

Switch 1 should always be set OFF

3.2.1 Baud Rate:

Switch 3 is used to select Baud Rate:

Switch 3	Baud Rate
Off	38400
On	9600

Switch 2 is used to switch on the diagnostic audio tone. When ON the terminal switches on the internal sounder whenever it receives a message with it's own address and turns the audio off when an acknowledge is received from the MSU. A regular click indicates that the terminal is being polled normally. Note that unlike the other DIL switches, switch 2 can be switched on and off at any time without having to power down the terminal to read it.

3.2.2 Terminal ID

Each terminal must be configured with it's own unique ID number between 1

and 31. The system will not operate properly if 2 or more terminals have the same ID number. Do not use ID number 00.

Switches 4 to 8 are used to set the ID number as follows:

Switch	**4**	**5**	**6**	**7**	**8**	**ID**
	On	Off	Off	Off	Off	1
	Off	On	Off	Off	Off	2
	On	On	Off	Off	Off	3
	Off	Off	On	Off	Off	4
	On	Off	On	Off	Off	5
	Off	On	On	Off	Off	6
	On	On	On	Off	Off	7
	Off	Off	Off	On	Off	8
	On	Off	Off	On	Off	9
	Off	On	Off	On	Off	10
	On	On	Off	On	Off	11
	Off	Off	On	On	Off	12
	On	Off	On	On	Off	13
	Off	On	On	On	Off	14
	On	On	On	On	Off	15
	Off	Off	Off	Off	On	16
	On	Off	Off	Off	On	17
	Off	On	Off	Off	On	18
	On	On	Off	Off	On	19
	Off	Off	On	Off	On	20
	On	Off	On	Off	On	21
	Off	On	On	Off	On	22
	On	On	On	Off	On	23
	Off	Off	Off	On	On	24
	On	Off	Off	On	On	25
	Off	On	Off	On	On	26
	On	On	Off	On	On	27
	Off	Off	On	On	On	28
	On	Off	On	On	On	29
	Off	On	On	On	On	30
	On	On	On	On	On	31

3.3. Contrast Adjustment

Because of the large characters and low multiplex ratio it is not necessary to adjust the contrast of the DT16 display and no control is provided.

Display contrast of the DT40 and DT40X can be adjusted by means of a rotary screwdriver control on the rear panel

The DT40 and DT40X are fitted with a temperature sensor to maintain the contrast level over the complete operating range. Once set the contrast should not require further adjustment.

3.4. Parameter Settings

The terminal has a 2K Byte nonvolatile memory for storage of parameters that adjust the functionality.

For details of the parameter functions see Appendix D

The NV memory can only be updated by a file transmitted to the terminal via the RS232 port. The file can be any length up to 254 Bytes and is in the form:

<STX><z><datan...><ETX>
or ***<STX><z><pxxxx><datan><ETX>***

Where *STX* = 02H, *ETX* = 03H and *datan* is a normal ASCII character, typically 0 (30H), 1 (31H) etc., *p* is 70H, and *xxxx* is a 4 digit number defining the start parameter number.

Notes:
1. To enable the terminal to be set up from the RS232 port even when configured for MultiDrop mode the message will also be accepted by the terminal even when set to MultiDrop mode.
Note that the DIL switch settings are different in the 2 modes, which may cause the baud rate to change when switching from one mode to the other. See section 3.1 for the DIL switch values in each mode.

2. The terminal performs a reset immediately after the message is completed so as to adopt the new configuration.

3. The pxxxx function allows the data to be loaded into any position in the NVData parameter list without having to start from zero. The syntax is <STX><z><pnnnn><data><ETX> where nnnn is the 4-digit parameter number e.g. 0004 for parameter 4.
The NV memory is read each time on power up to configure the terminal.

Resetting the Terminal.

Sending the z message with no data will cause the terminal to reset without changing the NVDATA.

E.g. <STX>z<ETX>

NVDATA Enquiry

Sending <STX><z><?> will cause the terminal to return the current contents of the NV memory.

Note: The first character of the returned data string denotes the type of LCD fitted where 0 (30H) = DT16 type character module and 1 (31H) = DT40 type module. This is set at the factory and cannot be adjusted with the z command.

3.5. Key Repeat

The keyboard keys can be set to automatically repeat if required.

When set to auto repeat there is a delay after touching the key, followed by a repetition of the key at a steady rate (selectable) or at a progressively increasing rate (repeating faster as the key is held down).

The type of key repeat is selected in the non-volatile memory parameter number 125.

A value of 0 will switch off the repeat function and the key will respond only once for each touch.
Values 1 to 7 select the repeat speed with 1 the slowest and 7 the highest.
A value of 8 selects the progressive mode.

E.g. <STX><z><p0125><0><ETX> selects No Key Repeat

3.6 Start-up Activity

When the terminal powers up it may present the user with a sign-on screen and send a message from the serial port to indicate to the host system that it is connected (the message sent is the digital I/O status message)
The default condition is to display the sign-on screen and send the message. This activity can be selected by parameter 29 in firmware version 2-41 on - see NVDATA parameter list for settings.

4.0 Digital I/O

The terminal has 2 digital inputs and 2 digital outputs fitted as standard. A further 8 digital inputs and 8 digital outputs can be added by fitting the OPTION3 board.
The native I/O are allocated numbers 9 and A leaving numbers 1 to 8 allocated to the OPTION3 I/O.

The digital inputs accept a signal in the range +5v to +30vdc with an input resistance of 10K.
Digital outputs are in the form of open-collector transistor signal with a current capability of 50mA and maximum voltage rating of 30vdc.

4.1 Operation.

Commands from the host to the terminal.

The operation differs slightly depending on whether the terminal is set to normal or MultiDrop mode: -

Commands	**RS232 Version.**	**MultiDrop Version**
Get Digital Data		
	<STX><**b***n*><ETX>	<STX><ID><**b***n*><ETX>
Set Digital Output		
	<STX><**o***xxxh*><ETX>	STX><ID><**o***xxxh*><ETX>
Digital Input Mode		
	<STX><**m***n*><ETX	<STX><ID><**m***n*><ETX>

Get Digital Data

The command causes the terminal to report the status of the digital inputs. "1 Shot" and continuous modes are available and an additional mode automatically sends the digital input report whenever any of the inputs changes state. Each digital input has a 50mS debounce filter.

Format **<STX><b*n*><ETX>**

Where *n* is a single byte with an ASCII value of

0 (30H) Turn off the automatic data report.

1 (31H) Get a single data report

2-7 (32H - 37H) Set for automatic reporting

Where 32H send a report every Poll when using MultiDrop mode (values above 32H are not used with the in MultiDrop) and in normal mode the automatic reporting interval can be selected as follows: -

2 (32H) sends a report every 200mS.

3 (33H) sends a report every 500mS.

4 (34H) sends a report every 1 second.

5 (35H) sends a report every 5 seconds.

6 (36H) sends a report every 10 seconds

7 (37H) sends a report whenever any of the digital inputs changes state.

Set Digital Output.

Set Digital Output sets the condition of the 2-digital outputs where *x* is the 4-bit control byte represented in ASCII HEX. 1=ON, default is both outputs OFF on power-up.
Format **<STX><o*nnx*><ETX>**
E.g. where *x*=3 (i.e. ASCII 33H) both outputs are set ON. Note that the first 2 characters nn are reserved for the 8 inputs associated with the option3 board.

E.g. <STX>**o**001><ETX>
Sets digital output 1 ON in normal mode.

E.g. <STX><ID>**o***003*<ETX>
To switches BOTH outputs ON in MultiDrop mode:

Set Digital Input Mode

The digital inputs can be configured as straight input signals or used as counters.
The Digital Input Mode command is used to set up the configuration: -
Each digital input can be set to 1 of 3 modes: -
(Where 9n relates to input 1, An relates to input 2).
And the value of *n* has the following effect: -

0 (30H) sets the input as a straight digital input.
1 (31H) sets the input as an UP counter.
2 (32H) resets the counter to zero.

Note: Changing the mode from straight input to counter or *vice versa* will also reset the counter to zero.

E.g. m90A1 sets the first input to straight digital input mode and the second

input to counter mode.

The mode defaults to digital input on power up.
The maximum count rate is 5 pulses/sec.

Reports from the terminal to the host.

There is a special case on power-up when the digital input status report is transmitted without being requested and headed with **s** instead of **i**. This is intended to be used as a sign-on message to the host. This feature can be deselected by Parameter 29.

The operation differs slightly depending on whether the terminal is set to normal or MultiDrop mode :-

Report	**RS232 Version.**	**MultiDrop Version**
Digital Inputs	<STX><**i***xxn*><ETX>	<STX><÷<ID><**i***xxn*><ETX>
Sign-on	<STX><**s***xxn*><ETX>	<STX><ID><**s***xxn*><ETX>
Counters	<STX><**c**1*nnnn*-A*nnnn*><ETX>	<STX><ID><**c**1*nnnn*-A*nnnn*><ETX>

Where *n* is an ASCII value. All data is passed in ASCII HEX format.

For the native I/O only counters 9 and A will have valid data.

5. Escape Sequence Commands

5.1 Display Mode (DT40 and DT40X)

The DT40 display is a 240 x 64 dot graphic module, which can be operated in *graphic* or *attribute* modes. The 2 modes cannot be used simultaneously and there are important differences in operation. Although it has a graphic mode the display only displays characters - the difference is that in graphic mode the character shapes can be expanded to various sizes. The disadvantage is that to draw each character at the smallest size requires 8 bytes to be transferred to the display in graphic mode and correspondingly more when using larger characters. Graphic mode is therefore slower than attribute mode.

Attribute Mode **Esc A or Esc a**

Attribute mode is faster than graphic mode but offers only single choice of character size (giving an 8 x 40 display) although numbers (and the decimal point) can be drawn at double height, double width.

Attribute mode offers Reverse Video.

Graphic Mode **Esc G or Esc g**

Graphic mode is slower than attribute mode as each single size character requires 8 characters to be transferred to the display module, (and 64 characters in double/height, double width mode etc.)

Graphic mode offers greatest flexibility in displaying characters:

Character sizes available in graphic mode:

Size	approximate dimensions
Single height, single width	3.8mm x 2.65mm
Double height, single width	7.5mm x 2.65mm
Double height, double width	7.4mm x 5.3mm
Quad height, double width	14.75mm x 5.3mm
Quad height, quad width	14.75mm x 10.6mm

Character sizes may be mixed on screen.

Reverse video is available.

Note that the display clears automatically when switching modes.

5.2 Character Size Selection (DT40 and DT40X)

Different font sizes may be mixed on the same screen.

To select different font sizes the host sends *ESCAPE S n,* where *n* is an ASCII character in the range 1 (31H) to 5 (35H.)

Note only selection 1 and 3 are supported in attribute mode

Selection Modes

	Character Size	*Display Configuration*
Esc S 1	Single height, single width	8 lines x 40 characters
Esc S 2	Double height, single width	4 lines x 40 characters
Esc S 3	Double height, double width	4 lines x 20 characters
Esc S 4	Quad height, double width	2 lines x 20 characters
Esc S 5	Quad height, Quad width	2 lines x 10 characters

Note that the characters are contiguous (no spaces - e.g. <1BH><73H><31H>)

5.3 Reverse Video (DT40 and DT40X)

Esc R or Esc r Reverse Video ON
Esc N or Esc n Reverse Video OFF

The display will stay in reverse video mode until deselected.

5.4 Cursor On/Off

Esc U *n*

Where *n* = 0 (30H) to turn cursor OFF
1 (31H) to turn cursor ON.

5.5. Function Key Labels.(DT40 and DT40X)

The DT40X/FM17 and DT40/QM are provided with 5 function keys located under the display window where they can be used as "soft keys"..

The function keys correspond generally to the VT100 Auxiliary Keypad (in Application Mode) and transmit a code sequence (*ESCAPE O n* where n is a single character depending on which key).

Note - this sequence can be replaced by a user-defined message (see section 12)

See keyboard details for Function Key code assignments.

The function key labels are a row of 5 boxes along the bottom of the screen. In graphic mode the boxes are an outline, in attribute mode the box is filled and characters appear in reverse video. Each box can hold a label with 2 lines of 6 characters of text. To use the function key labels send the following escape sequence:

Esc F *n text*

Where F=ASCII 45H, n = 1 to 5 (31H to 35H), text = up to 12 characters

The text will appear in the selected box, automatically wrapping from the top line to the bottom line. After 12 characters or Esc T the text entry point will be restored to the previous position on the screen.
The sequence can be concatenated to look like this:

Esc F 1 Start Esc 2 Stop Esc 5 End Job Esc T

Function key labels are erased when the screen is cleared.
Box 1 is on the left.

All 5 empty boxes will be drawn immediately on receipt of the first ESCAPE F sequence and can be erased by the screen clear command.

The effective screen size is reduced by the space taken up by the boxes and bottom margin parameters adjusted accordingly.

5.6 Direct Cursor Addressing.

The position of the cursor can be located directly by sending an escape sequence to the terminal:

Esc P (or p) *Xposition Yposition*

Note - alternatively the VT100 command sequence may be used for direct cursor positioning

Normal Mode:
Where *Xposition* is a single character with an ASCII value between 0(00H) and 39 (27H) (DT16: 00 and 15) inclusive and *Yposition* is a single character with an ASCII value between 00 and 07 (DT16: 00 and 01) inclusive. The 4-character sequence should be sent character directly after character without separation. Any failure in the sequence will cause the Direct Cursor Positioning to be abandoned and the terminal will thereafter respond normally until the next ESCAPE character is received.
It is not advisable to use DCP positioning and XON/XOFF flow control as column numbers 17 and 19 conflict with the flow control characters. If XON/XOFF is to be used then choose VT100 positioning mode.

MultiDrop Mode:
The DCP string can be embedded in the d command data and will be executed normally. Because MultiDrop mode uses control characters the column and row numbers are offset by 20h (32 decimal).
Where *Xposition* is a single character with an ASCII value between 32(20H) and 71 (47H) (DT16: 32 and 47) inclusive and *Yposition* is a single character with an ASCII value between 32 and 39 (DT16: 32 and 33) inclusive. The 4-character sequence should be sent character directly after character without separation.

Any failure in the sequence will cause the Direct Cursor Positioning to be abandoned and the terminal will thereafter respond normally until the next ESCAPE character is received.

5.7. Direct Display Clearing

To clear the complete screen send the character 0C (Hex) (i.e. Form Feed).

Individual lines can be cleared with the command sequence:

Esc C(or c) *Line Line*

Normal Mode:
Where *Line* is a single character with an ASCII value between 00 (00H) and 07 (07H) inclusive (DT16: 00 and 01). On receipt of this sequence the nominated line (or lines will be cleared). E.g. ESC C 03H 03H will clear line 4 only, whereas ESC C 03H 05H will clear lines 4, 5 and 6.

MultiDrop Mode:
Where *Line* is a single character with an ASCII value between 32 (20H) and 39 (26H) inclusive (DT16: 32 and 33). On receipt of this sequence the nominated line (or lines will be cleared). E.g. ESC C # # will clear line 4 only, whereas ESC C #% will clear lines 4, 5 and 6.

Note the difference between this and clear screen. Clear screen will home the cursor, the escape sequence clear will leave the cursor in the current position.

Alternatively the VT100 command *ESC [Pn J* may be used (see VT100 section for further details)

5.8 Security Code Enquiry

The non-volatile data contains an 8-character user programmable free text area starting at parameter 60. This can be read by **<ESC><?>**

The terminal returns a string in the form:

<CAN><cccccccc><ETX>

Where CAN = 18H
cccccccc = 8 character string
ETX = 03H

E.g. to program the Security Code:

<STX><z><p0060>*<cccccccc>*<ETX>

6. VT100 Emulation (DT40 and DT40X)

The DT40 Terminal supports a limited subset of VT100 commands.

Note that the DT40 has selectable CHARACTER sizes and care should be taken when using direct cursor positioning in larger size modes since the active position can be located at single size values and it is possible to overwrite part of the larger character.

Executing some VT100 commands while a mix of different size characters are being displayed may not give the normal results.

The DT40 VT100 Emulation complies with the VT100 specification for the definition of escape sequences. In addition, all of the escape sequences implemented by the DT40 VT100 Emulation are a subset of those specified in ANSI X 3.64 1977 and ANSI X 3.41 1974.

Cursor up	ESC [Pn A
Cursor down	ESC [Pn B
Cursor forward (right)	ESC [Pn C
Cursor backward (left)	ESC [Pn D
Direct cursor addressing	ESC [Pn; Pn H
Save cursor and attributes	ESC 7
Restore cursor and attributes	ESC 8

Detailed Escape Sequence Definitions

All of the following escape and control sequences are transmitted from the host computer to DT40.

6.1 CUU Cursor Up

Format ESC [Pn A default value: 1

The CUU sequence moves the active position up the screen without changing the column position. The distance moved is determined by the parameter. If the parameter value is zero or one, the active position is moved one line up. If the parameter value is n, the active position is moved n lines up. If an attempt is made to move the active position to above the top margin, the position is moved to the top margin.

6.2 CUB Cursor Backward

Format ESC [Pn D default value: 1

The CUB sequence moves the active position to the left.
The distance moved is determined by the parameter.
If the parameter value is zero or one, the active position is moved one position to the left. If the parameter value is n, the active position is moved n positions to the left. If an attempt is made to move the active position to the left of the margin, the active position is moved to the left of the margin.

6.3 CUD Cursor Down

Format ESC [Pn B default value: 1

The CUD sequence moves the active position down the screen without changing the column position. The distance moved is determined by the parameter. If the parameter value is zero or one, the active position is moved one line down. If the parameter value is n, the active position is moved n lines down. If an attempt is made to move the active position below the bottom margin, the active position stops at the bottom margin.

6.4 CUF Cursor Forward

Format ESC [Pn C default value: 1

The CUF sequence moves the active position to the right. The distance moved is determined by the parameter. If the parameter value is zero or one, the active position is moved one position to the right. If the parameter value is n, the active position is moved n positions to the right. If an attempt is made to move the active position to the right of the right margin, the active position is moved to the right margin.

6.5 CUP Cursor Position

Host to DT40

Format ESC [Pn; Pn H default value: 1

The CUP sequence moves the active position to the position specified by the parameters. This sequence has two parameter values; the first specifies the line position and the second specifies the column position. A parameter value of zero or one for the first or second value moves the active position to the first line or column in the display, respectively. The default condition with no parameters present is equivalent to a cursor to home command.

6.6 DECRC Restore Cursor

Format: ESC 8

This sequence causes the previously saved cursor position to be restored.

6.7 DECSC Save Cursor

Format: ESC 7

This sequence causes the cursor position to be saved.

7. Interface Options

The data terminal normally operates using an RS232 standard but by means of an internally fitted option module the following formats are available:

RS422 4-wire connection.

RS485 2-wire connection (Requires MultiDrop Polling Firmware).

20-ma current loop.

Notes:

The RS232 signals are not removed by fitting the option module but remain effectively in parallel. This means that the terminal will communicate in both RS232 and the option module standard (but not at the same time).

The RS485 2-wire option requires that the MultiDrop mode is selected from zdata (Parameter 2).

Although intended to be used with the IDP MultiDrop System Unit, MultiDrop mode may be implemented directly from the host (with suitable software)

This MSU system is described in a separate manual.

Connections

The recommended cabling for RS422 and RS485 non-isolated systems is BELDEN 9829 (2pair). For RS485 Isolated systems use BELDEN 8103 (3pair). Always ensure that the screen is connected at both ends. Always use metal connector hoods and ensure that the screen of the cable is connected directly to the hoods.

7.1. RS422 4-wire.

The interface is also compatible with RS485 requirements.

Connections:

PIN	FUNCTION
11	RXD +
13	TXD +
23	RXD -
25	TXD -

Link Selectable Tristate Transmit:

The processor RTS signal (inverse of the communications port pin) is internally connected to the 422 board and can control the tristate condition of the outputs.

A 2 position shorting link selector mounted on the 422 board can be set to provide normal operation where the TX output is always enabled, or set so that the RTS signal controls the tristate of the outputs. This feature is intended to be used in conjunction with parameter 7 (see Appendix D) to allow several terminals to share a common RS422 connection. The outputs are maintained in the tristate condition except when a character is being transmitted when the RTS line toggles to switch on the output immediately prior to the character being transmitted and then returned to the tristate condition afterwards.

Link Selector	*Function*
Position A	Normal
Position B	Tristating

7.2. RS485 2-wire.

The interface is also compatible with RS422 requirements.
Note that the normal version of this board is not opto-isolated. When using the opto-isolated version a separate return connection is provided on pin 11 which should only be used for the signal path. When used with non-isolated 485 systems this pin should be linked to pin 19 (ground).
Always ensure that the signal return is connected to the system zero volts and ground at one point, preferable at the CEP (central earth point). This connection is made internally in the MultiDrop System Unit.

Connections:

PIN	**FUNCTION**
13	Signal -
25	Signal +
11	Signal Return

Note that although the interface is differential, the signal return line must also be connected to provide a common reference for the drivers. The common mode voltage between the signal return point of connected terminals should not exceed 5v.
Typical 485 system connections using BELDEN 8103:

7	0v	Pair 1
16	+Power	Pair 1
13	Signal -	Pair 2
25	Signal +	Pair 2
11	Signal Return	Pair 3
11	Signal Return	Pair 3

Pair 3 has both wires connected to pin 11.

7.3 20 mA Current Loop

Connections:

PIN	FUNCTION
11	RXD -
13	TXD +
23	RXD +
25	TXD -

This interface is a passive type, with the 20 mA signal current sourced externally.

8. Terminal Responses

The terminal responds to the following control characters:

Ctrl	G	(07H)	Bell
Ctrl	H	(08H)	Backspace
Ctrl	I	(09H)	Forward space
Ctrl	J	(0AH)	Line Feed
Ctrl	K	(0BH)	Vertical Tab
Ctrl	L	(0CH)	Form Feed (interpreted as complete screen clear)
Ctrl	M	(0DH)	Carriage Return
		(7FH)	Delete (will delete the character immediately left of the cursor).

9. Handshaking (Main Port)

The terminal can be set to use software or hardware handshaking, or both, or no handshaking at all. The setting is controlled by parameter 7.

Operation - Receiving

When the input buffer fills to a predetermined value the RTS line goes low and/or XOFF is transmitted, depending on the handshake mode selected.

When the buffer empties the RTS line goes high and/or XON is transmitted.

Operation - Transmitting

If the CTS signal on pin 5 of the 25 way terminal main communication port connector is low the transmission from the terminal is inhibited, if high or unconnected then transmission is permitted.

If transmission is inhibited the keyboard will not give an audio key click when keys are pressed.

The terminal will also respond to XON/XOFF commands from the host.

10. Barcode / MagCard Decoding Option

Parameter 28 in zdata selects either Barcode or MagCard decoding where

0 (i.e. 30H) = Decoder Off
1 = Barcode decoding selected.
2 = MagCard decoding selected.

10.1 Barcode

The Barcode decoder is a firmware module designed to automatically discriminate and decode up to 6 different barcode formats.
Barcode wands or scanners may be directly connected to the barcode port, which also provides the required power supply.

Note: : Wands should provide a TTL level output.
: Scanners should be configured in Bar-Image mode.

The code may be scanned in either direction.

In normal mode Barcode data is transmitted in the form

<STX><b><barcode data><ETX>

In MultiDrop mode the Barcode data is included in the polled data string:

<STX><id><k><Keyboard data><STX><b><Barcode data><ETX><BCC>

10.1.1 Connections :

Normally the barcode connections are made via a 9 way D connector. Alternatively the barcode input is also available on the 25-way host communications connector at pin 15.

9 way D connector pin assignments

DT16 X and DT40X: 9 way D type Male connector (requires female for wiring)
DT16 and DT40: 9 way D type Female connector (requires male for wiring)

The connector is wired such that 2 possible wiring configurations are permitted. The wand or scanner should be wired according to either of the following wiring arrangements.

A: To suit DATALOGIC Wands type P10R-S12.

This type of wand will plug in directly.

	PIN	**FUNCTION**
	1	5vdc Power
	4	0v
	7	Signal Input
B:	**PIN**	**FUNCTION**
	9	5vdc Power
	5	0v
	2	Signal Input

10.1.2 Barcode Data Formats

The barcode decoder option will automatically discriminate and decode the following barcode formats: -

CODE 39
EAN13 and UPC Version A
EAN8
UPC Version E
Interleaved 2 of 5
Industrial 2 of 5

10.1.3 Power Supply Output

The barcode port provides a +5vdc regulated out put to power the wand or scanner. DTX terminals, having a switch mode power supply regulator, can provide up to 250mA whereas standard DT terminals may provide up to 50mA.

10.2 MagCard.

An undecoded magnetic card reader should be connected directly to the DT terminal via the host 25way-communication port.

The reader will require the following connections:

25w Pin Number	Description
19	0v
9	+5v
15	Clock
20	Data

Note that pin 20 is normally Dig In 2. For MagCard decoding this input is allocated to the reader and cannot be used as a normal digital input.

The terminal is set to decode track 2, and will decode in both directions of card swipe.

MagCard data is transmitted as if it were barcode data. I.e. in normal mode this is in the form

<STX><b><Magcard data><ETX>

In MultiDrop mode the magcard data is included in the polled data string:

<STX><id><k><Keyboard data><STX><b><Magcard data><ETX><BCC>

11.0 RS485 MultiDrop Commands and Protocol

This section details the implementation of IDP RS485 MultiDrop terminals without using the IDP MultiDrop System Unit. The messages are essentially the same as the MSU/Host protocol with the addition of checksum, ACK/NAK signaling and turnaround timing.

If MagCard decoding is selected instead of barcode the decoded data is treated exactly the same as for barcode.

11.1. Command List.

The general format for sending commands to the terminals is :

<STX><ID><COMMAND LETTER><COMMAND DATA><ETX><BCC>

Where	**STX**	= 02 Hex
	ID	= TERMINAL ID in the range 21H - 3FH
	COMMAND LETTER	= (see command list as follows)
	COMMAND DATA	= up to 40 characters of data
	ETX	= 03 Hex
	BCC	= Block Check Character (see section 3)

The terminal will respond with an ACK message on receipt of a valid command message. The ACK message is in the form
<STX><ID><ACK><ETX><BCC>

Where ACK is 06 H

Note: If the message fails the checksum the terminal responds with a NAK message in the form

<STX><ID><NAK><ETX><BCC>

Where NAK is 15H

11.1.1 d Display.

The display command causes the terminal to display the data in the Command Message on the screen.

Note:

1. The maximum length of text is 40 characters.

2. The text string may contain screen control characters (see terminal user guide).
These may include direct cursor positioning, character size commands etc. as appropriate for the particular terminal used.

3 **e.g. <STX><!><d><Test><ETX><BCC>**

Will display "Test" on Terminal 1.

11.1.2 i Input.

Format for input (set input string length). The maximum input string that can be typed from the keyboard is 40 characters. This is the default value. However by means of the i command this string can be adjusted from 1 to 40 characters.

The format is

<STX><ID><i><no of characters><ETX><BCC>

Where the number of characters is defined by a single character with an ASCII value between 21H and 47H.

E.g. <STX><!><i><"><ETX><BCC>

will set the input string length for terminal 1 to 2 characters.

11.1.3. c Control Byte

The Control Byte function is implemented differently for the **QM** version terminals (the version with a full QWERTY membrane keyboard and separate function keys).

The Control Byte Command provides control over 6 parameters providing access to the cursor, local echo and local edit facilities, and providing an immediate mode for the function keys. A PASSWORD ECHO mode can be selected to echo * on the terminal screen each time a key is pressed.

BIT0: Cursor ON/OFF

0=Cursor Off, 1=Cursor On

BIT1: Cursor Type

0=Underline, 1=Block

BIT2: Normal Local Echo ON/OFF

0=Local Echo Off, 1=Display Characters as entered.

Note: Function keys are echoed unless BIT5 is set.

BIT3: Password Local Echo ON/OFF

0=Local Echo Off, 1=Display * for each character as entered.

Note: Function keys are echoed unless BIT5 is set.

BIT4: Local Edit ON/OFF

0=Local Edit Off, 1=Local Edit On.
Local Edit means that DEL, Clear, < and > operate on the transmit buffer.

BIT5: Function Key Immediate Mode

0=Off, 1=On.

In immediate mode the Function key will terminate the string as soon as it is pressed, without waiting for ENTER. Also the function keys are not echoed to the display. When not in immediate mode the function key character (A to F) is included in the uploaded string in the same way as a numeric character.

Control Byte Command Message Format:

The command message format follows the same convention as other MultiDrop commands, i.e.

<STX><ID><c><Control Byte><ETX><BCC>

To determine the value the control byte, use the following table, which shows some examples.

Function	**B0**	**B1**	**B2**	**B3**	**B4**	**B5**	**SUM (ASCII)**
Value	1	2	4	8	16	32	
Default Setting							
	1	0	1	0	0	0	5 37 (%)
Typical Password Mode, Cursor ON, Password Echo ON							
	1	0	0	1	1	0	25 57 (9)
Local Edit ON, Function key immediate mode							
	1	0	1	0	1	1	53 85 (U)

E.g.

To set the terminal to Typical Password Mode send **STX<ID><c><9><ETX>**

32 (decimal) is added to ensure that the control byte value does not conflict with control characters.

Remember the control byte can be set in nonvolatile memory using the z setup function

11.1.4 p Poll

Poll commands are used to get data from the terminal. The format is :

<STX><ID><p><ETX>

The poll command does not require a BCC character and is not acknowledged by the terminal.

11.2. Getting Data from the Terminal.

A message string is returned to the host in response to a poll command. The message format is:

<STX><ID><k><KEYBOARD DATA><STX><b><BARCODE DATA><Optional Data><ETX><BCC>

Where Optional Data may be <STX><t(1or2)><Data> for an additional serial port or digital and/or analog data.

Where BCC is the Block Check Character

Note: *If there is no data the terminal returns a Null String* (<STX><ID>k<STX>b<ETX><BCC>)

Important! : The host must respond with a valid ACK to clear the data buffers in the terminal otherwise the terminal will repeat the same message on the next poll.

A valid ACK message is in the form <STX><ID><ACK><STX><BCC>

Where ACK is 06H

11.2.1 Keyboard Data.

The data string can be up to 40 characters or less if defined by the i command.

If less than the set number of characters are entered the operator must terminate the string with ENTER.

When the data has been terminated the display will flash and no further input will be allowed. (Usually the system operation is sufficiently fast that data is transferred before the screen starts flashing.)

The data is held in the transmit buffer until successfully transferred to the system unit.

Note:

1. The data will not be transmitted unless terminated.

2. As data is inputted it will appear on the screen, starting at the current cursor position. The cursor will be advanced with each character entered.

Local Editing.

The data string is terminated by entering the set number of characters or by pressing ENTER.

Prior to pressing ENTER the operator may edit the data string by means of the following keys:

DEL	Deletes the character to the left of the cursor
Clear Entry	Clears the entire buffer and moves the cursor back to the beginning.
<-	Moves the cursor left within the buffer.
->	Moves the cursor right within the buffer.

11.2.2 Barcode / Serial Port Data

Unless in the process of uploading data to the system the terminal is always ready to receive barcode or additional serial port data and this is input simply by scanning the barcode or sending data in on the additional RS232 port.

Barcode data terminates automatically after it is decoded and is then uploaded on the next poll.

Serial data is buffered in the terminal until it ceases to be received (120 mS time-out) or up to 255 characters have been received.

Further barcode scanning is inhibited until the current scan data is transferred to the system. In this way the system deals with only one barcode scan at a time (per terminal).

11.2.3 Analog & Digital Input/Output

See section 4 and Appendices.

11.3 Error Checking

All data transactions are checked by calculating a block check character and adding it to the string after the ETX. The block check character is a longitudinal redundancy check calculated by XORing all characters in the message excluding the first STX.

When a valid message is received then the host should respond with an ACK character (06HEX).

The system should include a retry mechanism. Under some circumstances (e.g. when decoding a barcode input) the terminal may not respond to the first command. It is recommended that the system software includes a sequence of 10 retries at 9600 baud or 40 retries at 38400 baud before failing the terminal.

11.4 Communication Protocol

The system should be set to 9600 or 38400 baud, no parity, 7 data bits and 1 stop bits. An inter-character delay is advisable.

Do not poll the terminal more frequently than every 150mS.

Turnaround time.

The terminal will transmit a return message after a short delay after receiving a valid poll. This delay depends on the baud rate:

At 9600 baud - approx. 5 mS
At 38400 baud - approx. 1.25 mS

12. Messages

The terminal can store messages in zdata. These messages can be displayed or transmitted from any of the 3 serial ports. If displayed they can be shown on the screen in the normal way (as if they were received from the host port) or they can be temporary messages (which overlay the current screen contents until the next key press when the original screen is automatically restored).

Messages may be activated in 1 of 2 ways:

By pressing a function key.
By a decode of barcode or magcard input.

The source is defined in one of the header characters. If a source is not defined then the default function is implemented. (E.g. if a function key is not defined as a message key then it behaves normally).

Up to 99 messages of each type can be stored (depending on overall memory capacity and size of each message) although in practice this is limited by the number of function keys in the hardware configuration. Only 1 decode message is permitted.

12.1 Message Format

The message format comprises a separator character followed by 5 header characters followed by the message itself:

<SOH><h1><number><h2><h3><message data>

where *SOH* = 01H, used as a separator character.
All parameter values mentioned below are ASCII characters (i.e. 0 = 30H)

	Value
***h1* is the source**	0 = None
	F = Function key
	D = Decoder (Barcode or Magcard)

number is a 2 digit number identifying the source :

***h2* is the destination**

0 = None

1 = Main Port

2 = Aux Serial Port 1

3 = Aux Serial Port 2

***h3* is the display action**

0 = None

1 = Display normally.

2 = Display normally and beep.

3 = Display temporarily.

4 = Display temporarily and beep.

5 = Display temporarily in Double height*

6 = Display temporarily in Double height* and Beep.

**Only in graphics mode*.

Note: The character size of displayed messages is always size 1 except where *h3* is 5 and 6.

message data is any ASCII data (see notes regarding control characters), of any length within the total memory constraints (and any limitations due to the MultiDrop protocol if using this mode, and display size,

if display is selected).

E.g. a message in the form **<SOH><F><08><1><4><This is key 8>**

Will, on pressing function key 8, cause the message "This is key 8" to be transmitted from the main port, and displayed temporarily in small size characters, together with a short audio warning beep.

Note: The message block (the area in *zdata* used to store messages) must both begin and end with 01H.

Appendix A - Key Assignments

This is a list of the ASCII codes assigned to each key, for each of the different keyboard layouts available.

Keyboard type 0 - FM (DeskTop) Keyboard (Membrane)

Key	ASCII Value (Hexadecimal)
0	30
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
-	2D
SPACE	20
DELETE	7F
CLEAR	0C
ENTER	OD
LEFT ARROW	08
RIGHT ARROW	09
F1	41
F2	42
F3	43
F4	44
F5	45
F6	46

Keyboard Type 1 - AM Keyboard (Membrane)

Key	ASCII Value (Hexadecimal)
A	41
B	42
C	43
D	44
E	45
F	46
G	47
H	48
I	49
J	4A
I	49
J	4A
K	4B
L	4C
M	4D
N	4E
O	4F
P	50
Q	51
R	52
S	53
T	54
U	55
V	56
W	57
X	58
Y	59
Z	5A
0	30
1	31
2	32
3	33
4	34

5	35
6	36
7	37
8	38
9	39
ESC	1B
ENTER	0D
DEL	08
.	2E

Keyboard Type 2 - Q Keyboard (Desk Top) (Silicon Rubber Type)

(Note internal functions are shown in brackets - these have an effect on the terminal without transmitting any keycode)

Key	Normal		Shift		2nd Shift	Ctrl	
1	31H	!	21H	Esc	1BH	NUL	0H
2	32H	"	22H	_	5FH	US	1H
3	33H	#	23H	-	2DH	n/a	
4	34H	$	24H	+	2BH	n/a	
5	35H	%	25H	=	3D	n/a	
6	36H	^	5EH	~	7EH	RS	EH
7	37H	&	26H	{	7BH	n/a	
8	38H	*	2AH	}	7DH	n/a	
9	39H	(	28H	[	5BH	n/a	
0	30H	)	29H	]	5DH	GS	DH
q	71H	Q	51H	HT	09H	DC1	1H
w	77H	W	57H	|	7CH	ETB	7H
e	65H	E	45H	\	5CH	ENQ	5H
r	72H	R	52H	?	3FH	DC2	2H
t	74H	T	54H	/	2FH	DC4	4H
y	79H	Y	59H	@	40H	EM	9H
u	75H	U	55H	'	60H	NAK	5H
i	69H	I	49H	---(CLEAR)---		HT	9H
o	6FH	O	4FH	---(BREAK)---		SI	FH
p	70H	P	50H	-----(SET)-----		DLE	0H
a	61H	A	41H	n/a		SOH	1H
s	71H	S	51H	n/a		DC3	3H
d	64H	D	44H	n/a		EOT	4H
f	66H	F	46H	n/a		ACK	6H

	g	67H	G	47H	n/a		BEL	7H
	h	68H	H	48H	n/a		BS	8H
	j	6AH	J	4AH	n/a		LF	AH
	k	6BH	K	4BH	(CAPS LOCK)		VT	BH
	l	6CH	L	4CH0	---(LIGHT)---		FF	CH
	CR	0DH	n/a		n/a		n/a	
	z	7AH	Z	5AH	n/a		SUB	AH
	x	78H	X	58H	n/a		CAN	8H
	c	63H	C	43H	n/a		ETX	3H
	v	76H	V	56H	n/a		SYN	6H
	b	62H	B	42H	n/a		STX	2H
	n	6EH	N	4EH	n/a		SO	EH
	m	6DH	M	4DH	n/a		CR	DH
	'	2CH	<	3CH	;	3BH	FS	CH
	.	2EH	>	3EH	:	3AH	n/a	
	DEL	7FH	---(INSERT)---			n/a	n/a	
SPACE		20H	SPACE	20H	n/a		n/a	
UP ARR		0BH	BS	08H	STX	02H	n/a	
DN ARR		0A	HT	09H	ETX	03H	n/a	

Keyboard Type 3 - QM Keyboard (Membrane)

The keyboard is allocated with the following key codes:

(Note internal functions are shown in brackets - these have an effect on the terminal without transmitting any keycode)

	Normal		**Shift**		**2nd Shift**
0	30H	)	29H	F21	ESC O 5 (1BH 4FH 35H)
1	31H	!	21H	ESC	1BH
2	32H	"	22H	F13	ESC O - (1BH 4FH 31H)
3	33H	#	23H	F14	ESC O . (1BH 4FH 2EH)

4	34H	$	24H	F15	ESC O / (1BH 4FH 2FH)
5	35H	%	25H	F16	ESC O 0 (1BH 4FH 30H)
6	36H	^	5EH	F17	ESC O 1 (1BH 4FH 31H)
7	37H	&	26H	F18	ESC O 2 (1BH 4FH 32H)
8	38H	*	2AH	F19	ESC O 3 (1BH 4FH 33H)
9	39H	(	28H		
F1	ESC O !		F7	ESC O '	
F2	ESC O "		F8	ESC O (	
F3	ESC O #		F9	ESC O)	
F4	ESC O $		F10	ESC O *	
F5	ESC O %		F11	ESC O +	
F6	ESC O &		F12	ESC O ,	
q	71H	Q	51H	HT	09H
w	77H	W	57H	|	7CH
e	65H	E	45H	\	5CH
r	72H	R	52H	?	3FH
t	74H	T	54H	/	2FH
y	79H	Y	59H	~	7EH
u	75H	U	55H	'	60H
i	69H	I	49H	+	2BH
o	6FH	O	4FH	=	3DH
p	70H	P	50H	(CAPS LOCK)	
a	61H	A	41H	£	23H
s	71H	S	51H	{	7BH
d	64H	D	44H	}	7DH
f	66H	F	46H	[	5B
g	67H	G	47H	]	5DH
h	68H	H	48H	_	5FH
j	6AH	J	4AH	(SET UP)	
k	6BH	K	4BH		
l	6CH	L	4CH0	(LIGHT)	

z	7AH	Z	5AH	<	3CH	
x	78H	X	58H	>	3EH	
c	63H	C	43H	,	2CH	
v	76H	V	56H	;	3BH	
b	62H	B	42H	:	3AH	
n	6EH	N	4EH	'	27H	
m	6DH	M	4DH	@	40H	
DELETE	7FH	n/a		CLEAR	0CH	
.	2EH	-	2DH	LEFT ARROW		08H
SPACE	20H	SPACE	20H	RIGHT ARROW		09H
CR	0DH	n/a		n/a		n/a

Keyboard Type 4 - FM6 (Panel Mount) Keyboard (Membrane)

Key	ASCII Value (Hexadecimal)
0	30
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
-	2D
SPACE	20
DELETE	7F
CLEAR	0C
ENTER	0D
LEFT ARROW	08
RIGHT ARROW	09
UP ARROW	0B
DOWN ARROW	0A

F1	41
F2	42
F3	43
F4	44
F5	45
F6	46

Keyboard Type 5 -FM17 (Panel Mount) Keyboard (Membrane)

Key	ASCII Value (Hexadecimal)
0	30
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
-	2D
SPACE	20
DELETE	7F
CLEAR	0C
ENTER	0D
LEFT ARROW	08
RIGHT ARROW	09
UP ARROW	0B
DOWN ARROW	0A
F1	41
F2	42
F3	43
F4	44
F5	45
F6	46
F7	47
F8	48

F9	49
F10	4A
F11	4B
F12	4C
F13	4D
F14	4E
F15	4F
F16	50
F17	51

Appendix B - Additional Serial Ports

3 Versions

- **1 additional port (25w Connector) - Option 2**
- **2 additional ports (2 x 9w Connector) - Option 5**
- **3 additional ports via 40w ribbon cable - Option 7 (with Dig I/O)**

The serial option board fits alongside the main communications port on the rear of the terminal. It provides a standard Male "D" connector for connection of either 1 extra channel (option 2) or 2 extra channels (option5) or 2 extra channels together with 16 Digital Inputs and 4 Digital Outputs (option 7)
The signal levels are RS232.
The following signals are provided:

TXD RXD CTS RTS

Together with 2 power supply outputs (5vdc and unregulated dc).
The option 2 version provides 5vdc on pin 9 and an unregulated power output on pin 16. (Pin 16 of the option board is connected to pin 16 of the main port that is the terminal power input.) The option 5 provides the 5v output on pin 9 of each connector, and the unregulated output on pin 4 of each connector. The option 7 provides 5v on pin 35 and 38, and unregulated on pin 40.

1. Connections:

Option 2: 25 w Male "D" Type - requires female at the cable end.

Pin	**Function**
1	Ground
2	TXD (Output from terminal)
3	RXD (Input to terminal)
4	RTS (Output from terminal)
5	CTS (Input to terminal)

7	Ground
9	+5v output
16	+Unregulated output

Option 5: 2 x 9w Male "D" Type - requires female at the cable end.

Each connector is wired as follows:

Pin	Function
2	RXD (Input to terminal)
3	TXD (Output from terminal)
4	+Unregulated output
5	Ground
7	RTS (Output from terminal)
8	CTS (Input to terminal)
9	+5v output

Option 7: 40w Ribbon Cable

Pin	Function
24	GROUND
25	RXDA
26	TXDA
27	RTSA
28	CTSA
29	+5VDC
30	GROUND
31	RXDB
32	TXDB
33	RTSB
34	CTSB
35	+5VDC
38	+5VDC

39	GROUND
40	UNREGULATED DC

2. Communications

Data may be sent to or received from any serial port.

2.1 Sending Data

To send data to a particular port use a message in the form:

RS232 Version	**MultiDrop Version**
<STX><*tn*><*Datan*><ETX>	<STX><id><*tn*><*Datan*><ETX><BCC>

Where *t* is ASCII 74H and *n* is the port number, 1 (ie 31H) for aux port1 (Option 2 and 5), and 2 (32H) for aux port 2 (Option 5 only)
For RS232 terminal versions *Datan* can be up to 250 characters in length, for MultiDrop versions the data length is limited to 40 characters.

Some control characters are used by the communication protocols. These are 02H, 03H, 11H and 13H. An attempt to send these characters via the auxiliary port may cause the terminal to malfunction.

Handshaking

The terminal does not respond to handshake signals from the device connected to the aux port(s) but can control the RTS line if selected in the zdata parameter.
There are sufficiently large buffers (250 characters) to accept complete messages.

When the terminal receives the serial port data from the host it is stored in a

temporary buffer (1 for each aux port). Once the terminating <ETX> is received from the host the terminal will output the message on the aux port, under interrupt control which allows the terminal to resume normal operation. If the terminal is still sending this data when the next aux serial port message for the same aux port arrives from the host then the terminal will beep.

Data will not be accepted for the aux serial port until the current transaction is completed.

2.2 Receiving Data

Each aux serial port has a 250 character receive buffer. Data is uploaded to the host whenever:

a) The number of characters reaches 250.
Or b) The terminating character is received, if selected.
Or c) if no terminating character is selected, the serial data pauses for longer than the time-out period,

Each port can be set to terminate independently, depending on the setting in *zdata* (see appendix D).

The choice of terminating character is:

CR (0DH) **LF** (0AH) **ETX** (03H)

3. Port Communication Settings

Each aux port can be set independently as follows:

Baud Rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400
Parity	Odd, Even, None

Word Length	7 or 8 bits
Stop Bits	1 or 2

The settings are stored using the *zdata* non-volatile memory function. See appendix D for further details.

Appendix C

Digital/Analog I/O (Option 3)

3 Versions - Analog Only, Digital Only or Analog + Digital
Analog - 4 Channels each 0 - 5v, 12 bit resolution
Digital - 8 Inputs + 8 Outputs

Digital I/O (Option 7)

1 Version with 16 Opto-Isolated Digital Inputs, 4 Opto-Isolated Digital Outputs and 2 serial ports.

The option board fits adjacent to the communications port on the rear of the terminal The Option 3 provides a high-density 44way "D" connector for connection of all analog and digital signals and the Option 7 has a 40 way ribbon connector (Plug)

The digital inputs accept a signal in the range +5v to +30vdc with an input resistance of 10K.
Digital outputs are in the form of open-collector transistor signal with a current capability of 50mA and maximum voltage rating of 30vdc. The option 3 board digital I/O is an extension of the 2 inputs and outputs already fitted as standard. The digital channels are numbered 1 to 8. When the Option 7 is fitted the 2 standard input channels are inoperative.

The Option 3 analog inputs are connected directly to the A-D converter and there is no hardware signal conditioning. A variety of software filters may be selected.

1.0 Operation.

Commands from the host to the terminal.

The operation differs slightly depending on the terminal firmware: -

Command Summary

Commands	**RS232 Version.**	**MultiDrop Version**
Get Analog Data		
	<STX><**a***n*><ETX>	<STX><ID><**a***n*><ETX>
Set Analog Filter		
	<STX><**f***1n2n3n4n*>	<ETX><STX><ID><**f***1n2n3n4n*><ETX>
Get Digital Data		
	<STX><**b***n*><ETX>	<STX><ID><**b***n*><ETX>
Set Digital Output		
	<STX><**o***nnn*><ETX>	<STX><ID><**o***nnn*><ETX>
Digital Input Mode		
	<STX><**m***n*><ETX	<STX><ID><**m***n*><ETX>

Get Analog Data

Where *n* is a single byte with an ASCII value of

30H : Turn off the automatic data report.
31H Get a single data report
32H - 36H Set for automatic reporting

Where 32H send a report every Poll when using the MultiDrop version (Values above 32H are not used with the MultiDrop version).

For the Terminal version the automatic reporting interval can be selected: -

32H sends a report every 200mS.
33H sends a report every 500mS.
34H sends a report every 1 second.
35H sends a report every 5 seconds.
36H sends a report every 10 seconds

Get analog data causes the terminal to send analog data back to the host. The data report includes all 4 analog channel values and can be requested as a "1 shot" reading on demand from the host or as a continuous reading at preset time intervals.

Get Digital Data

Where *n* is a single byte with an ASCII value of

30H : Turn off the automatic data report.
31H Get a single data report
32H - 37H Set for automatic reporting

Where 32H send a report every Poll when using the MultiDrop version (Values above 32H are not used with the MultiDrop version).

For the Terminal version the automatic reporting interval can be selected

32H sends a report every 200mS.
33H sends a report every 500mS.
34H sends a report every 1 second.
35H sends a report every 5 seconds.

36H sends a report every 10 seconds
37H sends a report whenever any the digital inputs changes state.

Get Digital Data causes the terminal to report the status of the digital inputs. "1 Shot" and continuous modes are available and an additional mode automatically sends the digital input report whenever any of the inputs changes state. Each digital input has a 50mS debounce filter.

Set Analog Filter

The analog filter controls the way analog signals are processed. Each analog channel can be set to 1 of 3 modes: -

Where *1n* relates to channel 1, *2n* relates to channel 2 etc...
and the value of *n* has the following effect :-

30H sets the filter OFF (Direct Reading)
31H set the filter to average the last 8 readings.
32H - 10 poll filter mode.

E.g. **f**10213140 (ASCII 66H 31H 30H 32H 31H 33H 31H 34H 30H) sets the filter off on channels 1 and 4 and sets channels 2 and 3 to averaging mode.

Set Digital Output.

Set Digital Output sets the condition of the 8 digital outputs where *hh* is the 8 bit control byte represented in ASCII HEX. 1=ON, default is all outputs OFF on power-up.

E.g. where *hh*=FF (i.e. ASCII 46H 46H) all outputs are set ON

Set Digital Input Mode

The digital inputs can be configured as straight input signals or used as counters.
The Digital Input Mode command is used to set up the configuration: -
Each digital input can be set to 1 of 3 modes: -

Where *1n* relates to input 1, *2n* relates to input 2 etc...
And the value of *n* has the following effect: -

30H sets the input as a straight digital input.
31H sets the input as an UP counter.
32H resets the counter to zero.

Note changing the mode from straight input to counter or *vice versa* will also reset the counter to zero.

E.g. m1020304051617181 sets the first 4 inputs to straight digital input mode and the last 4 inputs to counter mode.

The mode defaults to digital input on power up.
The maximum count rate is 5 pulses/sec.

Reports from the terminal to the host.

There is a special case on power-up when the digital input status report is transmitted without being requested and headed with **s** instead of **i**. This is intended to be used as a sign-on message to the host.

The operation differs slightly depending on the terminal firmware: -

Report Summary

Report	**RS232 Version.**	**MultiDrop Version**
Analog Data		
	<STX><**a***nnnn*><ETX>	<STX><ID><**a***hnnnn*><ETX>
Digital Input Status		
	<STX><**i***nnn*><ETX>	<STX><÷<ID><**i***nnn*><ETX>
Sign-on		
	<STX><**s***nnn*><ETX>	<STX><ID><**s***nnn*><ETX>
Counter status		
<STX><**c**1*nnnn*-8*nnnn*><ETX>		<STX><ID><**c**1*nnnn*-8*nnnn*><ETX>

Where *n* is an ASCII value. All data is passed in ASCII HEX format.

2.0 Connections.

2.1 Option 3

All connections are made via a 44 way high-density D type connector (female on the terminal side) requiring a cable to be made incorporating a male plug.

Analog Inputs:

Channel 1	27
Channel 2	26
Channel 3	11
Channel 4	10
0V	9

Notes: *1.Ensure that analog input signals do not exceed the range 0V to +5V.*
2. Always connect unused inputs to 0V.

Digital Input Number	**Option 3 Board Port Pin Number**
DI1	17
DI2	16
DI3	2
DI4	1
DI5	4
DI6	3
DI7	5
DI8	6

Notes: 1. Each input has an input resistance of 10k.
2. Do not exceed 30V d.c. on any input.

Digital Output Number	**Option 3 Board Port Pin Number**
DO1	36
DO2	35
DO3	34
DO4	33
DO5	32
DO6	31
DO7	37
DO8	38

Notes: *1. Outputs are open collector type.*
2. Do not exceed 50mA from any output.
3. Do not exceed 30V d.c. on any output.

Digital +5V Pins 7, 19, 20, 21, 22, 23.

Digital Ground Pins 8, 9, 15, 24, 25, 39, 40, 41, 42, 43, 44.

2.2 Option 7

The Option 7 Digital inputs and outputs connect via a 40 way ribbon cable socket that locates next to the main host RS232 connector on the rear panel.

Digital Output Number	**Option 7 Board Pin Number**
01	2
02	3
03	4
04	5

Digital Input Number	**Option 7 Board Pin Number**
01	6
02	7
03	8
04	9
05	10
06	11
07	12
08	13
09	14
10	15
11	16
12	17
13	18
14	19
15	20
16	21

Isolated +5vdc power supply signals are available as follows:

Isolated Ground	1
Isolated +5v	22
Isolated Ground	23

Note that the current available from the isolated supply is limited to 100mA

Appendix D NV Data Parameter List

The nonvolatile EEPROM data contains a number of parameter settings to adjust the function of the terminal. For normal applications no changes are necessary and the terminal may be used in the configuration as delivered. The NVData configuration facility permits a wide variety of alternative operating modes. It is setup by a data string received from the serial port in the form <STX>z<datan.....><ETX>. See also section 3.4.

Notes: Settings are Actual Characters (e.g. Valid Setting = 1 = 31H)

Default settings are shown in *Italics*

The first character of the NVData cannot be set from the serial port as it controls the type of display fitted. It can be read by <STX>z?

Parameter #	Function	Valid Settings
0	***Display Type***	***0 DT16 Type***
		1 DT40 Type
1	**Keyboard Selection**	0 FM Membrane
		1 AM Membrane
		2 QWERTY Rubber
		3 QWERTY Membrane
		4 FM6 Panel Mount
		5 FM17 Panel Mount
		6 SCOS 16 key

		7 Alternative QM 8 Backlit Rub 48 key Q 9 20 key Access Terminal A Alternative FM	
2	**Communication Mode**	0 Normal 1 MultiDrop	
3	**DT40 Display Mode**	*0 Attribute, non-scrolling* 1 Graphic 2 Attribute, scrolling *Default for Q kbd)* Not yet implemented	
4	**DT40 Character Size**	*0*	*8x40*
		1	8x40
		2	4x40
		3	4x20
		4	2x20
		5	2x10
5	**Language**	*0*	*USA*
		1	Swedish
		2	Norwegian
		8	English
6	**MultiDrop Control Byte**	*0%*	*Same as %*
7	**Main Port Handshake Mode**	0	No Handshaking
		1	XON/XOFF
		2	*CTS/RTS*
		3	XON/XOFF and
		4	RTS Toggle Mode

8-9 **Digital I/O Mode** Option3 0 Sets Digital Inputs as counter (1) or Input (0). Default is 000 = all inputs

10 " Native I/O as above

Data is in ASCII Hex i.e. FFF= all cntrs

See section 4 and appendix C

11 **Analog Filter Mode** Opt 3 Ch 1 0

12	"	2	0
13	"	3	0
14	"	4	0
15	"	5	0
16	"	6	0
17	"	7	0
18	"	8	0
20	**Port 2 Setup - Baud Rate**	0	9600
		1	300
		2	600
		3	1200
		4	2400
		5	4800
		6	9600
		7	19200
		8	38400
21	**Port 2 Parity, Wordlength, Stop Bits**		
		0	N,7,1
		1	E,7,1
		2	O,7,1
		3	N,8,1
		4	E,8,1
		5	O,8,1
		6	N,7,2
		7	E,7,2
		8	O,7,2
		9	N,8,2
		A	E,8,2
		B	O,8,2
22	**Port 2 Handshake Mode**	0	Fixed at OFF
23	**Port 2 RX Terminator**	0	TIME-OUT

			1	CR
			2	LF
			3	ETX
24	**Port 3 Setup**	**Baud Rate**	0	As P20
25	**Port 3**	**Word**	0	As P21
26	**Port 3 Handshake Mode**		0	As P22
27	**Port 3 RX Terminator**		0	As P23
28	**Barcode/Magcard Selection**		0	Off
			1	BarCode
			2	MagCard

29	**Sign-on Activity**	0	Screen and message
		1	Message but no screen
		2	Screen but no message
		3	no screen or message
60-67	**Security Code**	8 char programmable field	
68-107	**Sign-on screen Banner**	" Industrial Data Products Ltd "	
125	**Repeat Key**	0	Off
		1-7	Speed
		8	Progressive
127	**Conversion parameter for old version 2nd serial port**		
		0	Normal
		1	Omit "t1" & "t2" from serial port messages in normal mode.
128 on	**Messages**		

END