TCS

6433

6433 - PROGRAMMABLE SIGNAL PROCESSOR

TECHNICAL MANUAL

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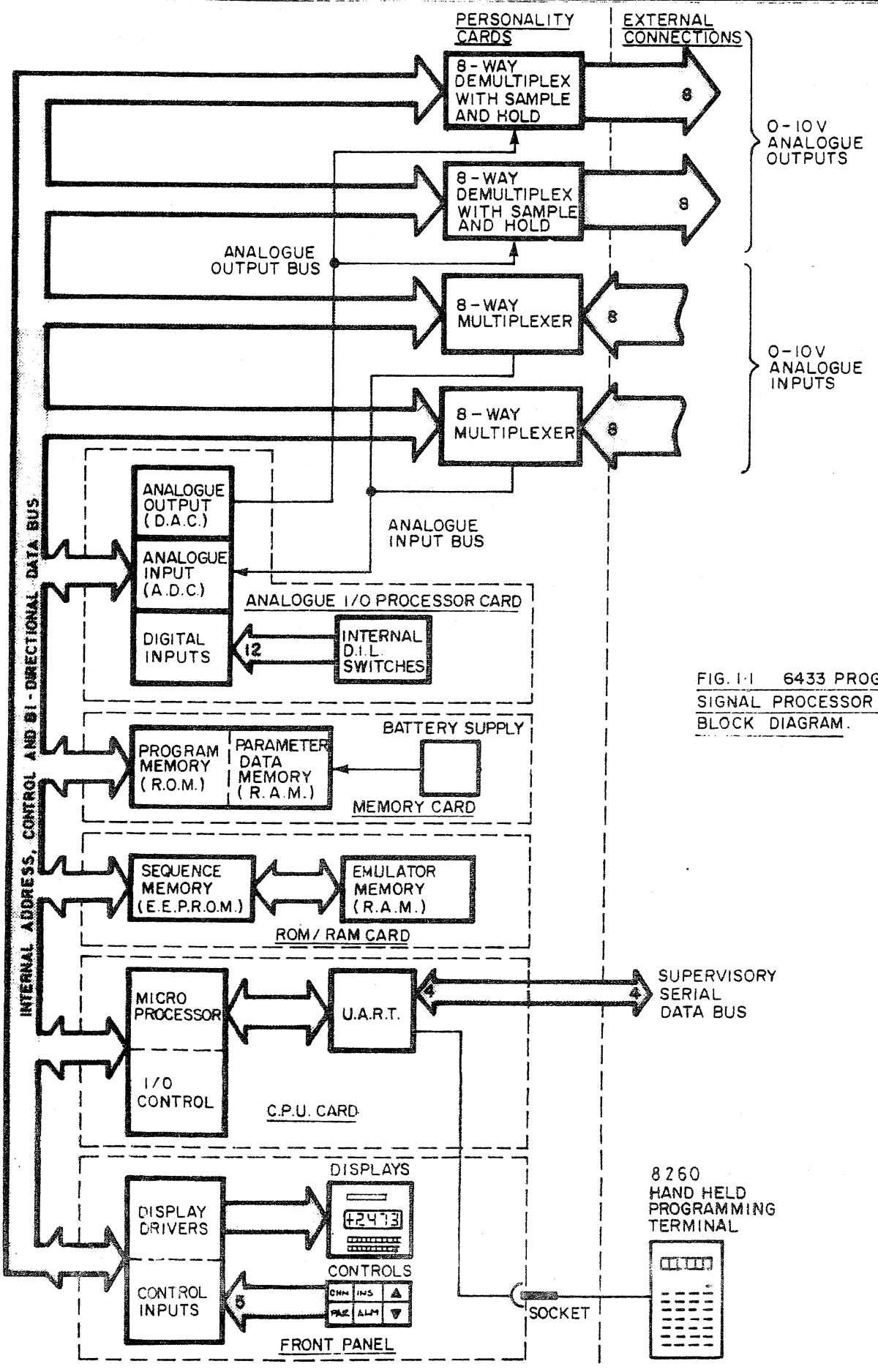


FIG. 1·1 6433 PROGRAMMABLE SIGNAL PROCESSOR SCHEMATIC BLOCK DIAGRAM.

As a Systems component it plugs directly into the model 7000 Rack unit or 7600 Bin unit for plant installation and integrates with the full capabilities of the range which includes modules for signal conditioning, actuator driving and centralised monitoring and control facilities.

The 6433 is also available housed within a 72 mm DIN compatible sleeve for front of panel mounting.

1.2 Features and General Description

The features of the 6433 Programmable Signal Processor are best described with reference to the schematic Block Diagram shown in Fig 1.1. It can be seen that the hardware structure is such that each of the instrument functions, namely:-

Front Panel Displays and Operator Controls
Analogue Input/Output signals
Digital Input/Output signals

- are implementated as separate hardware blocks. Each of these functional blocks communicates with the Central Processor Unit (CPU) which controls the overall operation of the instrument via the internal communication buses shown. The CPU itself contains the microprocessor which is the intelligent "heart" of the device and it in turn has to communicate with 2 blocks of memory. The memory card stores the necessary set of instrument operating programmes together with the channel ranging parameter and status information. The ROM/RAM Emulator card holds the sequence of programme steps entered by the user.

The Front panel contains all the indicators and displays necessary to allow an operator to monitor any of the 32 input/output channels. It also has a number of control push-buttons to allow an operator to select a desired channel for monitoring, and also to display and subsequently alter selected parameters associated with that Channel. A socket is provided on the front panel to allow an 8260 Hand-Held data terminal to be connected which is used to set up input/output channel characteristics initially, or monitor and change any of these channel parameters subsequently. Access to certain channel parameters for monitoring or updating purposes is also possible by means of a second communication channel available at the rear connector and intended for computer supervisory use.

The 6433 Programmable Signal Processor Module is configured for a specific application by plugging in appropriate Personality cards in the 4 slots available. These are of 4 basic types each one being an 8-way unit thus:-

a) 8-way 0-10V Analogue Multiplexor input card.

b) 8-way 0-10V Analogue Demultiplexor with Sample and Hold output card.

c) 8-way 0-15V logic input card.

d) 8-way 0-15V logic output card.

CONNECTOR NUMBER	CONNECTOR TYPE	DAUGHTER BOARD FUNCTION	POLARISING KEY POSITION
1	Double-sided	ROM/RAM Emulator	40 - 41
2	Double-sided	Central Processor Unit	39 - 40
3	Double-sided	Memory Mk 5 (006)	40 - 41
4	Double-sided	Analogue Processor	19 - 20
5	Single-sided	Input/Output Slot 4	27 - 28
6	Single-sided	Input/Output Slot 3	27 - 28
7	Single-sided	Input/Output Slot 2	27 - 28
8	Single-sided	Input/Output Slot 1	27 - 28
9	Single-sided	+5V Power Supply	25 - 26
10	Single-sided	±12V, -5V Power Supply	14 - 15

TABLE 1.1 Daughter board edge connector characteristics

1.3.1 Rack-Mounting Instruments

The 6433 Programmable Signal Processor may be rack mounted in the standard TCS type 7000 racking system. A 19" rack will house up to 6 instruments in their 72mm metal sleeves, though of course they can be mixed with other TCS Matric 6000 modules. A half width rack is also available, and this can hold up to 3 instruments. Rack wiring is carried out in the conventional manner, and a rack-wiring schedule may be prepared from the 6433 rear connector pin chart given in Appendix A.

1.3.2 Bin-Mounting Instruments

The 6433 Programmable Signal Processor may be mounted in the TCS 7600 Bin system, where the rear connector pins are wired to customer screw terminals. The system can be configured by referring to the B6433 rear termination assembly given in Appendix B.

1.3.3 Panel-Mounting Instruments

The 6433 Programmable Signal Processor can be used as a stand-alone panel-mounted instrument by using the 7900 single or multi-way sleeve assembly. In this case each instrument is provided with a 7433 rear termination assembly that contains a power supply, and gives access to all the module connections via screw terminals. Full data sheets on the 7900 sleeve unit and the 7433 rear termination assembly are provided in Appendix C.

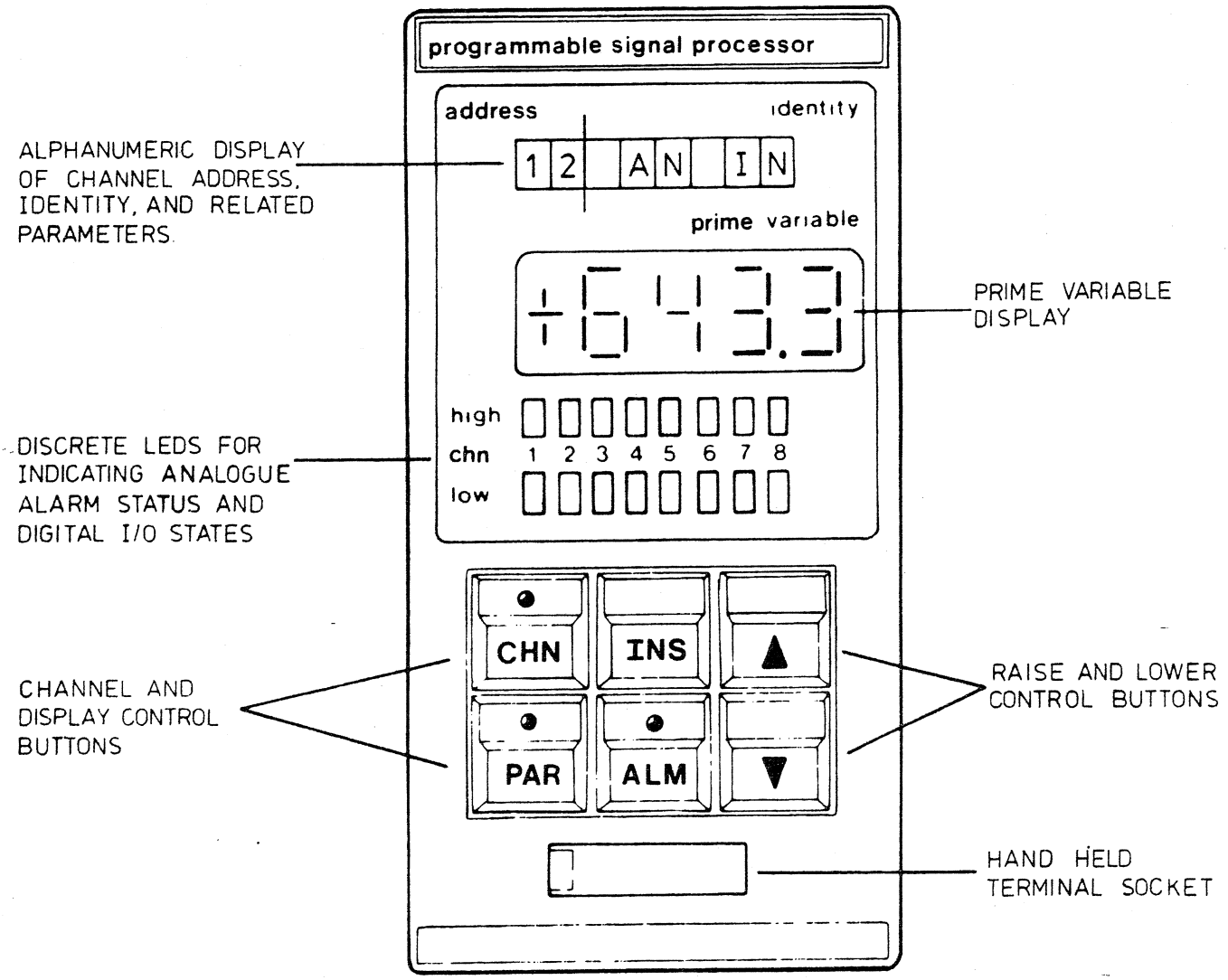


FIG. 1·3 6433 PROGRAMMABLE SIGNAL PROCESSOR FASCIA DIAGRAM.

1.4 Daughter Board Functional Descriptions

Each of the daughter boards are described in turn to indicate their function within the basic 6433 Programmable Signal Processor.

1.4.1 Front-Panel Daughter Board (Assembly: AC 069452)

The front-panel daughter board holds all the indicator and display components together with the Operator Control push-buttons. The display components actually visible to the Operator can be seen from the fascia diagram of Fig 1.3 and consist of the following :-

a) Digital Readout

A 4 digit, orange, 7-segment LED display with a sign digit and programmable decimal point position is provided for Prime Variable indication in the range -9999 to +9999.

b) 16 Way status LEDs

These consist of 2 horizontal rows of 8 red LEDs situated below the Prime Variable Display. They are used to indicate status information concerning the 8 channel Block currently being displayed. This information varies with the type of input/output card.

c) Address/Identity Display

This consists of a row of 8, red, 17-segment alphanumeric LED displays situated above the Prime Variable Display. Each of the 8 digits is capable of displaying a full 64 ASCII character set. It is used to display the Block and Channel Address in Primary Format or a selected Command Parameter in Secondary Format. It will also display diagnostic messages as well as a user defined 8 character "Tag" name in either mode if no buttons are pressed and switch S2 no. 4 is in the ON position.

There are 6 Control push-buttons fitted three of which incorporate LEDs. All the buttons are of the momentary action type though the INS button has an alternate action implemented by electronic means.

a) Inspect button - INS

As previously stated the INS button has an electronic alternate action and its state is indicated by the green LED's housed in the CHN and PAR push-buttons. The INS button is used to control whether the displays are operating in the Primary or Secondary Formats, and the resulting actions of the CHN and PAR push-buttons.

b) Channel Select button - CHN

This button is used in conjunction with the Raise/Lower buttons to select 1 of the 32 input/output channels for display, or to scroll through the Command Parameter list depending upon the operating mode.

c) Parameter Value button - PAR

This button is used in conjunction with the Raise/Lower buttons to alter the value of the currently displayed Prime Variable or Command Parameter depending upon the operating mode.

d) Alarm Acknowledge button - ALM

The red LED contained in the ALM button flashes whenever there is an unacknowledged Alarm or Status change on one of the 32 channels. When the Block containing the current alarm is being displayed the ALM button can be pressed to acknowledge it. The LED will then go steady and will subsequently go out only when the alarm condition disappears. It should be noted that Alarms or Status changes can only be acknowledged when their corresponding 8-channel Block is being displayed.

e) Raise/Lower buttons - △ ▽

These two buttons are used to increment or decrement the Channel address, the Prime Variable value, a selected Command Parameter value, or scroll forward or backwards through the Command Parameter list depending upon the current 6433 operating mode.

The front panel board contains all the drive electronics associated with these displays and push-buttons and also carries the 7-pin socket into which the 8260 Hand-Held programming terminal may be plugged.

1.4.2 Central Processor Daughter Board (Assembly: AC 069932)

The CPU daughter board contains the 16 bit microprocessor chip itself together with the associated support logic required for interrupt handling and for providing the necessary input/output decoding logic. A Universal Asynchronous Receiver Transmitter (UART) circuit and associated drivers are used to communicate with either the 8260 Hand-Held programming terminal via the Front Panel socket, or with a supervisory system via the rear connector serial data bus.

The CPU card also contains a Watchdog timer circuit which monitors the microprocessor Input/Output functions. Upon detection of a failure all the Analogue outputs are "frozen" and all Front Panel displays are cleared except for the 8 character alphanumeric readout.

1.4.3 Memory Daughter Board (Assembly: AC 075113)

The Memory Daughter Board is used to store the actual 6433 operating programmes in a Read-Only Memory (ROM) while the input/output channel parameters and other variables are stored in a non-volatile Random-Access Memory (RAM). The RAM chips are made non-volatile by means of a standby battery supply circuit which powers them when the main supply has failed or undergoes a transient failure. A long-life Lithium primary cell is used for this purpose and it may be isolated from the circuit during long shelf storage periods, if required.

1.4.4 ROM/RAM Emulator Daughter Board (Assembly: AC 075114)

The ROM/RAM Emulator Daughter Board contains 4K bytes of Random-Access Memory (RAM) which is used for storing the user defined sequence of program steps. Programs are always executed from RAM to allow on-line debugging and subsequent editing. Once the program has been checked out fully the CPU can transfer data from the RAM area into a similar amount of Electrically Erasable PROM (EEPROM). Whenever the 6433 is subsequently powered up, or a sumcheck is detected, the CPU automatically copies the program from EEPROM back into the RAM area to allow program execution. The CPU can also copy data from the EEPROM area back into the RAM under operator control to permit further editing and debugging cycles to be carried out.

Fig. 2.1 shows that the ROM/RAM Emulator also carries a 4 way DIL switch and 4 red LED's along its top edge. With issue 1 software only one of these switches is used, and this is S1 which serves as an EEPROM write inhibit switch. None of the LED's are used either by the issue 1 software and they should all be in the OFF state in normal operation.

BOARD ORDER CODE	BOARD TYPE IDENTITY	NUMBER OF CHANNELS	BOARD DESCRIPTION	BOARD CATEGORY
0 1 2 3 4 5 6 7	00 01 02 03 04 05 06 07	8	0-10V non-isol. 1M ohm Zin	Analogue input
8 9 10 11 12 13 14 15	08 09 0A 0B 0C 0D 0E 0F	8	0-10V non-isol + S/Hold	Analogue output
16 17 18 19 20 21 22 23	10 11 12 13 14 15 16 17	8	0-15V non-isol, non-latched	Digital input
24 25 26 27 28 29 30	18 19 1A 1B 1C 1D 1E	8	0-15V non-isol, O/C 2k2 pup	Digital output
X	1F	-	No board fitted	

TABLE 1.2 Table of daughter board types, their corresponding ordering codes and board identities

1.4.5 Analogue Processor Board (Assembly: AC 069398)

The Analogue Processor Board provides a number of digital and analogue functions as follows :-

a) Digital Functions

The board contains 12 internal switches which are used to set up the 6433 for certain operating modes and communication channel characteristics. Certain CPU busses are also routed through to the selected Input/Output slots 1 to 4 as necessary by logic on this board.

b) Analogue Functions

The board contains the circuitry necessary to provide an analogue output bus for driving 8-way Analogue Output cards when they are plugged into the Input/Output slots. It also provides an analogue input bus facility which is driven by 8-way Analogue input cards when they are plugged into the Input/Output slots. In addition, circuitry is provided on the board which allows the CPU to measure the battery voltage under dynamic loading conditions.

1.4.6 Input/Output Daughter Boards

The 6433 has 4 slots into which general purpose Input/Output daughter boards are plugged. These boards come in 4 basic categories, viz:-

a) Analogue input cards
b) Analogue output cards
c) Digital input cards
d) Digital output cards

The 6433 is configured for a specific application by plugging in appropriate Input/Output daughter boards of the desired type into any of the 4 slots available.

The 6433 hardware has the ability to detect which type of card is plugged into each of the 4 Input/Output slots by monitoring a board identity which is pre-programmed onto each card. The 6433 software verifies that the correct type of card is plugged into each slot and can also distinguish between the 8 different types of card within each category. Table 1.2 lists the types of Input/Output boards currently available together with their corresponding hardware identity codes.

The 4 types of Input/output boards that can be fitted to the 6433 Instrument are described in the following paragraphs.

a) Analogue Input Daughter Board (Assembly: AC 069400)

This board basically multiplexes 8 non-isolated input signals in the range 0-10V onto the analogue input bus of the Analogue Processor card. Each channel is provided with an input network comprising a pull-down resistor, a 100 usec CR filter, and a 12V zener diode clamping circuit.

b) Analogue Output Daughter Board (Assembly: 069402)

This board demultiplexes the 0-10V analogue output bus from the Analogue Processor card into 8 non-isolated output channels. Each output channel consists of a medium term sample-and-hold circuit and buffer amplifier stage capable of driving ±5mA signals.

c) Digital Input Daughter Board (Assembly: AC 069399)

This board contains 8 non-isolated, non-latched, digital input circuits which can be instantaneously accessed by the CPU control and address busses. Each input is provided with a 15V CMOS buffer circuit fitted with a 100k pull-down resistor to 0V.

d) Digital Output Daughter Board (Assembly: AC 069401)

This board contains 8 non-isolated digital latch circuits driven by the CPU control and address busses. The outputs of each latch are buffered by a 0-15V open-collector TTL gate fitted with a 2k2 pull-up resistor to the 15V supply.

1.4.7 +5V Power Supply Daughter Board (Assembly: AC 066518)

This board basically consists of a switching regulator circuit which draws its power from a 20-30 volt smoothed unregulated input and can supply up to 2.5A before current limiting. The board also contains the necessary logic circuitry to detect Power On and the Power Failure conditions and alert the CPU accordingly.

1.4.8 +12V, -5V, -12V Power Supply Daughter Board (Assembly : AC 066519)

This board also draws its power from the 20-30 volt supply input and uses a monolithic regulator to produce the +12V supply rail. A -16V supply is also generated on the board by means of an inverting regulator circuit and the -12V and -5V supply rails are derived from this with two further monolithic regulators. All 3 of these regulators incorporate current limit and thermal shutdown facilities.

1.4.9 Fuse Daughter Board (Assembly: AC 069441)

This board is used to mount the main 2A supply fuse together with circuitry capable of blowing it in the event of any internal supply rail exceeding its voltage tolerance limit. In addition the fuse board generates a regulated 15V supply for the Watchdog and other digital outputs, while a spare 2A fuse is also mounted on the board for convenience.

1.5 Technical Specification

1.5.1 Operator Displays

a) Digital readout : 4 digit, orange LED 7-segment display with sign and a decimal point that can be programmed to 4 positions.

± .9999
or ± 9.999
or ± 99.99
or ± 999.9
or none, i.e. ± 9999

b) Alphanumeric readout : 8 character, red 17 segment display with full 64 ASCII character set capability.

c) Status indicators : two rows of 8 red LEDs for HI, LO alarm or logic state indication.

1.5.2 Operator Controls

a) Operating mode selection : 3 momentary action, illuminated push-buttons:-

(i) Channel select (CHN) with green LED.

(ii) Parameter select (PAR) with green LED.

(iii) Inspect (INS) with electronic alternate action.

b) Function selection : 2 momentary action, non-illuminated push-buttons:-

(i) Raise (△)

(ii) Lower (▽)

c) Alarm acknowledge : 1 momentary action push-button (ALM) with integral red common collected alarm LED

1.5.3 Power Supplies

a) Input voltage : (May be unsmoothed, full-wave rectified AC)
: 20-30V DC recommended operating range.
: 19-35V DC absolute maximum input limits.

b) Input current : 550mA without Hand-held terminal at 28V DC.
: 650mA with Hand-held terminal at 28V DC.

c) Input fuse rating : 2A

d) Internal supply rails :

Nominal Voltage	Voltage Tolerance	Current Limit
+12V	±0.5V	200mA
+ 5V	±0.25V	2.5A
- 5V	±0.2V	200mA
-12V	+0.5V	300mA

e) Power failure detect threshold : when input voltage falls below 16.5 ± 0.5V

f) Memory standby battery characteristics : Lithium type
: 3V nominal output at 160mAh
: 8-10 year shelf life
: 5 year life minimum on continuous standby

g) Output supply characteristics : 15V DC ±0.5V at 200mA max

1.5.4 Communications

a) No. of communication channels	:	2 serial ports
b) Type	:	Full duplex
c) Functions	:	(A) Dedicated data link via the front-panel used by the Hand-held terminal.
	:	(B) Multi-drop data link via the rear connector used by a supervisory computer.

(A) Hand-Held Terminal Link

a) Transmission standard	:	2 wire RS232/V24 (±12V)
b) Data rate	:	300 baud
c) Character length	:	10 bits made up of:- 1 start + 7 data + 1 parity (even) + 1 stop

(B) Multi-drop Supervisory Link

a) Transmission standard	:	4 wire RS422 (0-5V)
b) Line impedance	:	120-240 ohm twisted pair
c) Line length	:	4000ft max. (At 9600 baud)
d) No. of instruments/line	:	16
e) Data rate	:	Selectable from 110, 300, 600, 1200, 2400, 3600, 4800, or 9600 baud
f) Character Length		
(i) ASCII mode - 110 Baud	:	11 bits made up of:- 1 start + 7 data + 1 parity (even) + 2 stop.
(ii) ASCII mode - 300 to 9600 Baud	:	10 bits made up of:- 1 start + 7 data + 1 parity (even) + 1 stop.
(iii) Binary mode - 110 Baud	:	12 bits made up of:- 1 start + 8 data + 1 parity (even) + 2 stop.
(iv) Binary mode - 300 to 9600 Baud	:	11 bits made up of:- 1 start + 8 data + 1 parity (even) + 1 stop.

1.5.5 Physical Specification

a) Mechanical

(i)	Width	:	72 mm
(ii)	Height	:	142 mm
(iii)	Depth	:	300 mm
(iv)	Weight	:	1.7 kg

b) Environmental

(i)	Operating temperature	:	0 to +50°C
(ii)	Storage temperature	:	-20 to +55°C
(iii)	Relative humidity	:	5 to 90% non-condensing
(iv)	Ventilation	:	Rack or Bin mounted Controllers must have at least a 1U gap above and below the case for proper ventilation.
		:	Sleeve mounted Controllers should be mounted as specified in the 7900 Sleeve data sheet (see Appendix C).

1.5.6 Analogue input board - Type 0

a) Number of channels	:	8 non-isolated inputs
b) Input signal levels	:	Inputs are 0-10V or 1-5V range selectable by software
c) Resolution	:	12 bit binary ADC (0.025%) hardware applied to inputs
	:	15 bit binary representation obtained after digital filtering and signal averaging giving resolution of 1 digit in ±9999
d) Accuracy	:	±1 LSB max. over 0 to 50°C range for hardware
	:	±1 digit of reading for 0-4000 range
	:	±2 digits of reading for 0-8000 range
	:	±3 digits of reading for 0-9999 range
		- after input filtering
e) Sampling rate	:	ADC samples 1 channel every 38ms i.e. worst case sample rate is 304ms with 8 channels enabled on board
f) Input impedance	:	1M ohm pull-down to 0V on all channels
g) Input signal processing	:	Linear: normal or inverse,
	:	Normalised square root
	:	Type J, K, T, S, R, E, B, thermocouples.
	:	Platinum resistance thermometers.
	:	Up to 5 user specified linearisations.

1.5.7 Analogue output board - Type 8

a) Number of channels	:	8 non-isolated outputs
b) Output signal levels	:	Outputs are 0-10V or 1-5V range selectable by software
c) Output circuit type	:	Medium-term analogue sample-and-hold circuits preceded by DAC
d) Output resolution	:	12 bit binary (0.025%) giving minimum analogue voltage steps of 2.5mV
e) Accuracy (0-10V output)	:	±1 LSB max. over 0 to 50°C range
f) Sample-and-hold	:	DAC updates 1 channel every 38ms i.e. worst case refresh rate is 304ms with 8 channels enabled on board
g) Output drift rate under Watchdog failure conditions	:	0.5mV/sec maximum (equivalent to 1% of full scale in 3 minutes)
h) Output drive capability	:	±5mA for voltage outputs

1.5.8 Digital input board - Type 16

a) Input type	:	Non-latched, non-isolated
b) Number of inputs	:	8
c) Input voltage levels	:	15V = logic one
	:	0V = logic zero
d) Input impedance	:	100k ohm pull-down to 0V (gives 150uA logic one current)
e) Sampling rate	:	All digital inputs (from 8 to 32) are sampled once every 38ms

1.5.9 Digital output board - Type 24

a) Output type	:	Non-isolated
b) Number of outputs	:	8
c) Output voltage levels	:	15V = logic one
	:	0V = logic zero
d) Output drive capability	:	2k2 ohm open-collector pull-up to +15V supply
	:	Maximum logic zero sink current = 16mA
e) Output update rate	:	All digital outputs (from 8 to 32) are updated once every 38ms

1.6 ORDER SHEET

DESCRIPTION	ORDER CODE
Programmable Signal Processor module (basic assembly)	6433
Slot 1 daughter board position, pin connections 10-17 Specify board type from table of ordering codes :-	/NN
Slot 2 daughter board position, pin connections 18-25 Specify board type from table of ordering codes :-	/NN
Slot 3 daughter board position, pin connections 26-33 Specify board type from table of ordering codes :-	/NN
Slot 4 daughter board position, pin connections 34-41 Specify board type from table of ordering codes :-	/NN

Example

6433/0/0/8/X

- where slots 1 and 2 are Analogue Input boards, slot 3 is an Analogue Output board and slot 4 is empty.

Note

All 4 daughter board ordering codes must always be specified after the 6433 basic assembly code. If a board is not required in any slot position then an X must be entered in the appropriate place. (see Table 1.2 for board ordering codes)

Section 2 Installation

2.1 General Requirements

The sequence of events for installing a 6433 Programmable Signal Processor in a system should be as follows:-

a) Rack or Bin Systems

(i) Ensure that a 72mm slot, fitted with a 48 way connector and all the correct mounting hardware, is available in a TCS 7000 Rack or 7600 Bin (See sections 1.3.1 and 1.3.2).

(ii) Ensure that an appropriate 24V DC supply is available and has been wired to the slot in the manner outlined in the System 6000 Installation Guide Section 5.

b) Self-Powered Sleeves

(i) Ensure that a 7900/7433 Self-Powered Sleeve is available (See Section 1.3.3).

(ii) Ensure that the 7900/7433 Self-Powered Sleeve has been correctly wired to either a 110/240V AC mains supply or a 24V DC supply (See Appendix C).

c) Before sliding the instrument into the rack, Bin or 7900/7433 sleeve check that all the internal switches have been set correctly as outlined in Section 2.3

d) Check that all the plant connections and other external inputs have been implemented correctly and that the signals are at the right levels as outlined in Section 2.4.

e) Power up the instrument in the manner outlined in Section 2.5.

f) The instrument can now be programmed with the Instrument and Channel command parameters following the instructions given in Section 4.

g) Once the 6433 has been loaded with these parameters it can be operated in the various modes and configurations as described in Section 3.

h) The 6433 may now be programmed for specific applications using the interpretive high-level language as described in the 6433 User Manual.

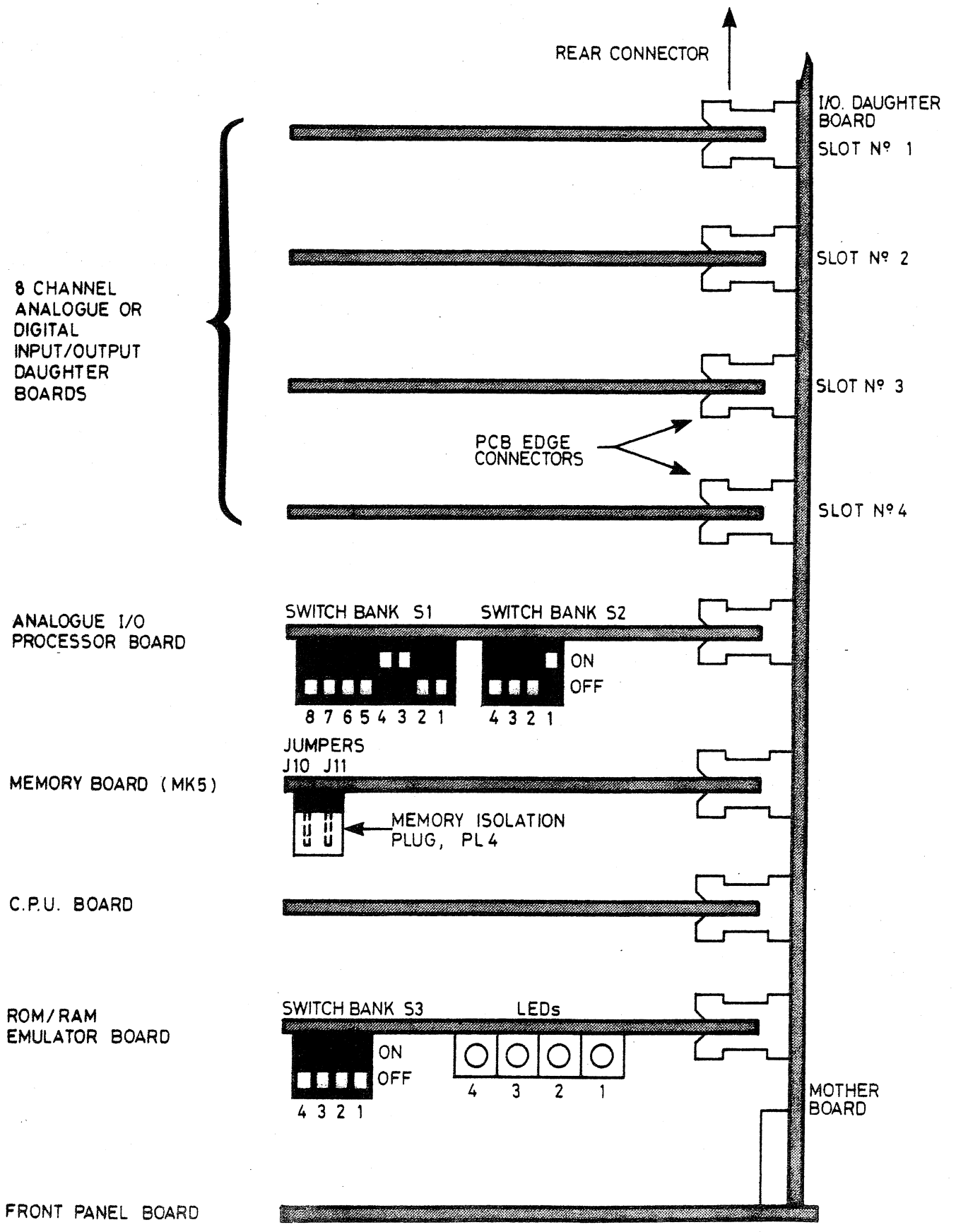


Fig 2.1 Plan View of 6433 Programmable Signal Processor with Internal Switches Shown

2.2 Power Supply Connections

For a description of Power Supply connections including discussions of:

Basic Ground connections,
Connection of Separate 24V DC supplies,
Common Parallel Supply configuration,
Combination supply configuration
and External Ground connections

refer to the System 6000 Installation Guide Section 5.

2.3 Internal Switch Settings

Fig 2.1 is a view of the 6433 Programmable Signal Processor looking down at the top of the sleeve and illustrates the relative positions of the various daughter boards and their associated internal switches.

2.3.1 Memory Isolation Plug

This plug PL4, is situated on the Memory daughter board and its function is to isolate the CMOS parameter memory from the standby battery supply. In normal operation this plug should always be fitted to ensure that all the instrument parameters are stored safely when the external power supply is interrupted for any reason. When power is re-established the instrument will continue operation using the last set of stored parameters.

If the instrument is to be stored or left un-powered for any length of time without parameters programmed into the memory, then the plug can be removed to avoid draining the standby battery. It should be checked carefully that the plug has been refitted before attempting to power up the instrument and start entering parameters. Note that whenever this plug is removed, all stored parameters will be lost automatically.

2.3.2 Analogue I/O Processor Board Internal Status Switches

Fig 2.1 shows that the Analogue Input/Output Processor daughter board carries a 4 way and an 8 way DIL switch situated along the top edge. These two switch banks S1 and S2 are used for setting up various internal functions within the 6433 Programmable Signal Processor to characterise it for a specific control system application. The functions assigned to each of the switches contained within S1 and S2 are listed in Table 2.1 and are detailed below.

NOTE: The functions of some of the switches are related to the use of the supervisory serial data link. Remote supervision and monitoring of TCS microprocessor-based instruments by an external intelligent device is discussed fully in Section 4 of the System 6000 Communications Manual.

SWITCH BANK	SWITCH NUMBER	SWITCH ACTION		SWITCH FUNCTION	
		ON (UP)	OFF(DOWN)		
S2 RIGHT	1	UID range 8-F	UID range 0-7	Instrument Unit identifier (UID) select	
	2			N/A	
	3			N/A	
	4	Tags enabled	Tags disabled	Tag display enable	
S1 LEFT	1	Same as RS 422	300 baud	RS 232 data link baud rate selection	
	2	see	Table 2.2	Baud rate selection switches for RS422 data link	
	3				
	4				
	5	Binary	ASCII	Protocol mode select	
	6	4	0	2^2	Instrument Group identifier (GID)
	7	2	0	2^1	
	8	1	0	2^0	

TABLE 2.1 Analogue I/O Processor Board internal switches S1 and S2 functions

a) Switch Bank S1 Functions

Most of the switches on this bank are used to set up the RS422 supervisory data link as follows:-

(i) Switch no. 1

This switch is used to select the baud rate for operation of the front-panel RS232 programming socket thus:-

S2 no. 2 OFF = 300 baud (8260 Hand-held terminal).

S2 no. 2 ON = baud rate as determined by S1 switches 2, 3, and 4 for the RS422 data link.

(ii) Switches no. 2, 3 and 4

These switches select the baud rate at which the RS422 data link operates. The 8 possible data rates are 110, 300, 600, 1200, 2400, 3600, 4800 and 9600 bauds and the required switch settings to obtain them are given in Table 2.2.

(iii) Switch no. 5

This switch selects the operating mode of the serial link communications protocol thus:-

S1 no. 5 OFF = ASCII mode protocol

S1 no. 5 ON = Binary mode protocol

NOTE: All instruments on the RS422 data link must use the same protocol mode.

(iv) Switches no. 6, 7 and 8

In a large Supervisory Control system many System 6000 instruments may be connected to the central computer via a single serial data link. In such a configuration each instrument must have a unique identity so that when the computer sends a message to a particular instrument, only the unit with that identity will reply. When a 6433 Programmable Signal Processor is connected to the RS422 data link, it is addressed by the supervisory computer as 8 separate devices or units. The first 4 units correspond to the 4 blocks of 8 way input/output channels, while the second 4 units correspond to the 4 block of 8 way pseudo input/output channels. The hardware of the 6433 allows up to 128 separate blocks of input/output channels, i.e. 16 instruments, to be uniquely identified via a 7 bit binary address.

SWITCH BANK	SWITCH NUMBER			BAUD RATE	NUMBER OF STOP BITS
	2	3	4		
1	Off	Off	Off	110	2
	Off	Off	On	300	1
	Off	On	Off	600	1
	Off	On	On	1200	1
	On	Off	Off	2400	1
	On	Off	On	3600	1
	On	On	Off	4800	1
	On	On	On	9600	1

TABLE 2.2 RS422 Supervisory Serial Data Link Baud Rate Selections

The 4 least-significant bits of this address are called the Unit Identifier (UID), and the 3 most-significant bits of this address are called the Group Identifier (GID). Conceptually each of the real and pseudo input/output blocks of a 6433 is addressed as a separate unit so that the instrument occupies up to 8 consecutive unit addresses. Consequently only the top bit of the UID is set in the 6433 by switch no. 1 of switch bank S2, while the bottom 3 bits are used by the computer to select which of the 8 input/output blocks are being accessed (see Section 2.3.2 b) (i)).

The 3 Group Identifier (GID) bits are selected by means of switches 6, 7 and 8 of switch bank S1. Table 2.1 shows that the binary weighting of each switch is as follows:-

S1 no. 8 = 1
S1 no. 7 = 2 } when in the "ON" position
S1 no. 6 = 4

Thus these 3 switches can be used to select a Group Identifier from 0 - 7.

b) Switch Bank S2 Functions

Only 2 out of the 4 switches of switch bank S2 are used by issue 1 software and these are allocated to the following functions:-

(i) Switch no. 1

This switch represents the most-significant bit of the UID and a four bit UID allows 16 units to be addressed within a group. Hence this switch places the 8 input/output blocks of a 6433 in the upper or lower half of a group, thus:-

S2 no. 1 OFF, UID = 0-7

S2 no. 1 ON, UID = 8-F

As the UID transmitted by the computer varies from binary 0 to F (15) the top bit is used to select one of two 6433 instruments within a group depending on the S2 no. 1 switch setting. The bottom 3 bits then effectively select which of the 8 input/output blocks within the selected 6433 is actually being addressed. This addressing scheme is illustrated in Table 2.3 which shows that if a UID of A were transmitted, for example, this would access input/output block 3 of the second 6433 instrument in the group.

SWITCH BANK S2 SWITCH NO 1	UID TRANSMITTED	INPUT/OUTPUT BLOCK ACCESSED	6433 NO.
OFF	0 1 2 3 4 5 6 7	1 2 3 4 5 6 7 8	1
ON	8 9 A B C D E F	1 2 3 4 5 6 7 8	2

TABLE 2.3 Relationship between the transmitted UID and the I/O block addressed with two 6433 Programmable Signal Processors on the same Group address

(ii) Switch no. 4

The 8 character alphanumeric display at the top of the front panel identifies the type of input/output channel currently being displayed. This is done by displaying one of the 4 possible messages below according to input/output block type, thus:-

BC AN IN
BC AN OUT
BC DIG IN
BC DIG OUT

where:-

B = input/output blocks no. : 1-8
C = input/output channel no. : 1-8

S2 no. 4 allows the user the option of displaying an 8 character tag or identifier for each of the 64 input/output channels, thus:-

S2 no. 4 OFF = BC AN IN type identifier always displayed.

S2 no. 4 ON = 8 character tag display enabled for each channel.

It should be noted, however, that with the tag display mode enabled (S2 no. 4 ON), as soon as any front-panel push-button is pressed the display reverts to the BC AN IN type format as if S2 no. 4 were OFF.

2.3.3 ROM/RAM Emulator Board Switches

It can be seen from Fig. 2.5 that the ROM/RAM Emulator board has a third 4 - way DIL switch bank, S3, available along its top edge. The 6433 issue 1 software currently allocates only one of these switches. The function of this switch is as follows:-

a) Switch 1

This switch is used to control the write enable line to the 4K block of EEPROM situated on the ROM/RAM emulator board as follows:-

S3 no. 1 OFF = writing enabled.

S3 no. 1 ON = writing inhibited (read-only).

If S3 no. 1 is ON and the user attempts to copy a program from RAM into EEPROM via the "FIX" utility, an error condition will be indicated (see 6433 Users Guide, Section 2.6.3 a)).

2.4 Plant and Other External Connections

Appendix A lists the functions of the rear connector pins of the 6433 Programmable Signal Processor. For correct operation of the instrument in a system it is necessary that external plant and equipment is connected up to it in the following manner.

2.4.1 Power Supplies

Connection of the 0V ref., 0V power and +24V supply rails of pins 2, 3 and 8 respectively are fully dealt with in the System 6000 Installation Guide Section 5.

2.4.2 Analogue Inputs

Whenever an Analogue Input board (type 0) is specified for a particular input/output slot, a block of 8 analogue input channels is available. These inputs accept 0-10V or 1-5V signal levels as described in Section 4.4.1 and may be ranged in engineering units, filtered and linearised as required. They may also be checked against absolute alarm limits and the alarm condition routed through to a digital output channel if required.

2.4.3 Analogue Outputs

Whenever an Analogue Output board (type 8) is specified for a particular input/output slot, a block of 8 analogue output channels is available. These outputs provide 0-10V or 1-5V signal levels as described in Sections 4.5.1 and may be ranged in engineering units as required. The actual output level may be altered via the front-panel Raise/Lower buttons within user programmable High and Low limits.

2.4.4 Digital Inputs

Whenever a Digital Input board (type 16) is specified for a particular input/output slot, a block of 8 digital input channels is available. These inputs accept logic 1 levels from 5 to 15V and may be used to generate alarm conditions on either low to high transitions, or high to low transitions, or both. (see Section 4.6.2).

2.4.5 Digital Outputs

Whenever a Digital Output board (type 24) is specified for a particular input/output slot, a block of 8 digital output channels is available. These outputs have signal logic levels of 0V and 15V (with 15V representing the non alarm condition) and consist of open-collector type TTL gates. Each output is provided with a 2k2 pull-up resistor to the + 15V rail (pin 7) and can sink a maximum of 16mA in the logical zero (alarm) state. The individual output levels may be altered via the front-panel raise/lower buttons provided that the appropriate masking bit has been set (see Section 4.7.1). They may also be used to generate alarm conditions on either low to high transitions, or high to low transitions, or both. (see Section 4.7.2).

2.4.6 Serial Data Bus

For a full description of the Serial Data Bus, including discussions of:

Interface Connections,
Cable Impedance and Termination,
and Interface Signal Polarity

refer to the System 6000 Installation Guide Section 7.

2.5 Instrument Power-Up Sequence

There are two possibilities that can occur when the 6433 Programmable Signal Processor is connected to an external power supply and these are as follows:-

2.5.1 Power-Up from Initial Un-programmed State

When the Instrument is first powered-up before any parameters have been programmed, the parameter storage area of the non-volatile memory will be empty. The first thing that the CPU does after the power-up sequence has been completed is to check the memory for stored sumcheck patterns. These sumchecks are only updated as parameters are entered into the memory so this check will cause a memory error condition to occur upon initial power-up. Consequently the CPU will force the instrument to behave as for MEMORY SUMCHECK FAIL conditions as described in Sections 2.6.2 c) and d).

2.5.2 Power-Up from a Previously Programmed State

If the power supply to an instrument is interrupted during its normal working state then all the parameters will be stored in the non-volatile memory area, provided that the standby battery is properly connected (see Section 2.3.1). Upon subsequent re-establishment of the power supply the CPU will verify the stored memory sumcheck values. This test should be carried out successfully and the CPU will then return the instrument to exactly the same set of operating conditions as were present before the power interruption.

2.6 6433 Hardware Diagnostic Facilities

The 6433 incorporates a number of diagnostic facilities for continuously monitoring and checking the status of the Instrument hardware during operation. Each of these diagnostic facilities provides the following features:-

a) Indication and identification of the fault via the 3 operator interfaces, viz:-

   (i) Front-panel display indication
   (ii) Local indication via rear connector logic signals
   (iii) Remote indication via the serial data links.

b) Well defined shut-down procedures for each type of fault with the instrument taking up pre-determined operating conditions to maximise plant safety.

c) Automatic restart under certain transient fault conditions.

Table 2.4 lists the 10 major instrument faults that can occur and shows that they have a number of common characteristics, viz:-

a) Certain faults are indicated by an appropriate message on the 8 character alphanumeric display.

b) Certain faults affect the large 4 digit Prime Variable display.

c) Certain faults affect the 6433 Operating mode in a controlled "fail-safe" manner.

d) Each fault sets various status bits within the Command Parameters so that the condition can be monitored remotely via the supervisory data link.

e) Each of the faults has a well-defined error recovery procedure allowing the operator to quickly identify and rectify a fault condition.

The diagnostic facilities listed in Table 2.4 are described in the following sections.

INSTRUMENT FAULT	DIAGNOSTIC MESSAGE	PRIME VARIABLE DISPLAY	OPERATING MODE CHANGE	COMMAND PARAMETER INDICATION	ERROR RECOVERY PROCEDURE
Watchdog (hardware) failure	None	Blanked	Analogue outputs "frozen"	All comms. disabled	Replace Instrument
Front-Panel hardware fault	FP ERROR	No change	HHT and push-buttons disabled	MD bit 6 set to 1;	Replace Front-Panel board
I/O board 1, 2, 3, or 4 hardware fault	11 HW ER 21 HW ER 31 HW ER 41 HW ER	Err Err Err Err	All B1, B2, B3, or B4 AN OUTs frozen; DIG OUTs set to 0V	S1, S2, S3, or S4 bit 12 set to 1; MD bit 12 set to 1	Replace slot 1, 2, 3, or 4 board; set S1, S2 S3, or S4 digit B=0
Instrument parameter sumcheck failure	IP SC ER	No change	No change	MD bit 8 set to 1; > set to * in list of parameters	Set MD bit 8 to 0; re-enter corrupted parameters
I/O channel parameter sumcheck failure	BC SC ER (B=Block, C=Channel number)	No change	Block B, channel C I/O frozen	ST bit 3 set to 1; MD bit 13 set to 1; * in list	Set ST bit 3 to 0; re-enter corrupted parameters
Program sumcheck failure	PG SC ER	No change	No change	No change	Inspect & re-compile program
Run time error	RT ERROR	No change	No change	No change	Correct program
No program running	"HALTED"	No change	No change	No change	Run a program
1 to 5V analogue input out of range	BC OR ER (B=Block, C=Channel number)	PV> 5.5V PV< 0.5V	No change	ST bit 2 set to 1; MD bit 10 set to 1;	Restore analogue input to 1-5V range
Battery voltage low	None	Decimal points flash	No change	MD bit 11 set to 1	Replace battery

TABLE 2.4 6433 Instrument Diagnostics

2.6.1 Watchdog Timer

The CPU card incorporates a Watchdog Timer circuit which has to be refreshed periodically by the CPU to maintain correct operation, as described in Section 1.4.2. If the CPU fails to refresh the Watchdog at the normal rate due to some fault condition, the following actions occur:-

a) All the Front-panel displays are extinguished except for the 8 character alphanumeric readout. This provides immediate visual indication to the operator.

b) The WATCHDOG TIMER logic output on pin 9 of the rear connector is reset from 15V to 0V to indicate the fault condition and will stay low as long as the fault persists. This feature allows the pin 9 output to be used for external alarm monitoring purposes or for switching in Manual back-up systems etc.

c) All 8 outputs of any digital output boards fitted are reset from 15V to 0V to indicate the fault condition and will stay low as long as pin 9 is at 0V.

d) The "sample and hold" circuitry is forced into the "hold" state so that all 8 outputs of any analogue output boards fitted will retain the last voltage level set by the CPU before the Watchdog tripped out. (See Section 1.4.5). Under these conditions the capacitors are not refreshed by the DAC and an output drift rate of up to 0.5mV/sec maximum may occur (equivalent to a drift of 1% of full scale in 3 minutes worst case).

While the Watchdog is tripped out, a circuit automatically attempts to restart the instrument at approximately 10ms intervals, using the same restart procedure as when the 6433 is first powered up. Consequently there are three possibilities that can occur after each restart attempt:-

(i) If the failure was due to a transient fault without loss of memory the instrument will restart automatically as described in Section 2.5.2. The Watchdog output, pin 9, is reset to 15V by the CPU about 30ms after the restart occurs.

(ii) If the failure was due to a transient fault which has corrupted the memory, then the instrument will restart automatically as described in Section 2.5.1. The Watchdog output will again be reset to 15V after a 30ms period.

(iii) If the failure was due to a permanent hardware fault such as a damaged integrated circuit, then the CPU will not be able to refresh the Watchdog and the pin 9 logic output will remain at 0V.

2.6.2 Instrument Diagnostic Messages

The 6433 Programmable Signal Processor software continually monitors various functions within the instrument, apart from the Watchdog and Battery checking described in Sections 2.6.1 and 2.6.3. These additional diagnostic functions are listed in Table 2.4 where it can be seen that each one is capable of displaying a diagnostic message on the upper alphanumeric readout, e.g.

B2 HW ER

These messages will flash alternately with the name or identity of the channel currently being displayed on the front-panel.

The 6433 hardware incorporates data input/output ports on the Front-panel, Analogue I/O processor, and Input/Output daughter boards of Section 1.4.1, 1.4.5, and 1.4.6 respectively. Before the CPU carries out a data transfer to or from any of these ports, the hardware itself is checked. This is done by connecting a bit from each output port back to a spare bit on the corresponding input port. The CPU then checks that these test bits can be set or reset correctly before each port is used for a data transfer. If any input/output port fails this hardware check the appropriate diagnostic message a) or b) is displayed. All the diagnostic messages produced by the 6433 (shown in Table 2.4) are described briefly below.

a) Front-Panel Hardware Fault

When the CPU finds that it cannot communicate correctly with the data I/O ports on the front-panel board, it attempts to flash the diagnostic message:-

FP ERROR (Front Panel hardware Error)

The prime Variable display is unchanged but all the Front-panel push-buttons and the Hand-held terminal socket are disabled. The "MD" parameter has bit 6 set to logic 1 and the fault may only be corrected by replacing the front-panel board.

b) Input/Output Board 1, 2, 3 or 4 Hardware Fault

When a hardware fault is detected on the Input/Output board fitted in the I/O Slot 1, 2, 3 or 4 position, the following messages are displayed on the alphanumeric readout respectively:-

11 HW ER	(Block 1 Hardware Error)
21 HW ER	(Block 2 Hardware Error)
31 HW ER	(Block 3 Hardware Error)
41 HW ER	(Block 4 Hardware Error)

If it is attempted to display any of the 8 channels of a faulty block on the front panel via the CHN and Raise/Lower buttons, the 4 digit readout will display the following:-

Err

If the faulty board is an Analogue Output type, all the outputs will be put into a "hold" state as for a Watchdog failure of Section 2.6.1 d). If the faulty board is a Digital Output type, all 8 outputs will be reset from 15V to 0V as for a Watchdog failure of Section 2.6.1 c).

The fault is indicated via the RS232 and RS422 serial links by setting bit 12 of the appropriate S1, S2, S3 or S4 parameters to a one. The Common Hardware Alarm, bit 12 of the MD command parameter is also set to a one. The fault can be cured by replacing the faulty board in slot 1, 2, 3 or 4 with the appropriate type of working board, but the error indication may be inhibited by setting digit B of parameter S1, S2, S3 or S4 to zero. This effectively removes all 8 channels of the board from the input/output scan.

c) Instrument Parameter Sumcheck Failure

The 6433 Programmable Signal Processor maintains a separate sumcheck of the set of Instrument Parameters that are entered and stored in the non-volatile memory area. Any corruption of these stored parameters will cause the subsequently calculated sumcheck to differ from the stored sumcheck value. When the CPU detects this failure condition, the following message is displayed on the alphanumeric readout:-

IP SC ER (Instrument Parameters Sumcheck Error)

Table 2.4 shows that under these conditions the 4 digit readout is unaffected. Bit 8 of the "MD" instrument status parameter is set to logic 1 and all the instrument parameters will have the greater - than sign (>) replaced by an asterisk (*) when read back via the Hand-held terminal or the supervisory data link using the ASCII mode of the communications protocol.

If the sumcheck error was due only to a transient memory corruption then it can be corrected by resetting bit 8 of the "MD" parameter to logic 0. The Instrument Parameters should first be checked for possible corruption and re-entered where necessary. Instrument operation will then continue as normal.

If the sumcheck error was due to a permanent hardware fault it will not be possible to reset bit 8 of the "MD" parameter and the operating conditions given in Table 2.4 will prevail. The error can, in this case, be corrected by replacing the memory board with a new unit.

d) Input/Output Channel Parameter Sumcheck Failure

The 6433 Programmable Signal Processor maintains a separate sumcheck of the command parameters associated with each of the 8 channels contained within any Input/Output block. Any corruption of these stored parameters will cause the subsequently calculated sumcheck to differ from the stored value. When the CPU detects this condition, the following message is displayed on the alphanumeric readout.

BC SC ER (Block B, Channel C parameters Sumcheck Error)

Where B is the block and C is the number of the Channel which has the sumcheck error. Table 2.4 shows that under these conditions the 4 digit readout is unaffected, but all analogue or digital I/O for that Channel is suspended. Bit 3 of the Channel status word "ST" for Block B Channel C will be set to logic 1 to indicate the sumcheck failure, and bit 13 of the "MD" status word will also be set to logic 1. All associated channel parameters will have the greater - than (>), minus (-) or decimal point (.) signs replaced by an asterisk (*), when read back via the Hand-held terminal or supervisory data link using the ASCII mode of the communication protocol.

It should also be noted that the front-panel channel selection scan (CHN plus Raise/Lower) will stop automatically on all I/O channels containing I/O parameter sumcheck errors in the same way as for alarms (see Section 3.1.3 b)).

If the sumcheck error was due only to a transient memory corruption then it can be corrected by resetting bit 3 of the appropriate Channel "ST" parameter to logic 0. The parameter list of Block B Channel C should first be checked for possible corruption and re-entered where necessary. Channel Input/Output will then be released from its suspended state and operation will continue as normal.

If the sumcheck error was due to a permanent hardware fault it will not be possible to reset bit 3 of the "ST" parameter for Block B Channel C and the operating conditions given in Table 2.4 will prevail. The error can in this case be corrected by replacing the memory board with a new unit.

e) User Program Sumcheck Failure

The 6433 maintains a separate sumcheck of the RAM area on the ROM/RAM Emulator board used for storing User programs. Any corruption of these stored programs will cause the subsequently calculated sumcheck to differ from the stored value. When the CPU detects this condition the following message is displayed on the alphanumeric readout:-

PG SC ER (Program Sumcheck Error)

Table 2.4 shows that under these conditions the 4 digit readout and the Instrument operating mode remain unaffected and there are no changes to any of the command parameters. The error condition should be investigated by inspecting the program and if necessary the RAM area can be erased via the NEW command and the program copied from EEPROM to RAM again via the RECALL command (see 6433 Users Guide Section 2.6.2).

f) User Program Run Time Error

The 6433 software is capable of detecting Run Time Errors in the User programs. These errors, such as attempting to operate on an empty stack, are listed in appendix E of the 6433 Users Guide and cause the following message to be displayed on the alphanumeric readout:-

RT ERROR (Run Time Error)

The error condition can only be cured by finding the error within the user program and correcting it.

g) No User Program Running

When no User Program is running, which may be deliberate or as a result of a fault condition, the following message is displayed on the alphanumeric readout:-

HALTED

This message can only be removed by actually running a User program.

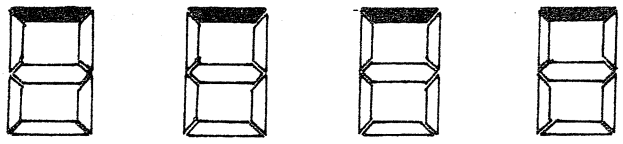
h) 1-5V Analogue Inputs Out of Range

The 6433 Programmable Signal Processor has the facility to programme any of the active analogue inputs of an Analogue Input board to accept 1-5V signals by setting Bit 0 of the appropriate channel status word, ST, (see Section 4.4.1 d) (iv) to logic 1. When an input has been set up for 1-5V operation, the CPU checks that the signal level lies within range. For an input signal less than 1 volt the corresponding input variable is set to it's minimum value (e.g. "PV" = "LR"). For an input signal greater than 5 volts the input variable is set to it's maximum value (e.g. "PV" = "HR"). If the signal lies outside the range 0.5V - 5.5V the following message is displayed on the alphanumeric readout.

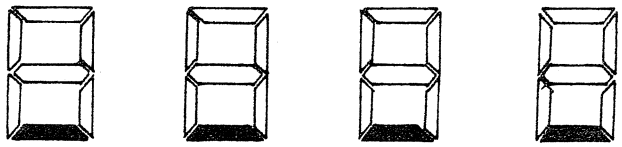
BC OR ER (Block B Channel C Out of Range Error)

Table 2.4 shows that under these conditions instrument operation remains unchanged but attempting to display the out-of-range analogue input, using the (CHN) and Raise/Lower buttons, produces the following:-

(i) If the input signal is greater than 5.5V, then only the top bars of each 7-segment display will be illuminated indicating "input over-range" i.e.



(ii) If the input signal is less than 0.5V, then only the bottom bars of each 7-segment display will be illuminated indicating "input under-range" i.e.



It can be seen from Table 2.4 that while the out-of-range condition persists bit 10 of the "MD" status word will be set to logic 1, and bit 1 of the appropriate Channel "ST" parameter will also be set to logic 1. This fault can be corrected by restoring the analogue input to a value within the range of 1-5V.

NOTE: If the 6433 is used with 1-5V signals or 4-20mA signals (with burden resistors) the out-of-range detection described above will indicate open-circuit analogue inputs.

2.6.3 Standby Battery Check

The memory daughter board incorporates a long life Lithium standby battery which powers the RAM circuits when the external power supply has failed or is interrupted for any reason (see Section 1.4.3). A comparator on the Analogue I/O Processor board is monitored every 500ms and will indicate a failure if the battery voltage falls below 2.7 volts. Should a battery failure be detected the CPU takes the following actions:-

a) All the unused decimal points on the Front-panel digital readout are flashed continuously to warn an operator of the battery condition.

b) The Battery Voltage Low bit of the "MD" status word, bit 11, is set to 1.

These indications will continue to be operative until the battery on the memory board is replaced by a new unit. When the instrument is subsequently powered, up the CPU immediately starts with a battery voltage test and, if this is successful, the following actions are taken:-

a) Only the decimal points programmed via the "ST" parameter for the displayed channel will be illuminated, the others will remain OFF (see Section 4.4.1 a)).

b) All parameters stored in the non-volatile memory will have been corrupted, so the instrument will behave as if powered up from an initially un-programmed state (see Section 2.5.1). The CPU will thus force a memory sumcheck failure condition and the operator must re-program the instrument as detailed in Sections 2.6.2 c) and d).

It should be noted that if the memory isolation plug, PL4 of Figure 2.1 is inadvertently left out, the CPU will immediately detect this as soon as the instrument is powered up and it will behave as if the battery voltage were low.

2.7 Use of the 6433 with 4-20mA Input Signals

The 6433 Programmable Signal Processor has the facility to program any of the Analogue inputs of any active channel to accept 1-5V signal levels by setting Bit 0 of the ST status word for the appropriate channel to logic 1 (see section 4.4.1 d) (iv). Once any input has been set up in this way it can be used with 4-20mA input signals provided that a 250 ohm precision resistor is used to convert this to a 1-5V signal. When these external resistors are used it is very important that they are connected in a manner that does not inject current into the 0V reference bus and so degrade the system 0V reference. (See the System 6000 Installation guide Section 6.2 for a fuller description of the use of TCS instrumentation with 4-20mA Input signals).

Section 3 Instrument Operating Modes

The mode of operation of a 6433 Programmable Signal Processor depends largely upon its application within a particular control system. In those applications where it is being used as a remote input/output peripheral to a supervisory computer there is little need for operator interaction with the instrument via the front panel. In those applications where it is operating autonomously as a local data gathering and processing unit, or a sequencer, however, there may well be a requirement for frequent operator interaction. In the latter applications the instrument front panel serves as the local operator interface and may be used in the manner described in Sections 3.1 and 3.2. The type of information presented to the operator, and the control functions available obviously depend upon the type of input/output channel being accessed. The facilities available with each of the 4 types of input/output board are described in Sections 3.3.1 to 3.3.4 inclusive.

3.1 Front-Panel Operation

Whenever an Operator requires local interaction with any of the 32 input/output channels of the 6433 this is achieved via the instrument front-panel illustrated in Fig. 1.3. This fascia diagram shows that the front-panel consists of an upper section containing displays and indicators, and a lower section containing the control push-buttons as described in Section 1.4.1.

3.1.1 Displays and Indicators

The upper section of the front-panel contains the following displays and indicators:-

a) Address/Identity Display

This 8 character, alphanumeric display is used to indicate the following information:-

(i) Block and Channel address and input/output type, e.g.:-

23 AN IN

(ii) Command parameter mnemonic and value in secondary display format, e.g.:-

HA +85.00

(iii) Instrument diagnostic messages (flashing) e.g:-

11 HW ER

(iv) User defined channel "Tag" names or identities (S2 no. 4 ON) e.g:-

FIC 101

b) Digital Readout

This 4 digit, numeric display is used to indicate the value of the Prime Variable for analogue input/output channels, and is blanked for digital input/output channels.

c) 16 Way Status LED's

The 2 rows of 8 red LED's indicate status information concerning the 8 channel input/output block currently being displayed. This information consists of HI/LO alarm status for analogue inputs and HI/LO logic level states for digital inputs and outputs. The LED's are blanked for analogue outputs.

3.1.2 Control push-buttons

The lower section of the front-panel contains 6 control push-buttons the functions of which are described in Section 1.4.1. These functions are summarised below:-

a) Inspect button - INS

This has an electronic alternate action and selects the Primary or Secondary display formats. Its state is indicated by the green LED's contained in the CHN and PAR push-buttons.

b) Channel select button - CHN

This button is used to select an input/output channel for display, or to scroll through the parameter list.

c) Parameter value button - PAR

This button alters the currently displayed Prime Variable value, or the Command Parameter depending upon the operating mode.

d) Alarm acknowledge button - ALM

The red LED contained in this button flashes to indicate unacknowledged alarms or status changes.

e) Raise/Lower buttons - Δ,∇

These buttons are used in conjuction with the CHN and PAR Buttons for the following functions:-

(i) Select an input/output channel.
(ii) Alter the Prime Variable value.
(iii) Scroll through the parameter list.
(iv) Alter the displayed Command parameter value.

PAR and CHN button LEDs	Function button held in	Display Format selected	Action occuring when RAISE/ LOWER buttons are operated
Don't care	none	Primary	Inhibited
OFF	CHN	Primary	Raise/Lower the Channel Address
	PAR	Primary	a) Raise/Lower the value of the Prime Variable b) Set/Reset Digital Outputs
ON	CHN	Secondary	Scroll forwards or backwards through the Command Parameter list
	PAR	Secondary	Raise/Lower the value of a selected Command Parameter

TABLE 3.1 6433 Front-panel Operating Modes

3.1.3 Front panel operating modes

The 6433 front-panel can operate in a number of modes depending upon what combinations of push-buttons are being pressed and whether the LED's in the CHN and PAR buttons are ON or OFF. Each of these operating modes causes the 6433 front-panel displays to function in either the Primary or Secondary Display formats as discussed in Section 3.2.1 and 3.2.2 respectively. Furthermore, the operating mode determines what effect the Raise/Lower buttons have on the various functions of the module. Table 3.1 summarises these operating modes with their appropriate display formats and Raise/Lower button actions as follows:-

a) Normal Operation

This is the normal operating mode that occurs when no buttons are pressed regardless of the state of the CHN and PAR button LED's. Table 3.1 shows that the Primary Display format is selected and the Raise/Lower buttons are inhibited.

b) CHN button held in, LED OFF

In this case the Primary display format is selected and the Raise/Lower buttons are used to increment or decrement the current channel address on the upper alphanumeric display.

A feature has been incorporated to assist the Operator when searching for a channel that is in alarm. This causes the incrementing or decrementing channel scan to halt automatically whenever it reaches the address of a channel that has an unacknowledged alarm present. The channel alarm can then be acknowledged which will allow the scan to proceed, or the CHN button can be released and pressed again to allow the scan to continue without acknowledging the alarm.

c) PAR button held in, LED OFF

Table 3.1 shows that under these conditions the Primary display format is selected and the Raise/Lower buttons are used to alter the value of the Prime Variable displayed on the central 4 digit readout. They will also control the logic output state of a selected digital output channel.

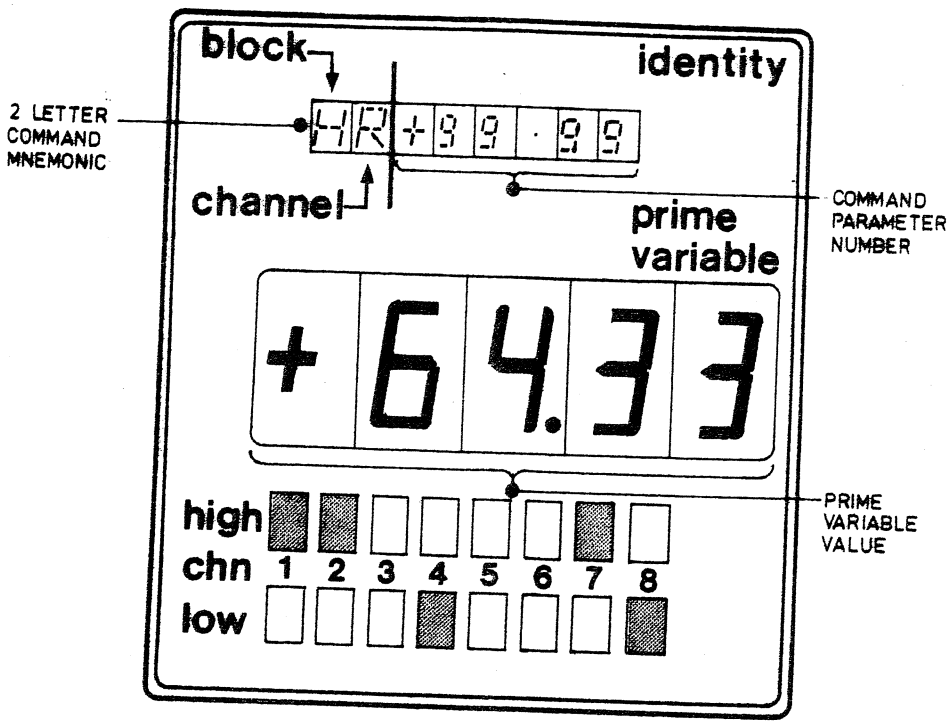


FIG. 3.2 Appearance of Secondary Display Format

	Analogue		Digital	
	Input card	Output card	Input card	Output card
Address/ Identity Display	Command Parameter	Command Parameter	Command Parameter	Command Parameter
Prime Variable Display	PV input value	OP output value	blank	blank
Upper row of LED's	HI Alarm state	blank	HI logic input state	HI logic output state
Lower row of LED's	LO Alarm state	blank	LO logic input state	LO logic output state

TABLE 3.3 Secondary Display Format Data Types

3.2.2 Secondary Display Format

Fig. 3.2 shows the apearance of the upper alphanumeric display and the central 4 digit readout in the Secondary Display Format. Table 3.3 illustrates how the data appearing on these displays varies depending upon the type of 8 channel input/output block currently being viewed. The 4 types of display can be considered as follows:-

a) Address/Identity Display

In the Secondary Display Format, the upper 8 character alphanumeric display is always used to indicate one of the Command parameters appropriate to the 8 channel input/output block. The Command Parameter consists of a 2 letter Command Mnemonic followed by a 4 digit value with sign and decimal point. The Command Parameters available with each type of input/output block are listed in Tables 4.3, 4.6, 4.7, and 4.8.

Table 3.1 shows that the list of Parameters for an input/output block may be examined by means of the Raise/Lower buttons when the CHN button is pressed and its LED is ON. The value of the selected Parameter may then be altered by the Raise/Lower buttons provided that the PAR button is held in and its own LED is on also.

b) Prime Variable Display

Table 3.3 shows that the Prime Variable Display is used in exactly the same way as for the Primary Display Format described in Section 3.2.1 b).

c) Upper row of LED's

The status information displayed on the upper row of 8 LED's is the same for the Secondary Display Format as for the Primary Display Format and is described in Section 3.2.1 c).

d) Lower row of LED's

The status information displayed on the lower row of 8 LED's is the same for the Secondary Display Format as for the Primary Display Format and is described in Section 3.2.1 d).

3.3 Input/Output Block displays and operation

Section 3.1 and 3.2 describe how the action of the control push-buttons and the appearance of the displays in Primary or Secondary Display format vary depending upon the type of input/output block being accessed. The following 4 sub-sections describe the specific control modes and display formats for each of the input/output block types.

3.3.1 Analogue Input Blocks

The functions of the control push-buttons are considered for each display format as follows:-

a) Primary Display Format

In Primary Display format the 4 types of front panel displays indicate the following for Analogue input blocks:-

(i) Address/Identity Display

With tags disabled (S2 no. 4 OFF) the 8 character alphanumeric display identifies each analogue input channel via the message:-

BC AN IN

as described in Section 3.2.1 a). The channel number (C) is incremented or decremented by pressing the Raise or Lower buttons respectively in conjunction with the CHN button as described in Section 3.1.3 b). With tags enabled (S2 no. 4 ON) an 8 character channel label is displayed unless any button is pressed when the display reverts to BC AN IN.

(ii) Prime Variable Display

Here, the Prime Variable is a signed 4 digit value of the currently selected input channel in Engineering Units corresponding to the PV command mnemonic.

(iii) Upper row of LED's

The 8 LED's indicate the HI alarm status of all 8 channels of the block currently being viewed regardless of which individual channel is being displayed as Prime Variable. If a channel goes into HI alarm, the corresponding LED will flash until acknowledged, or will be steady immediately if auto-acknowledge is selected (Section 4.3.6).

(iv) Lower row of LED's

The 8 LED's indicate the LO alarm status of all 8 channels of the block currently being displayed with the same acknowledgement facilities as for the HI alarm.

b) Secondary Display format

In Secondary Display format the 4 types of front panel displays indicate the following for analogue input blocks:-

(i) Address/Identity Display

The 8 character alphanumeric display is used to indicate either the High or Low Alarm parameters in the following format:-

HA +800.0

LA -200.0

The HA parameter is selected by holding the CHN button in and pressing Raise, while LA is selected by holding in CHN and pressing Lower. The actual value of HA or LA may then be incremented or decremented by holding in the PAR button and pressing Raise or Lower respectively.

(ii) Prime Variable Display

Same as for Primary Display Format.

(iii) Upper row of LED's

Same as for Primary Display Format.

(iv) Lower row of LED's

Same as for Primary Display Format.

3.3.2 Analogue Output blocks

The functions of the control push-buttons are considered for each display format as follows:-

a) Primary Display format

In Primary Display format the 4 types of front panel displays indicate the following for Analogue output blocks:-

(i) Address/Identity Display

With tags disabled (S2 no. 4 OFF) the 8 character alphanumeric display identifies each analogue output channel via the message:-

BC AN OUT

as described in Section 3.2.1 a). The channel number (C) is incremented or decremented by pressing the Raise or Lower buttons respectively in conjunction with the CHN button as described in Section 3.1.3 b). With tags enabled (S2 no. 4 ON) an 8 character label is displayed unless any button is pressed when the display reverts to BC AN OUT.

(ii) Prime Variable Display

Here, the Prime Variable is a signed 4 digit value of the currently selected output channel in Engineering Units corresponding to the OP command mnemonic. As this output level is controlled by the 6433 instrument, it may be altered by holding in the PAR button and using the Raise or Lower buttons as described in Section 3.1.3 c).

(iii) Upper row of LED's

All 8 LED's are blanked for Analogue Output blocks.

(iv) Lower row of LED's

All 8 LED's are blanked for Analogue Output blocks.

b) Secondary Display Format

In Secondary Display format the 4 types of front panel displays indicate the following for analogue output blocks:-

(i) Address/Identity Display

The 8 character alphanumeric display is used to indicate either the High or Low Output limit parameters in the following format:-

HO +75.00

LO +15.00

The HO parameter is selected by holding the CHN button in and pressing Raise, while LO is selected by holding in CHN and pressing Lower. The actual value of HO or LO may then be incremented or decremented by holding in the PAR button and pressing Raise or Lower respectively.

(ii) Prime Variable Display

Same as for Primary Display Format.

(iii) Upper row of LED's

All 8 LED's are blanked for Analogue Output blocks.

(iv) Lower row of LED's

All 8 LED's are blanked for Analogue Output blocks.

3.3.3 Digital Input blocks

The functions of the control push-buttons are considered for each display format as follows:-

a) Primary display format

In Primary Display format the 4 types of front panel displays indicate the following for digital input blocks:-

(i) Address/Identity Display

With tags disabled (S2 no. 4 OFF) the 8 character alphanumeric display identifies each digital input channel via the message:-

BC DIG IN

as described in Section 3.2.1 a). The channel number (C) is incremented or decremented by pressing the Raise or Lower buttons respectively in conjunction with the CHN button as described in Section 3.1.3 b). With tags enabled (S2 no. 4 ON) an 8 character label is displayed unless any button is pressed when the display reverts to BC DIG IN.

(ii) Prime Variable Display

The Prime Variable Display is blanked for Digital Input blocks.

(iii) Upper row of LED's

The 8 LED's indicate whether the corresponding digital inputs have a HI logic signal present or not. They can be made to flash when a transition to this condition occurs and then go steady upon acknowledgement.

(iv) Lower row of LED's

The 8 LED's indicate whether the corresponding digital inputs have a LO logic signal present or not. They are mutually exclusive with the corresponding upper row LED's and have the same change of state detection facilities.

b) Secondary Display format

In Secondary Display format the 4 types of front panel displays indicate the following for digital input blocks.

(i) Address/Identity Display

The 8 character alphanumeric display is used to indicate the Alarm Mask parameter in the following format:-

AM > ABCD

This parameter is always displayed regardless of the CHN, Raise, or Lower buttons. Furthermore, it cannot be altered by means of the PAR button used in conjunction with the Raise or Lower buttons.

(ii) Prime Variable Display

The Prime Variable Display is blanked for Digital Input blocks.

(iii) Upper row of LED's

Same as for Primary display format.

(iv) Lower row of LED's

Same as for Primary display format.

3.3.4 Digital Output blocks

The functions of the control push-buttons are considered for each display format as follows:-

a) Primary display format

In Primary display format the 4 types of front panel displays indicate the following for digital output blocks.

(i) Address/Identity Display

With tags disabled (S2 no. 4 OFF) the 8 character alphanumeric display identifies each digital input channel via the message:-

BC DIG OUT

as described in Section 3.2.1 a). The channel number (C) is incremented or decremented by pressing the Raise or Lower buttons respectively in conjunction with the CHN button as described in Section 3.1.3 b). With tags enabled (S2 no. 4 ON) an 8 character label is displayed unless any button is pressed when the display reverts to BC DIG OUT.

(ii) Prime Variable Display

The Prime Variable Display is blanked for Digital Output blocks.

(iii) Upper row of LED's

The 8 LED's indicate whether the corresponding digital outputs are set to the HI logic level or not. A selected channel may be set to the HI state by pressing the Raise button with the PAR button held in as described in Section 3.1.3 c). They can be made to flash when a transition to this condition occurs and then go steady upon acknowledgement.

(iv) Lower row of LED's

The 8 LED's indicate whether the corresponding digital outputs are set to the LO logic level or not and are mutually exclusive with the corresponding upper row LED's. A selected channel may be set to the LO state by pressing the Lower button with the PAR Button held in as described in Section 3.1.3 c). They can be made to flash when a transition to this condition occurs and then go steady upon acknowledgement.

b) Secondary Display format

In Secondary Display format the 4 types of front panel displays indicate the following for digital output blocks.

(i) Address/Identity Display

The 8 character alphanumeric display is used to indicate the Alarm Mask parameter in the following format:-

AM > ABCD

This parameter is always displayed regardless of the CHN, Raise, or Lower buttons. Furthermore, it cannot be altered by means of the PAR button used in conjunction with the Raise or Lower buttons.

(ii) Prime Variable Display

The Prime Variable Display is blanked for Digital Output blocks.

(iii) Upper row of LED's

Same as for Primary display format.

(iv) Lower row of LED's

Same as for Primary display format.

CHANNELS SCANNED WITHIN I/O BLOCK	38ms SCANNING PERIOD Time in ms →							
	0 to 37	38 to 75	76 to 113	114 to 151	152 to 189	190 to 227	228 to 265	266 to 303
1 (4 enabled)	1	2	3	4	1	2	3	4
2 (3 enabled)	1	2	3	1	2	3	1	2
3 (1 enabled)	1	1	1	1	1	1	1	1
4 (8 enabled)	1-8	1-8	1-8	1-8	1-8	1-8	1-8	1-8

TABLE 3.4 Example of the I/O channel scanning algorithm in operation

3.4 Input/Output Channel Scanning Algorithm

The kernel of the 6433 software is a real-time, multi-tasking executive which schedules a number of system "tasks" on an interrupt driven basis derived from a 2ms real-time clock. One of these tasks (called Input/Output) is scheduled whenever the analogue or digital inputs are to be scanned, or whenever the analogue or digital outputs are to be updated. With analogue inputs, for example, the A to D conversion, Prime Variable ranging, filtering and linearisation are all done within this scheduled Input/Output task operation. The 8 analogue or digital channels within each I/O block are controlled by a channel scanning algorithm which works on a basic scan period of 38ms. The rate at which input/output channels are scanned depends upon the types of I/O Blocks fitted, and the number of enabled channels within each Block. During each 38ms scan period, the following occurs on each of the 4 different types of Blocks:-

a) 1 channel is scanned on each analogue input or output Block.

b) Up to 8 channels are scanned on each digital input or output Block.

This is illustrated by the example given in Table 3.4 where a 6433 is configured as follows:-

(i) Block 1 - analogue input or output with 4 channels enabled.

(ii) Block 2 - analogue input or output with 3 channels enabled.

(iii) Block 3 - analogue input or output with 1 channel enabled.

(iv) Block 4 - digital input or output with 8 channels enabled.

The order in which the channels are scanned in each Block is shown in Table 3.4 where the following points are brought out:-

a) An analogue I/O Block with 4 channels enabled has each channel scanned every 4 x 38 = 152ms.

b) An analogue I/O Block with 1 channel only enabled is scanned every 38ms.

c) A digital I/O Block is scanned every 38ms regardless of the number of channels enabled.

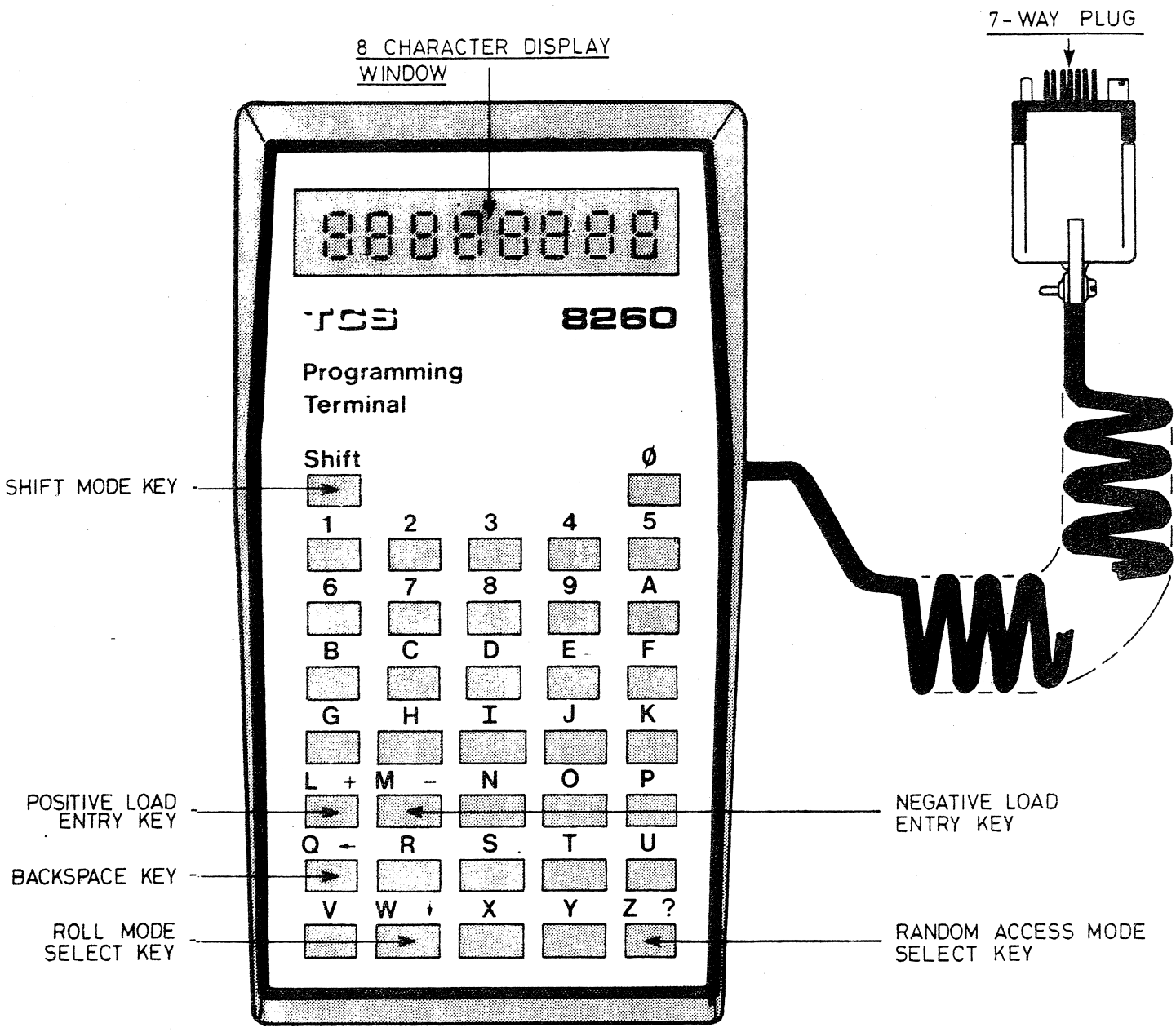


FIG.4.1 HAND HELD TERMINAL KEYBOARD LAYOUT

Section 4 6433 Programmable Signal Processor Command Parameters

4.1 Programming Terminal Characteristics

The 8260 Hand-held programming terminal is a device the same size as a pocket calculator. It is provided with a 37-key positive tactile response keyboard and is capable of sending and receiving data in eight bit serial ASCII code.

The terminal has a simultaneous display capacity of eight characters in-line on 16-segment "starburst" LED's which can clearly and legibly generate all 64 ASCII upper case alphanumerics and symbols. When it is being used to enter parameters into the 6433 Programmable Signal Processor though, only the first 7 character positions are used starting from the left-hand end of the display. These 7 characters include the decimal point position so that a typical message would have the following structure:-

P	V	3	4	.	5	6

The interface between the terminal and the instrument is at standard RS232/V24 voltage levels using a transmission rate of 300 baud and 10 bit characters when S1 no. 1 is OFF as described in Section 2.3.2 a) (i). Connection to the instrument is via a 7-pin plug and socket arrangement, the socket being situated behind a small door just above the catch handle on the front panel of the instrument. This 7-pin connector is also used to provide power to the terminal from the +5V supply within the instrument and it requires typically 350mA.

A plan view of the keyboard of the 8260 Hand-held terminal is given in Fig. 4.1, and for a more detailed description of its characteristics refer to Section 2 of the System 6000 Communications Handbook.

FORMAT	RANGE	POLARITY	DECIMAL POINT POSITION
1	0000 to +/-9999	Bipolar (+/-)	Defined by status word
2	0000 to +9999	Positive (+)	Defined by status word
3	00.00 to +99.99	Positive (+)	Fixed
4	000.0 to +999.9	Positive (+)	Fixed
5	0000 to FFFF	4 Hexadecimal digits	
6	00 to 99	2 Decimal digits	
7	0 to 9	1 Decimal digit	
8	AAAA to ZZZZ	4 ASCII characters (upper case)	
9	0.000 to +9.999	Positive (+)	Fixed
10	0000 to 9999	Positive (+)	Fixed
11	.0000 to +.9999	Positive (+)	Fixed
12	.0000 to +/-.9999	Bipolar (+/-)	Fixed
13	0.000 to +/-9.999	Bipolar (+/-)	Fixed
14	00.00 to +/-99.99	Bipolar (+/-)	Fixed
15	000.0 to +/-999.9	Bipolar (+/-)	Fixed
16	0000 to +/-9999	Bipolar (+/-)	Fixed

TABLE 4.1 List of Command Parameter Data Formats

4.2 Terminal Initialisation and Parameter Entry Procedures

When the 8260 Hand-held terminal is first plugged into the front-panel of the instrument, the CPU detects its presence via one of the pins of the 7-way connector. As soon as this occurs, the RS422 supervisory serial data link on the rear connector is disabled and after a delay of about 2 seconds, the terminal is initialised. The following message is transmitted to the display:-

?	?			C	M	D

This message is a prompt to the operator requesting that a 2 character Command Parameter is entered in the position of the two question marks. Lists of all possible user commands are given in Tables 4.2, 4.3, 4.6, 4.7 and 4.8 together with their corresponding 2 character mnemonics that are actually entered via the terminal keyboard. These parameters themselves are divided into the following 2 types:-

a) Instrument Command Parameters, which are concerned with the overall functions and operation of the instrument.

b) Channel Command Parameters, which are concerned with the status and operating characteristics of each of the input/output channels. There may be up to 8 active input/output blocks within the 6433 each of which can have up to 8 active channels. For analogue I/O blocks each individual channel has a set of channel command parameters, while digital I/O blocks have a single set of parameters associated with all 8 channels.

A full description of Parameter entry procedures using the 8260 Hand-held terminal is given in Section 3 of the System 6000 Communications Handbook. It is recommended that this document is consulted before the user attempts to programme the 6433 via the Hand-held terminal. It is also recommended that the Instrument Command parameters are always set up first and that a record of each parameter is made on a 6433 Set-up Sheet like the example shown in Appendix D. This will assist in record keeping and programming spare or replacement instruments.

4.2.1 Command Parameter Formats

It can be seen from the pages of Command parameters given in Tables 4.2, 4.3, 4.6, 4.7 and 4.8 that each parameter has an associated data format. These formats define the range, polarity, and decimal point position for each parameter according to the list given in Table 4.1.

a) Range

The range indicates how many digits have to be entered for a particular parameter and the span of the data.

b) Polarity

Certain parameters are entered as either positive or negative values (bipolar), others are always positive, while formats 5, 6, 7 and 8 are effectively unsigned.

c) Decimal Point Position

An operator never has to enter a decimal point for a parameter, most of them appear in the display in a fixed position for each format. Some formats have no decimal point (formats 5, 6, 7, 8), while formats 1 and 2 have the position defined by command parameters called status words. For example the Prime Variable for an Analogue Input Channel is a format 1 parameter and Section 4.4.1 a) shows that its decimal point position is defined by the first digit of the associated "ST" command parameter. The ST parameter itself is a status word with a format 5 data structure.

4.2.2 Instrument Parameter access

Section 4.2 recommended that the Instrument Command Parameters are programmed first and this can be done by entering "II" in response to the "?? CMD" command prompt. Table 4.2 shows that the Instrument parameters form a continuous list and once the last parameter has been entered (MD), the scroll mode key (W↓) will take the terminal back to the first parameter (II) again.

4.2.3 Input/Output Channel Parameter access

The 4 real Input/Output Blocks that can be fitted to the 6433 Signal Processor each have their own set of Block Command Parameters associated with them. These are used for setting up the operating characteristics of each of the 8 channels within the Block. The actual lists of Block Command Parameters are given in Tables 4.3, 4.6, 4.7, and 4.8 where it can be seen that they vary depending upon the type of board fitted in a particular Block (Input/Output slot position). However, the access mechanism is common to all types of Block and is as follows :-

a) Re-initialise the 8260 Terminal by means of the Z key (Z?), so that the CPU issues the usual operator prompt:-

   ?? CMD

b) Enter one of the Block Command Parameter lists by typing in :-

   CN - in place of the question marks

c) The CPU will now reply with the current Block and Channel number as displayed on the front-panel Address/Identity display in the following format:-

   CN BC where:-

   B is the current Block address from 1 to 8
   C is the current Channel address from 1 to 8

d) If the scroll mode key (W↓) is now pressed the display will access the list of Block Command Parameters associated with the currently selected channel. This list will be one of the 4 types depending on the input/output Block, and the front-panel Address/Identity display will always show the currently selected Block and Channel.

e) If it is required to examine the Block Command Parameters of a new Block or Channel, then this can be achieved by entering the required address in response to the CN command of c) above, e.g.:-

   CN B'C' where:-

   B' is the new Block Address from 1 to 8
   C' is the new Channel Address from 1 to 8

f) Upon receipt of these two digits the CPU will clear the display and check the following :-

i) The required Block Address lies in the range 1 to 8.

ii) The required Channel Address lies in the range 1 to 8.

iii) An input/output board is actually fitted at the required address.

iv) The input/output channel at the required address has been enabled by the appropriate Instrument Parameter Block Status words S1 to S8 inclusive. (see Section 4.3.2 b))

g) If these conditions are all valid the 6433 will go to the required address and display it on the Front-Panel Address/Identity display and also echo the address on the 8260 Terminal display as :-

CN B'C'

The new list of Command Parameters can now be accessed as described in d) above

h) If the conditions of f) above are not all met then the 6433 will not allow that channel to be accessed and the last address selected will remain up on the Front-Panel Address/Identity display. The CPU will also re-output the current channel address on the 8260 Terminal display as in c) above, thus :-

CN BC

j) The above discussion shows that it is possible to access a new list of Block Command Parameters at any time in one of two ways :-

i) Re-initialise the 8260 Terminal and enter a new CN value as described in a) above.

ii) Scroll down the current list of Block Command Parameters as described in d) above until the end of the list is reached and the CN command reappears at the top of the list. Then enter a new CN value as described in e) above.

NOTES

1) The CN Command Parameter is only available via the 8260 Terminal. It cannot be accessed via the serial data link as this uses a different technique for selecting the address of a required Block Command Parameter.

2) Digital Input or Output cards have their own command parameters associated with the complete I/O Block rather than with the individual channels with the exception of the Channel Tag parameters 1T and 2T. Therefore the same set of command parameters are read back via the 8260 Hand-held terminal whatever value of CN is entered for Digital I/O Blocks.

COMMAND MNEMONIC	COMMAND PARAMETER FUNCTION	UNITS	FORMAT	PARAMETER TYPE
II	Instrument Identity	-	5	Monitor-only
S1	Channel scan and board type	-	5	Input/Output block 1
A1	Historic alarms	-	5	
S2	Channel scan and board type	-	5	Input/Output block 2
A2	Historic alarms	-	5	
S3	Channel scan and board type	-	5	Input/Output block 3
A3	Historic alarms	-	5	
S4	Channel scan and board type	-	5	Input/Output block 4
A4	Historic alarms	-	5	
S5	Channel scan and board type	-	5	Pseudo-Input/Output block 1
A5	Historic alarms	-	5	
S6	Channel scan and board type	-	5	Pseudo-Input/Output block 2
A6	Historic alarms	-	5	
S7	Channel scan and board type	-	5	Pseudo-Input/Output block 3
A7	Historic alarms	-	5	
S8	Channel scan and board type	-	5	Pseudo-Input/Output block 4
A8	Historic alarms	-	5	
SW	Switch bank S1/S2 settings	-	5	Status words
MD	Front panel and diagnostic status indications	-	5	
C1 C2 C3 C4 C5 C6 C7 C8	Alarms Auto-Acknowledge	-	5	Status words

TABLE 4.2 List of 6433 Instrument Command Parameters and their respective mnemonics

4.3 Instrument Command Parameters

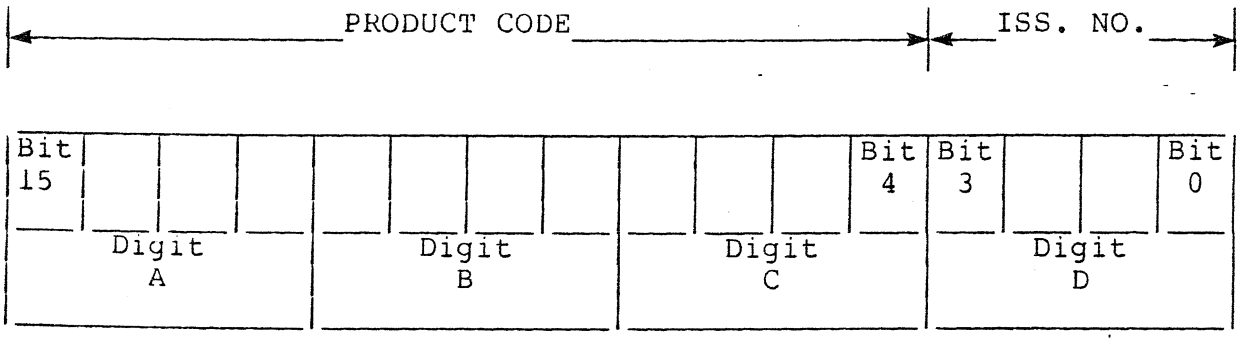
Table 4.2 shows that there are 27 Instrument Command parameters associated with the overall operation of the 6433 and they are all format 5 parameters. Table 4.2 shows that they consist of 4 hexadecimal characters in the range 0000 to FFFF with a positive sign character for parameter entry. When any of these parameters are entered via the 8260 Hand-held terminal the Instrument replies with the current value of the parameter preceded by a "greater than" sign to indicate that the data is in hexadecimal notation, e.g:-

I	I	>	4	3	3	3

Detailed descriptions of each of the 27 status word parameters are given in the following Sections.

4.3.1 II - Instrument Identity

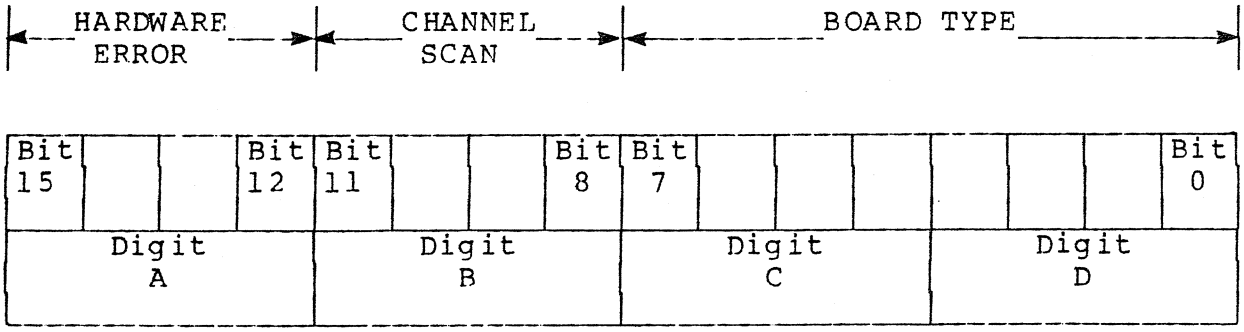
This parameter returns the instrument identity and issue number, i.e. 4333 for the 6433 issue 1. II is a read-only parameter and its exact format is given below:-



DIGIT	BIT	FUNCTION
A,B,C	15-4	Product Code (6) 433
D	3-0	Issue Number 3

4.3.2 S1 to S8 - Input/Output Block channel scan and board type

The 4 command parameters S1 to S4 inclusive are used to give access to the status of the 4 real input/output blocks of the 6433. Similarly S5 to S8 inclusive give access to the status of the 4 pseudo-input/output blocks. All 8 parameters are used to set-up the number of active channels within each block and read back the board type fitted in each I/O slot. The format of these parameters is given below:-



DIGIT	BIT	FUNCTION
A	12	Hardware Error (0 = O.K.; 1 = Error).
B	11-8	Channel Scan 1 to 8; 0 = I/O block disabled.
C,D	7-0	Board Type 00 to 1E; 1F = no board fitted.

The exact function of the individual digits within the S1 to S8 parameters are described in the following sections.

a) Hardware Error (digit A)

This digit is read-only and should read back as a zero under normal conditions. If it reads back as a 1 it means that there is a Hardware error in the corresponding input/output Block. This error condition will occur under the following conditions:-

(i) No input/output board is fitted in the Block position on the 6433 motherboard.

(ii) A hardware fault exists on the input/output board.

If the faulty input/output Block has been enabled by the corresponding channel scan parameter (see 4.3.2 (b)), then the Hardware Error condition is indicated to the operator. This is done by flashing the message:-

BC HW ER

on the Address/Identity display where B and C signify the faulty Block and Channel Address respectively as described in Section 2.6.2 b). Furthermore the front-panel channel scan will stop on all channels with Hardware Errors in the same way as for alarms (see Section 3.1.3 b)). The Error message can only be removed by replacing the faulty board or completely removing it from the channel scan by means of digit 2 of the appropriate Block Status parameter.

It should be noted that this digit always reads back as a zero for the pseudo input/output boards of S5 to S8.

b) Channel Scan (digit B)

This digit is entered via the Hand-held Terminal or serial link to select the number of channels it is required to scan within each input/output block. If the digit is set to 0 then the entire block is removed from the scan and channels cannot be accessed via the Front-panel or the Hand-held terminal. When the digit is set from 1 to 8 then that number of channels will be scanned within the input/output block, always starting from channel 1. e.g.

B = 1 - scans channel 1 only

B = 2 - scans channels 1 and 2

B = 3 - scans channels 1, 2 and 3 etc.

It should be noted that all input or output channels that are excluded from the Channel scan by digit 2 of the S1, S2, S3 or S4 parameters will have their alarms cleared automatically but not Historic alarms. The following actions will also occur depending upon board type:-

AN IN - cannot be accessed

AN OUT - cannot be accessed and no longer refreshed

DIG IN - set to zero on LED displays

DIG OUT - set to zero on LED displays

c) Input/Output board type (digits C,D)

As described in Section 1.4.6 there are 4 basic types of board which may be fitted into each input/output slot on the motherboard. Each board is fitted with a hardware identity which can be accessed via the CPU to ascertain which type of board is fitted in each slot (Block) position. This hardware identity is in the form of a 2 digit hexadecimal number in the range 00 to 1E and may be accessed via digits C and D of the slot status parameter. These two digits correspond to the different board types given in Table 1.2 as follows:-

Digits CD	Board type
00 to 07	Analog input
08 to 0F	Analog output
10 to 17	Digital input
18 to 1E	Digital output

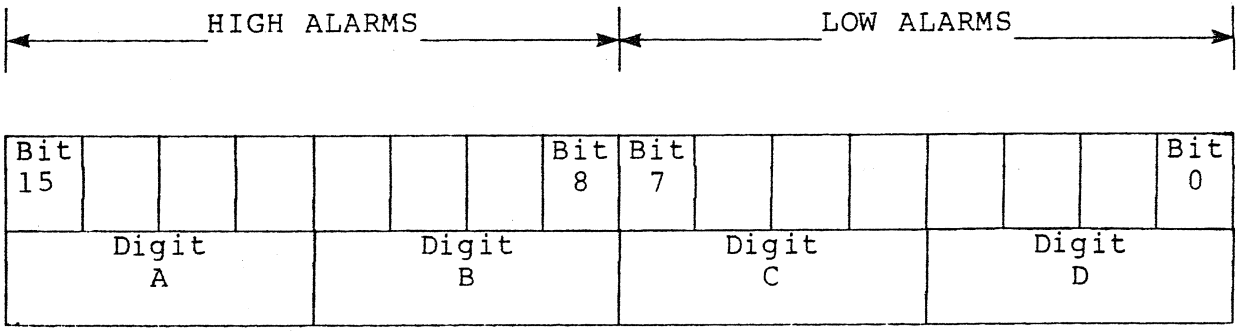
This scheme allows 8 different versions of each board type to be identified, though initially only board types 00, 08, 10 or 18 are available.

It should be noted that a slot without a board fitted will read back a board identity of 1F.

For the real input/output boards of parameters S1 to S4 digits C and D are read-only. For the pseudo-input/output boards of parameters S5 to S8 digits C and D may be written to in order to specify the pseudo-block type.

4.3.3 A1 to A8 - Input/Output Block Historic Alarms

The 8 command parameters A1 to A8 are used to give access to the historic alarm conditions of each of the real and pseudo input/output blocks of the 6433. The format of these parameters is given below:-



DIGIT	BIT	CHANNEL	FUNCTION
A	15	1	Historic High Alarms (0 = safe; 1 = alarm)
	14	2	
	13	3	
	12	4	
B	11	5	
	10	6	
	9	7	
	8	8	
C	7	1	Historic Low Alarms (0 = safe; 1 = alarm)
	6	2	
	5	3	
	4	4	
D	3	5	
	2	6	
	1	7	
	0	8	

The exact function of the individual digits within the A1 to A8 parameters are described in the following sections:-

a) Historic High Alarms (digits A, B)

Each bit of the most-significant byte of A1 is set when the corresponding channel of Block 1 goes into High Alarm where the most-significant bit of digit A corresponds to channel 1 and the least-significant bit of digit B corresponds to channel 8. Each bit remains set even if the corresponding alarm channel is acknowledged via the Front-panel and subsequently goes out of alarm. Each bit therefore serves as an historic alarm record for the corresponding input/output channel and can only be reset by writing a 0 to the appropriate bit position via the Hand-held terminal or serial data link.

b) Historic Low Alarms (digits C, D)

Each bit of the least-significant byte of A1 is set when the corresponding channel of Block 1 goes into Low Alarm where the most-significant bit of digit C corresponds to channel 1 and the least-significant bit of digit D corresponds to channel 8. Otherwise it is very similar to the most-significant byte, for example:-

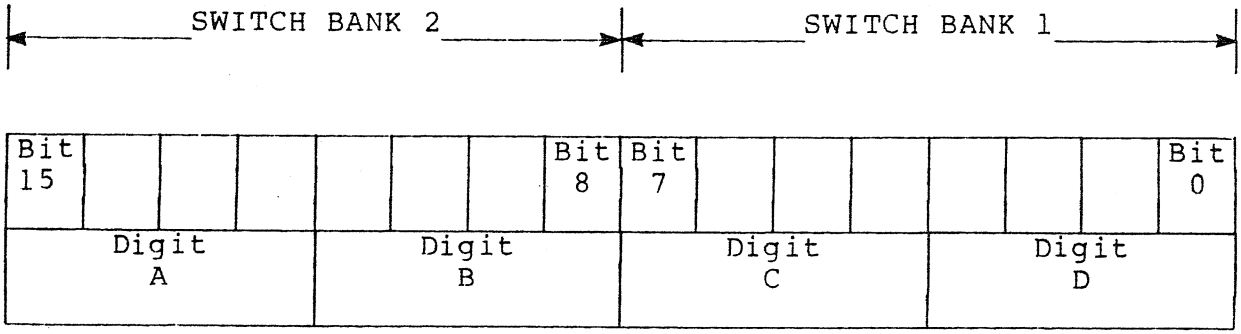
A1 > 4228

means that Block 1 channels 2 and 7 have been in High Alarm and Block 1 channels 3 and 5 have been in Low Alarm since the A1 parameter was last accessed and rest to zero.

4.3.4 SW - Internal Switch Status

The status word command parameter, SW, is a monitor-only parameter and is used to obtain a readout of the settings of the 12 internal switches of switch banks S1 and S2. This facility allows the internal switch status of a 6433 Programmable Signal Processor to be determined via the Hand-held terminal or the RS422 supervisory link without removing the instrument from the rack or sleeve.

The format of the SW parameter is shown below:-



DIGIT	BIT	SWITCH		FUNCTION
	15	1	S2	UID select (0 = 0 - 7; 1 = 8 - F)
A	14	2		N/A
	13	-		
	12	-		
	11	-		
B	10	-		
	9	3		N/A
	8	4		Tag display enable (0 = disable; 1 = enable)
	7	1	S1	RS 232 baud rate select (0 = 300; 1 = as RS 422)
C	6	2		Baud rate selection switches for RS422 data link (see Table 2.2)
	5	3		
	4	4		
	3	5		Protocol mode select (0 = ASCII; 1 = Binary)
D	2	6		4
	1	7		2 Group Identifier (GID)
	0	8		1

Each bit of the SW parameter is set to a logic 1 when the corresponding switch is in the ON position, a logic 0 will be read back for a switch in the OFF position.

The exact functions of the digits within the SW parameter are discussed in the following sections:-

a) Switch bank S2 (digits A, B)

Bits 14 and 15 of digit A, and bits 8 and 9 of digit B read back the status of internal switch bank S2. The individual switch functions within S2 are discussed in Section 2.3.2 b) and are listed in Table 2.1.

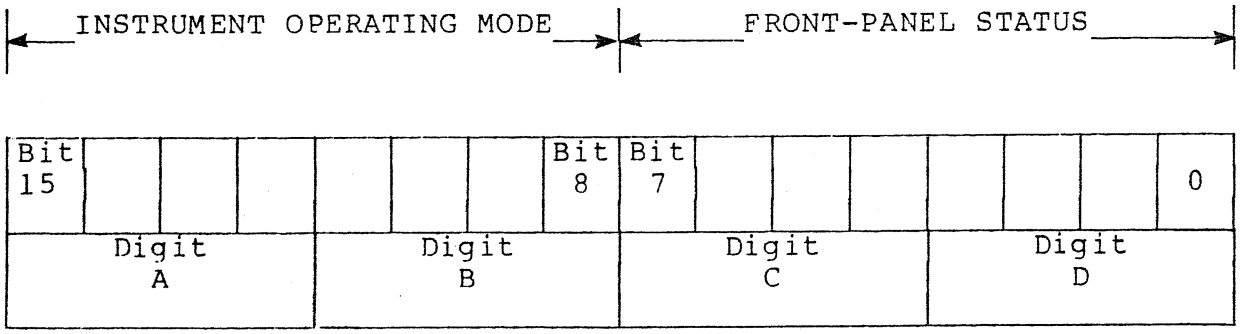
b) Switch banks S1 (digits C, D)

The two least-significant digits of SW read back the status of internal switch bank S1. The individual switch functions within S1 are discussed in Section 2.3.2 a) and are listed in Table 2.1.

4.3.5 MD - 6433 Operating Status

The status word parameter MD is used to give access to the current Operating Status of the 6433 Programmable Signal Processor and the state of the Front-panel controls via the 8260 Hand-held terminal or Supervisory data link.

The format of the MD parameter is shown below:-



DIGIT	BIT	FUNCTION			READ/WRITE STATUS
	15	Collected state change alarm			Read-write
A	14	Parameter change of state bit			Read-write
	13	Common channel parameters sumcheck failure			Read/write
	12	Common I/O hardware failure		OPERATING	Read/write
	11	Battery voltage LOW		MODE	Read/only
B	10	Common 1-5V I/P out of range			Read-write
	9	N/A			
	8	Instrument parameters sumcheck failure			Read-write
	7	8260 Terminal connected			Read-only
C	6	Test bit			Read-only
	5	RAISE button	(△)	FRONT-	Read/only
	4	INSPECT button	INS		Read-only
	3	CHANNEL button	CHN	PANEL	Read-only
D	2	LOWER button	(▽)	STATUS	Read-only
	1	ALARM button	ALM		Read-only
	0	PARAMETER button	PAR		Read-only

The exact functions of the digits within the MD parameter are discussed in the following sections:-

a) 6433 Operating Status (digits A, B)

The first two digits of the MD command parameter, A and B corresponding to bits 15 to 8 inclusive, indicate the current operating status of the 6433. The functions of each of these 8 bits are described below:-

(i) Bit 15 - Alarm Change of State bit

The most-significant bit of digit A is set to a logic "1" whenever any of the input/output channels in any Block goes into alarm. It will stay set until reset to "0" by the Hand-held terminal or serial data link. It is not reset when the Historic Alarm parameters A1, to A8 are reset. This bit, corresponding to an MD value of 8000 is read/write.

(ii) Bit 14 - Parameter Change of State bit

The second bit of digit A is set to a logic "1" whenever the Hand-held terminal or Raise/Lower push-buttons have been used to change the value of a Command Parameter. This bit will always read as a logic "1" via the Hand-held terminal and must be reset via the serial data link. This bit, corresponding to an MD value of 4000 is therefore read-only via the Hand-held terminal, but read/write via the serial data link.

(iii) Bit 13 - Block Parameter Sumcheck failure

This third bit of digit A is set to a logic "1" whenever a sumcheck failure occurs on any of the Block Command Parameters. This bit cannot be reset to logic "0" until the appropriate sumcheck failure bit in the Block Command Parameters has been reset first. This bit corresponding to an MD value of 2000 is read/write.

(iv) Bit 12 - Common Hardware Alarm

The least-significant bit of digit A is set to a logic "1" to indicate a Common Hardware Alarm condition caused by any of the 4 input/output Blocks having a Hardware Error (see Section 2.6.2 b)).

This bit cannot be reset by writing a logic "0" from the Hand-held terminal or serial data links until the alarm condition causing is has been removed. This bit corresponding to an MD value of 1000 is read/write.

(v) Bit 11 - Battery voltage LOW

The most-significant bit of digit B is set to a logic "1" as soon as the battery voltage on the memory card drops below the level required to guarantee non-volatility of the parameter memory area. Under these conditions the unused decimal points on the Prime Variable display will also flash to give a visual indication that the battery should be replaced. This bit is reset automatically by the CPU as soon as it detects that the battery is reading a safe voltage. This bit corresponding to an MD value of 800 is read-only.

(vi) Bit 10 - Common Out of Range Alarm

The second bit of digit B is set to a logic "1" to indicate a common out of range condition on 1-5V analogue input channels. This will occur when any analogue input that has been set up for a 1-5V input (see Section 4.4.1 d) (ii)) receives a signal less than 0.5V or greater than 5.5V. This bit can be reset by writing a logic "0" from the Hand-held terminal or serial data links while the out of range condition exists. This bit corresponding to an MD value of 400 is read/write.

(vii) Bit 9

This bit of the MD parameter is unallocated and will therefore read back as a zero.

(viii) Bit 8 - Instrument Parameter Sumcheck failure

The least-significant bit of digit B is set to a logic "1" whenever a sumcheck failure occurs on any of the Instrument Command Parameters of Table 4.2. Under these conditions the greater than sign which precedes all format 5 parameters is replaced by an asterisk for all the Instrument Command Parameters. Furthermore, the error condition is indicated to the operator by flashing the message:- IP SC ER - on the alphanumeric Address/Identity display as described in Section 2.6.2 c). The condition is rectified by re-entering all the Instrument Command Parameters and finally writing a zero to Bit 8. This bit, corresponding to an MD value of 100 is read/write.

b) Front-Panel Status (digit C, D)

The last two digits of the MD command parameter, C and D, corresponding to bits 0 to 7 inclusive, indicate the current state of the Front-panel push-buttons etc. The functions of each of these 8 bits are described below:-

(i) Bit 7 - Hand-held Terminal Connected

The most-significant bit of digit C is used to indicate whether the Hand-held terminal is plugged into the Front-panel socket or not. Bit 7 will normally be a logic "0" but will set to logic "1" as soon as the terminal is plugged in.

Note that the Hand-held terminal should always read this bit back as a logic "1" and the supervisory computer can only read back the MD status word when this bit is at logic "0".

(ii) Bit 6 - Test Bit

The second bit of digit C is used as a Test bit by the CPU to check out the functions of the input/output ports on the Front-panel hardware and should always read back as a logic "1".

(iii) Bits 0 to 5 inclusive - Front panel push-buttons

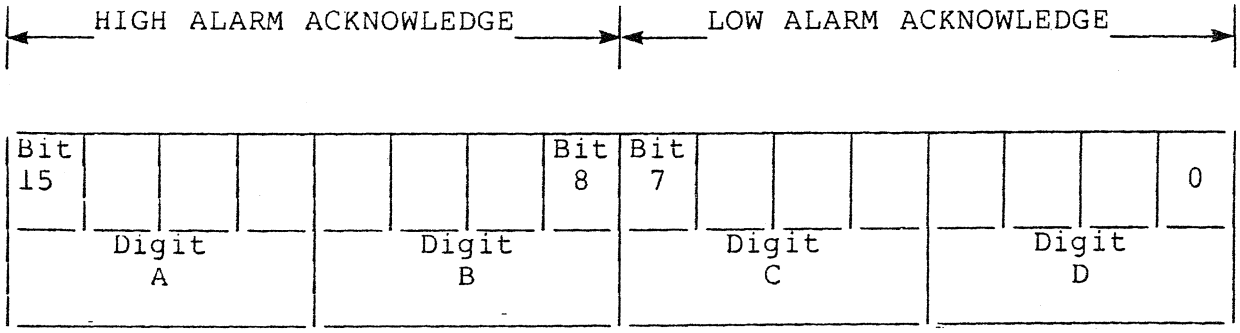
These 2 bits of digit C and 4 bits of digit D are normally at logic "0" and are set to logic "1" whenever the corresponding front-panel push-button is being pressed.

Note that when no alarms are present and no push-buttons are being pressed the MD parameter should read back as >40C0 on the Hand-held terminal.

4.3.6 C1 to C8 - Alarm Auto-Acknowledge

The eight command parameters C1 to C8 are used to enable and disable automatic acknowledgement of alarms. When this feature is enabled, the particular alarm goes from non-alarm (indicator not lit) to acknowledge alarm (indicator lit steady) when alarm is entered. When leaving alarm the indicator goes from lit steady to not lit.

Each 16-bit status word provides 8 bits to select high alarm acknowledge and 8 bits for low alarm acknowledge. A one selects the auto-acknowledge on the corresponding channel alarm; a zero disables the feature. This format is given below:



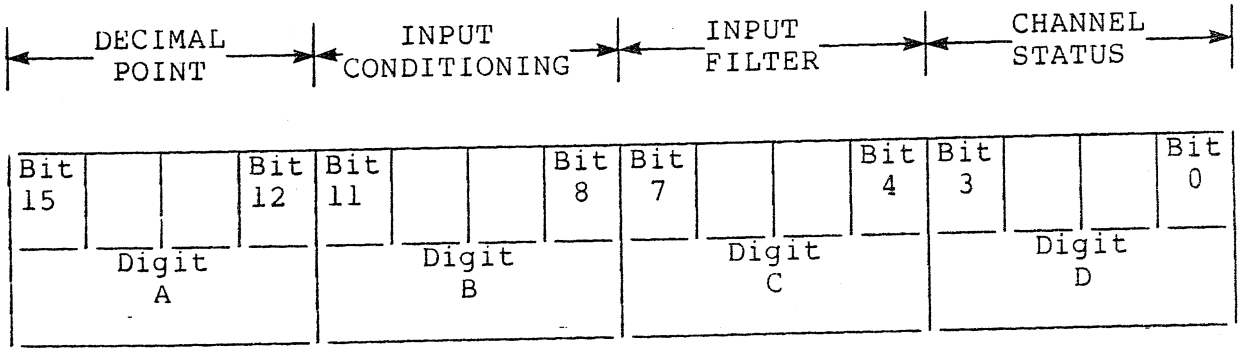
DIGIT	BIT	CHANNEL	FUNCTION
	15	1	High Alarm Acknowledge (0 = Disable Acknowledge 1 = Enable Acknowledge)
A	14	2	
	13	3	
	12	4	
	11	5	
B	10	6	
	9	7	
	8	8	
	7	1	Low Alarm Acknowledge (0 = Disable Acknowledge 1 = Enable Acknowledge)
C	6	2	
	5	3	
	4	4	
	3	5	
D	2	6	
	1	7	
	0	8	

4.4 Analogue Input Channel Command Parameters

The list of the 8 Channel Command Parameters associated with each channel of an 8-way Analogue Input block is given in Table 4.3. The means of accessing them via the Hand-held terminal is given in Section 4.2.3, and detailed descriptions of each parameter are given in the following sections.

4.4.1 ST - Channel Status

The Channel Status parameter, ST, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. It is used to define the decimal point position, input signal processing and filter time constant for the Prime Variable input in the format given below:-



DIGIT	BIT	FUNCTION
A	12-15	Decimal point position select (0 to 4)
B	8-11	Prime Variable input channel processing (0 to F)
C	4-7	Prime Variable input filtering (0 to F)
	3	I/O channel parameters sumcheck fail (0 = O.K.; 1 = fail)
D	2	1-5V input out of range (0 = O.K.; 1 = out-of-range)
	1	HA, LA parameter Raise/Lower inhibit (0 = enable; 1 = inhibit)
	0	0-10V or 1-5V input select (0 = 0-10V; 1 = 1-5V)

COMMAND MNEMONIC	COMMAND PARAMETER FUNCTION	UNITS	FORMAT	PARAMETER TYPE
CN(1)	Block/Channel number	-	6	
ST	Channel status	-	5	Analogue
HR	Prime Variable high range	Eng	1	
LR	Prime Variable low range	Eng	1	Input
HA	High alarm (absolute)	Eng	1	
LA	Low alarm (absolute)	Eng	1	channels
AR	Alarm routing	-	5	
PV	Prime Variable value	Eng	1	
1T(2)	Channel Tag characters 1-4	ASCII	8	Channel Tag
2T(2)	Channel Tag characters 5-8	ASCII	8	names

TABLE 4.3 List of Analogue Input Channel Command Parameters and their respective mnemonics

NOTES

(1) CN does not appear in the parameter list when accessing parameters via the serial data link.

(2) The 1T and 2T Channel Tag characters do not appear when the parameter list is scrolled via the (W ↓) command of the 8260 Hand-held terminal. Instead, they must be accessed individually by first using the ?? CMD prompt once the required Block and Channel number (CN) has been selected previously. (see Section 4.8)

The exact functions of the digits within the ST parameter are discussed in the following sections:-

a) Decimal Point Selection (digit A)

The first or most-significant digit of the ST parameter is used to select the decimal point position for the Prime Variable analogue input as it is displayed on the Front-panel digital readout. The number entered must lie within the range 0 to 4 and will position the decimal point according to the table shown below:-

DIGIT 1 (M.S)	DISPLAY FORMAT
0	9 9 9 9
1	9 9 9.9
2	9 9.9 9
3	9.9 9 9
4	.9 9 9 9

Once the Channel 1 decimal point position has been programmed the resulting display format will appear on the Hand-held terminal for every Command function that is related to the Prime Variable range of that input channel. This means in fact that all of the Format 1 commands listed in Table 4.3 will be displayed with the same decimal point position as for the Process Variable, viz:-

HR, LR, HA, LA, PV

b) Input Channel processing (digit B)

It has been mentioned that each of the 8 analogue input channels of an Analogue Input Block can be linked independently to a digital processing routine. The second digit of ST is used to select which of the 16 possible processing routines are linked to each input channel. Digit B can lie in the full hexadecimal range of 0 to F, and Table 4.4 lists the 16 possible processing routines with their corresponding hexadecimal numbers. If no processing is required for the Prime Variable then it can be seen from Table 4.4 that a zero is entered in the digit B position of the ST parameter. The use of the input channel processing functions is discussed in the following sections.

HEX. CHAR	PROCESSING ROUTINE FUNCTION	RANGE
0	No Processing	0 to 10V
1	Square Root Function:- Vout = $\sqrt{\text{Vin} \times 10\text{V}}$	0 to 10V
2	Thermocouple type J (Iron-Constantan)	0 to 800 °C
3	Thermocouple type K (Chromel-Alumel)	0 to 1280 °C
4	Thermocouple type T (Copper-Constantan)	-240 to 400 °C
5	Thermocouple type S (Pt10%RH-Pt)	0 to 1750 °C
6	Thermocouple type R (Pt13%RH-Pt)	0 to 1750 °C
7	Thermocouple type E (Chromel-Constantan)	0 to 1000 °C
8	Thermocouple type B (Pt30%Rh-Pt6%Rh)	0 to 1800 °C
9	Platinum Resistance Thermometer (Pt100%)	-200 to 1000 °C
A	Reserved for User Specified Linearisation	As Required
B	Reserved for User Specified Linearisation	As Required
C	Reserved for User Specified Linearisation	As Required
D	Reserved for User Specified Linearisation	As Required
E	Reserved for User Specified Linearisation	As Required
F	Inversion Function:- Vout = 10V - Vin	0 to 10V

TABLE 4.4 List of the Available Input Signal Processing Functions (Selected by ST Parameter, Digit B)

(i) Function 1 - Square Root Function

The formula of Table 4.4 shows that the output of the Square Root function is a value that may be considered as corresponding with a voltage. This effective output voltage, Vout, is a 0-10V value and is formed by taking the square root of the input voltage Vin multiplied by 10 where Vin is also in the range 0-10V, e.g:-

Vin	Vout (effective)
0V	0V
0.4V	2.0V
1.6V	4.0V
10.0V	10.0V (theoretical)

(ii) Functions 2 to 8 - Thermocouple Linearisation

Table 4.4 shows that functions 2 to 8 are used for linearisation of the 7 most common thermocouple types, i.e. types J, K, T, S, R, E and B respectively.

Table 4.4 also shows the maximum temperature range over which the linearisation will function for each type and the programmed setpoint span of the Prime Variable must always lie within this range.

For example, the type J thermocouple linearisation from Table 4.4 can be used over the range 0 to 800°C which means that for the Prime Variable input:-

LR = 000.0 (Prime Variable low range)
HR = 800.0 (Prime Variable high range)

Furthermore, if, for example, a Prime Variable range of 0 to 400.0°C were required, then LR = 000.0 and HR = 400.0, but in addition the thermocouple amplifier or input converter must be scaled to provide a 0 to 10V output for a 0 to 400.0°C input.

Thus, in general, when the thermocouple linearisation functions of Table 4.4 are used:-

PRIME VARIABLE SPAN LR to HR

= INPUT CONVERTER SPAN 0 TO 10V

The 6433 automatically decides which portion of the linearisation table is to be used for the selected Prime Variable span by referring to the Decimal Point Position (ST digit A), Prime Variable High Range (HR), and Prime Variable Low Range (LR) parameters of Sections 4.4.1 a) and 4.4.2 respectively. When using the thermocouple linearisation functions the HR and LR ranging parameters should always be integers. If they are inadvertently entered as non-integers the 6433 will automatically round them to the nearest integer value internally for linearisation purposes. However, for display purposes the PV will remain scaled to the non-integer values of HR and LR.

Again, for example, if a Prime Variable range of 0 to 1000 °C is required with a type S thermocouple then the following parameters would be entered to give Prime Variable readings with a 1°C resolution:-

ST > 0500

HR = 1000

LR = 0000

The associated Input Converter must be ranged to provide a 0 to 10V output for a 0 to 1000°C input.

It should also be noted that greater display resolution can be obtained by appropriate selection of the Decimal Point Position and Prime Variable Range. For example, the type J thermocouple linearisation could be used to obtain Prime Variable readings with a 0.01°C resolution over a 100°C span by entering the following parameters:-

ST > 2200

HR = 99.99

LR = 00.00

It is not possible, however, to exceed 0.01°C resolution on any of the thermocouple ranges specified in Table 4.4.

(iii) Function 9 - Platinum Resistance Thermometer

The Platinum Resistance Thermometer linearisation function of Table 4.4 requires the same operating characteristics as for the thermocouples, viz:- the Prime Variable span must lie within the range -200.0 to 1000°C and the associated input converter must be ranged appropriately.

(iv) Function A to E - User Specified Linearisations

These 5 processing routines are reserved for any special linearisation functions required by the user that are not catered for by functions 1 to 9. Each linearisation function must be specified by the user in the form of a 24 element break-point table over the required range of values. The TCS factory will then be able to quote a price and delivery for including these functions in a 6433 Programmable Signal Processor.

(v) Function F - Inversion Functions

The formula of Table 4.4 shows that the output of the inversion function is a value that may be considered as corresponding with a voltage. This effective output voltage, Vout, is a 0-10V value formed by direct inversion of the Vin signal which is also in the range 0-10V, e.g:-

Vin	Vout (effective)
0V	10V
5V	5V
10V	0V

The Vout value will then be used by the 6433 as the resultant signal obtained from the Prime Variable (PV) signal. The inversion effectively occurs before any other processing is carried out so that the Prime Variable as displayed on the digital readout would be the inverted value in this case.

As an example, to demonstrate the effect of the Inversion function, assume that the 6433 has been programmed with the following parameters :-

ST > 1F00

HR = 500.0

LR = 000.0

The Prime Variable will now be displayed on the front-panel digital readout, or read back via the serial data links as follows:-

ANALOGUE INPUT	PRIME VARIABLE DISPLAY
0.0V	500.0
2.5V	375.0
5.0V	250.0
7.5V	125.0
10.0V	000.0

HEXADECIMAL CHARACTER	SELECTED INPUT FILTER TIME IN SECONDS
0	0
1	0.2
2	0.4
3	0.6
4	0.8
5	1.0
6	2.0
7	4.0
8	6.0
9	8.0
A	10.0
B	15.0
C	20.0
D	25.0
E	30.0
F	60.0

TABLE 4.5 List of the available input filter time values (selected by ST parameter digit C)

c) Input filter time selection (digit C)

The third digit of ST is used to select an input filter time constant for the Prime Variable. This is a simple, digitally implemented, first order filter whose time constant varies from 200ms to 60 seconds as digit C varies from 1 to F as shown in Table 4.5.

d) Status bits (digit D)

The fourth or least-significant digit of ST is used as four separate bits for status information as follows:-

i) Bit 3

This bit is automatically set to a logic 1 by the CPU whenever a sumcheck failure is detected on any of the command parameters associated with the selected channel. The diagnostic messages generated on the front panel and the indications via the serial data links are described in Section 2.6.2 d). This condition is rectified by re-entering any corrupted channel command parameters and re-setting bit 3 to logic 0.

ii) Bit 2

This bit is automatically set to a logic 1 by the CPU when the Prime Variable input has been selected for a 1 to 5V operating range (see Section 4.4.1 d) (iv)), and the signal is less than 0.5V or greater than 5.5V. The diagnostic messages and indications associated with this input over-range condition are given in Section 2.6.2 h). Bit 2 of the ST parameter remains at logic 1 for as long as the input over-range conditions occurs, and it will revert to logic 0 only when the analogue signal is restored to the 1 to 5V operating range.

iii) Bit 1

When this bit is set to a logic "1" via the 8260 Hand-held terminal or RS422 data link it inhibits the Operator from using the Raise or Lower buttons to alter the value of the HA or LA command parameters in conjunction with the PAR button in Secondary Display format (see Section 3.3.1 b) i)).

iv) Bit 0

When this bit is set to a logic "0" the Prime Variable analogue input is treated as being a signal in the range 0-10V. When this bit is set to a logic "1" the input is treated as being a signal in the range 1-5V.

4.4.2 HR,LR - Prime Variable input ranging

These parameters define, in Engineering Units, the span of the Prime Variable input, PV. The value entered in HR is equivalent to an input of 10V when ST bit 0 is at logic "0", or 5V when ST but 0 is at logic "1". Similarly LR is equivalent to an input of 0V when ST bit 0 is at logic "0", or 1V when ST bit 0 is at logic "1". The range of values is -9999 to +9999 and HR must be greater than LR. The decimal point position for both of these parameters is programmed by digit A of the ST parameter as described in Section 4.4.1 a).

4.4.3 HA, LA - Absolute Alarm limits

The Absolute Alarm limit parameters HA and LA are used to set the levels in Engineering Units at which the Prime Variable will generate a High or Low Absolute alarm respectively. The selected analogue input channel will enter the High Alarm condition if the PV exceeds the value set in HA. Under these conditions the appropriate upper row LED will flash as described in Section 3.3.1 a) (iii). The selected analogue input channel will enter the low alarm condition if the PV is less than the value set in LA. Under these conditions the appropriate lower row LED will flash as described in Section 3.3.1 a) (iv).

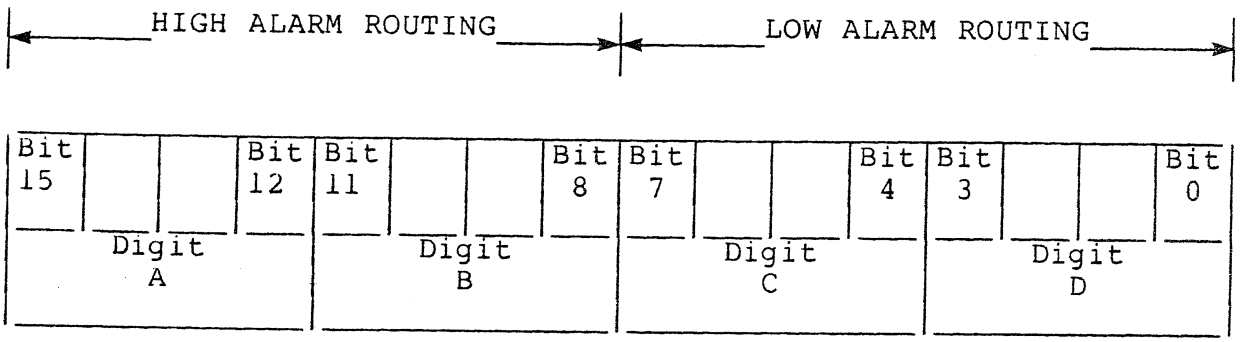
It should be noted that an unacknowledged alarm flashes in-phase with the Common Alarm LED in the ALM button, while an acknowledged alarm is steady. However, an unacknowledged alarm that goes out of alarm flashes in anti-phase with the ALM button LED.

Both the High and Low absolute alarms have a hysteresis of ± ½% of the Prime Variable range span. The values of HA and LA may be altered by means of the PAR and Raise/Lower buttons in Secondary Display format as described in Section 3.3.1 b) (i) provided that bit 1 of the ST parameter is not set (see Section 4.4.1 d) (iii)). The range of HA and LA are the same as the Prime Variable, i.e. LR to HR, and HA must be greater than LA. Table 4.6 shows that the decimal point position for HA and LA is the same as for the PV, i.e. it is programmed by digit A of the ST parameter as described in Section 4.4.1 a).

4.4.4 AR - Alarm Routing Parameter

When the 6433 is being used as a Remote Signal Processing peripheral it is often required that the internally generated analogue input channel alarms are available as external logic signals. These can then be used for driving annunciator panels, plant safety interlock mechanisms or other external monitoring equipment. To achieve these features it is necessary to link the internally generated alarms through to digital output channels, and this is done with the use of the Alarm Routing Parameter, AR. Table 4.6 shows that AR is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry.

The format of the AR parameter is shown below:-



DIGIT	FUNCTION	
A	Block Address	High alarm Routing
B	Channel Address	
C	Block Address	Low Alarm Routing
D	Channel Address	

The exact functions of the digits within the AR parameter are discussed in the following sections.

a) High Alarm Routing (digits A and B)

The first two digits A and B define the Block and Channel address respectively of the digital output to which the High Alarm signal is to be routed. This address should correspond to a slot fitted with a digital output board otherwise the alarm routing will be ignored. As soon as routing occurs the selected digital output will go to a logic "1" (15V) until the Analogue input channel goes into High alarm when it will fall to a logic "0" (0V).

b) Low Alarm Routing (digits C and D)

The last two digits C and D define the Block and Channel address respectively of the digital output to which the Low Alarm signal is to be routed. The function of these 2 digits is the same as for the first 2 except that the logic output goes low when the analogue input channel goes into Low alarm.

This scheme allows very comprehensive alarm collection facilities to be programmed by the user with complete freedom, for example:-

a) The High and Low alarms of each analogue input channel may be routed to separate digital output lines for separate alarm facilities.

b) The High and Low alarms of an analogue input channel may be routed to the same digital output line for a deviation alarm facility.

c) The High and Low alarms of a number of analogue input channels may be routed all to the same digital output line for a common deviation alarm facility.

d) Combinations of the above can be used to implement common High or common Low alarms.

4.4.5 PV - Prime Variable

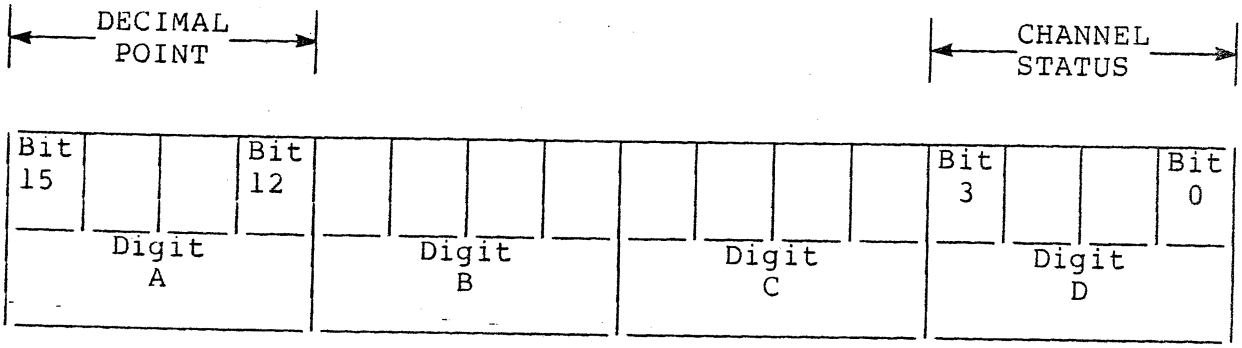
This parameter defines, in Engineering Units the value of the Prime Variable input signal after it has been filtered and had any signal processing applied. The PV input is scaled by the input ranging parameters HR and LR as described in Section 4.4.2. Input channel processing for PV is defined by digit B of the ST parameter as described in Section 4.4.1 b). Table 4.6 shows that the decimal point position is programmed by digit A of the ST parameter as described in Section 4.4.1 a).

4.5 Analogue Output Channel Command Parameters

The list of the 8 Channel Command Parameters associated with each channel of an 8-way Analogue Output block is given in Table 4.6. The means of accessing them via the Hand-held terminal is given in Section 4.2.3 and detailed descriptions of each parameter are given in the following sections.

4.5.1 ST - Channel Status

The Channel Status parameter, ST, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. It is used to define the decimal point position for the Prime Variable output and provide channel status information in the format given below:-



DIGIT	BIT	FUNCTION
A	12-15	Decimal point position select (0 to 4)
B	8-11	Unallocated
C	4-7	Unallocated
	3	I/O channel parameters sumcheck fail (0 = O.K.; 1 = fail)
D	2	Unallocated
	1	HO, LO parameter Raise/lower inhibit (0 = enable; 1 = inhibit)
	0	0-10V or 1-5V output select (0 = 0-10V; 1 = 1-5V)

COMMAND MNEMONIC	COMMAND PARAMETER FUNCTION	UNITS	FORMAT	PARAMETER TYPE
CN(1)	Block/Channel number	-	6	
ST	Channel status	-	5	Analogue
HR	Prime Variable high range	Eng	1	
LR	Prime Variable low range	Eng	1	Output
HO	High output limit	Eng	1	
LO	Low output limit	Eng	1	channels
OP	Prime Variable value	Eng	1	
1T(2)	Channel Tag characters 1-4	ASCII	8	Channel Tag
2T(2)	Channel Tag characters 5-8	ASCII	8	names

TABLE 4.6 List of Analogue Output Channel Command Parameters and their respective mnemonics

NOTES

(1) CN does not appear in the parameter list when accessing parameters via the serial data link.

(2) The 1T and 2T Channel Tag characters do not appear when the parameter list is scrolled via the (W ↓) command of the 8260 Hand-held terminal. Instead, they must be accessed individually by first using the ?? CMD prompt once the required Block and Channel number (CN) has been selected previously. (see Section 4.8)

The exact functions of the digits within the ST parameter are discussed in the following sections:-

a) Decimal Point Selection (digit A)

The first or most-significant digit of the ST parameter is used to select the decimal point position for the Prime Variable analogue output as it is displayed on the Front-panel digital readout. The number entered must lie within the range 0 to 4 and will position the decimal point according to the table shown below:-

DIGIT 1 (M.S)	DISPLAY FORMAT
0	9 9 9 9
1	9 9 9.9
2	9 9.9 9
3	9.9 9 9
4	.9 9 9 9

Once the Channel 1 decimal point position has been programmed the resulting display format will appear on the Hand-held terminal for every Command function that is related to the Prime Variable range of that output channel. This means in fact that all of the Format 1 commands listed in Table 4.6 will be displayed with the same decimal point position as for the Prime Variable, viz:-

HR, LR, HO, LO, OP

b) Digit B

This is unallocated and reads back as zero.

c) Digit C

This is unallocated and reads back as zero.

d) Status bits (digit D)

The fourth or least-significant digit of ST is used as four separate bits for status information as follows:-

i) Bit 3

This bit is automatically set to a logic 1 by the CPU whenever a sumcheck failure is detected on any of the command parameters associated with the selected channel. The diagnostic messages generated on the front panel and the indications via the serial data links are described in Section 2.6.2 d). This condition is rectified by re-entering any corrupted channel command parameters and re-setting bit 3 to logic 0.

ii) Bit 2

This bit is unallocated and reads back as zero.

iii) Bit 1

When this bit is set to a logic "1" via the 8260 Hand-held terminal or RS422 data link it inhibits the Operator from using the Raise or Lower buttons to alter the value of the HO or LO command parameters in conjunction with the PAR button in Secondary Display format (see Section 3.3.2 b) (i)).

iv) Bit 0

When this bit is set to a logic "0" the Prime Variable analogue output is treated as being a signal in the range 0-10V. When this bit is set to a logic "1" the input is treated as being a signal in the range 1-5V.

4.5.2 HR, LR - Prime Variable Output Ranging

These parameters define, in Engineering Units, the span of the Prime Variable output, OP. The value entered in HR is equivalent to an output of 10V when ST bit 0 is at logic "0", or 5V when ST bit 0 is at logic "1". Similarly LR is equivalent to an output of 0V when ST bit 0 is at logic "0", or 1V when ST bit 0 is at logic "1". The range of values is -9999 to +9999 and HR must be greater than LR. The decimal point position for both of these parameters is programmed by digit A of the ST parameter as described in Section 4.5.1 a).

4.5.3 HO, LO - Prime Variable Output Limits

The HO and LO limit parameters restrict the range over which the Prime Variable Output parameter, OP can vary. They operate on OP whether it is being varied by the Raise/Lower buttons or serial links. The range of HO and LO are the same as the Prime Variable, i.e. LR to HR, and HO must be greater than LO. Table 4.6 shows that the decimal point position for HO and LO is the same as for OP, i.e. it is programmed by digit A of the ST parameter as described in Section 4.5.1 a).

The values of HO and LO may be altered by means of the PAR and Raise/Lower buttons in secondary display format as described in Section 3.3.2 b) i), provided that bit 1 of the ST parameter is not set (see section 4.5.1 d) (iii)).

4.5.4 OP - Prime Variable

Table 4.6 shows that the OP parameter is the current value of the analogue output channel expressed in Engineering Units over the range LR to HR. The decimal point position is programmed by digit A of the ST parameter as described in Section 4.5.1 a). The OP value is always displayed on the digital readout in the Primary or Secondary display formats and it is always constrained to lie within the limits defined by LO and HO as described in Section 4.5.3. The value of OP may be altered by means of the PAR and Raise/Lower buttons in Primary display format as described in Section 3.3.2 a) (ii), or via the Hand-held terminal or RS 422 supervisory data link.

It should be noted that a fixed value of OP can be obtained by setting the HO and LO parameters equal to the desired level. An operator is then inhibited from changing OP by means of the front panel push buttons.

COMMAND MNEMONIC	COMMAND PARAMETER FUNCTION	UNITS	FORMAT	PARAMETER TYPE
CN(1)	Block/Channel number	-	6	
ST	Block status	-	5	Digital
AM	Alarm masking bits	-	5	Input
DS	Digital Input states	-	5	channels
1T(2)	Channel Tag characters 1-4	ASCII	8	Channel Tag
2T(2)	Channel Tag characters 5-8	ASCII	8	names

TABLE 4.7 List of Digital Input Block Command Parameters and their respective mnemonics

NOTES

(1) CN does not appear in the parameter list when accessing parameters via the serial data link.

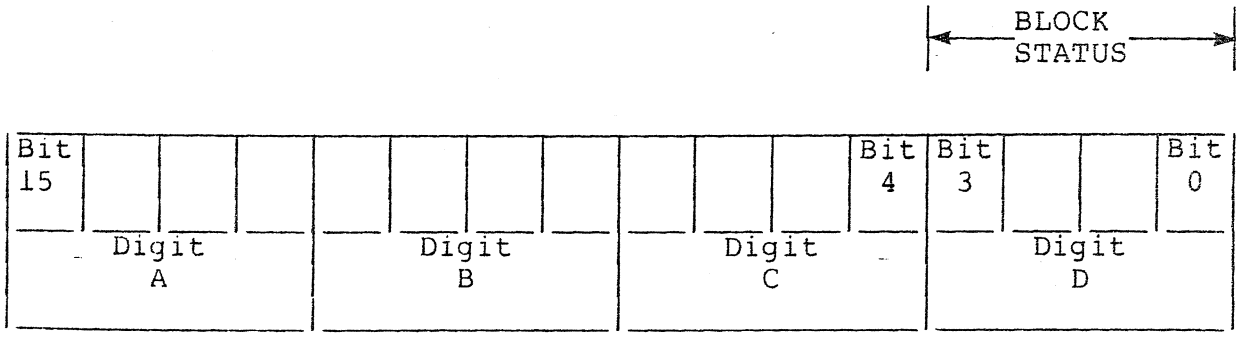
(2) The 1T and 2T Channel Tag characters do not appear when the parameter list is scrolled via the (W ↓) command of the 8260 Hand-held terminal. Instead, they must be accessed individually by first using the ?? CMD prompt once the required Block and Channel number (CN) has been selected previously. (see Section 4.8)

4.6 Digital Input Block Command Parameters

The list of the 4 Block Command Parameters associated with an 8 channel Digital Input Board is given in Table 4.7. It should be noted that these parameters are associated with the complete 8 channel block and read back the same for all of the 8 channels with the exception of the Tag parameters 1T and 2T. The means of accessing the parameters via the Hand-held terminal is given in Section 4.2.3, and detailed descriptions of each of them are given in the following sections.

4.6.1 ST - Block Status

The Block Status parameter, ST, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. Only 1 bit of the ST parameters is used to provide status information in the format given below:-



DIGIT	BIT	FUNCTION
A	12-15	Unallocated
B	8-11	Unallocated
C	4-7	Unallocated
	3	I/O block parameters sumcheck fail (0 = O.K.; 1 = fail)
D	2	Unallocated
	1	Unallocated
	0	Unallocated

The exact functions of the digits within the ST parameter are discussed in the following sections:-

a) Digit A

This is unallocated and reads back as zero.

b) Digit B

This is unallocated and reads back as zero.

c) Digit C

This is unallocated and reads back as zero.

d) Status bits (digit D)

The fourth or least-significant digit of ST is used as four separate bits for status information as follows:-

i) Bit 3

This bit is automatically set to a logic 1 by the CPU whenever a sumcheck failure is detected on any of the command parameters associated with the selected I/O block. The diagnostic messages generated on the front panel and the indications via the serial data links are described in Section 2.6.2 d). This condition is rectified by re-entering any corrupted block command parameters and re-setting bit 3 to logic 0.

ii) Bit 2

This bit is unallocated and reads back as zero.

iii) Bit 1

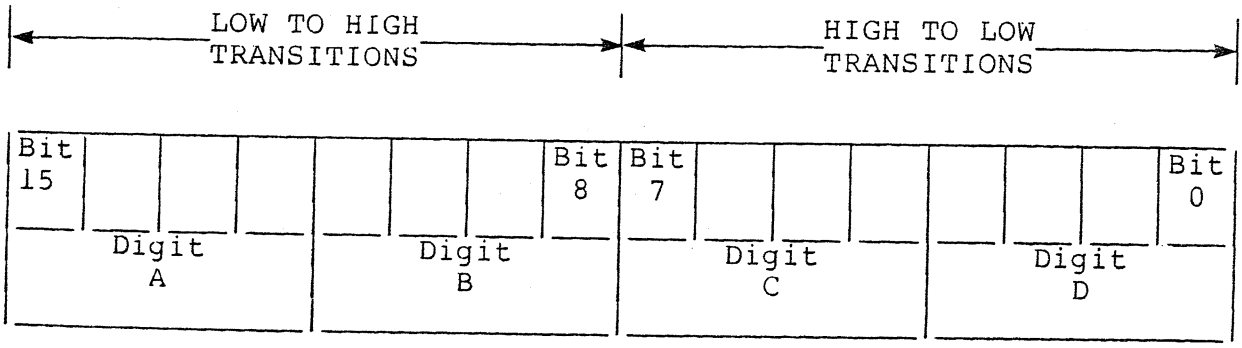
This bit is unallocated and reads back as zero.

iv) Bit 0

This bit is unallocated and reads back as zero.

4.6.2 AM - Alarm Mask

The Alarm Masking Parameter, AM, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. The function of the AM parameter is to determine which logic state transition of each digital input channel will generate an alarm condition. The format of the AM parameter is given below:-



DIGIT	BIT	CHANNEL	FUNCTION
A	15	1	Low to High transition Alarm mask. (0 = disable alarm; 1 = enable alarm)
	14	2	
	13	3	
	12	4	
B	11	5	
	10	6	
	9	7	
	8	8	
C	7	1	High to Low transition Alarm mask. (0 = disable alarm; 1 = enable alarm)
	6	2	
	5	3	
	4	4	
D	3	5	
	2	6	
	1	7	
	0	8	

The exact function of the individual digits within the AM parameter are described in the following sections:-

a) Low to High transition Alarm mask (digits A, B)

Each bit of digits A and B is set to a logic "1" when it is required that the corresponding digital input signal generates an alarm condition when it changes from the low state to the high state. The most-significant bit of digit A corresponds to the channel 1 digital input and the least-significant bit of digit B corresponds to the channel 8 digital input and so on. The alarm condition will be indicated by flashing the appropriate upper row LED and the common alarm LED in the ALM button, unless the channel alarm is set for automatic acknowledgement (see Section 4.3.6).

An acknowledged alarm will go steady but if the input returns to the low level first then the lower row LED will go steady leaving the upper row LED flashing in anti-phase with the common alarm LED. Subsequent acknowledgement will extinguish the upper row LED.

b) High to Low transition Alarm mask (digits C, D)

Each bit of digits C and D is set to a logic "1" when it is required that the corresponding digital input signal generates an alarm condition when it changes from the high state to the low state. The most-significant bit of digit C corresponds to the channel 1 digital input and the least-significant bit of digit D corresponds to the channel 8 digital input and so on. The alarm conditions are indicated in the same way as described in (a) above except that they occur on high to low going transitions of the selected digital input channels.

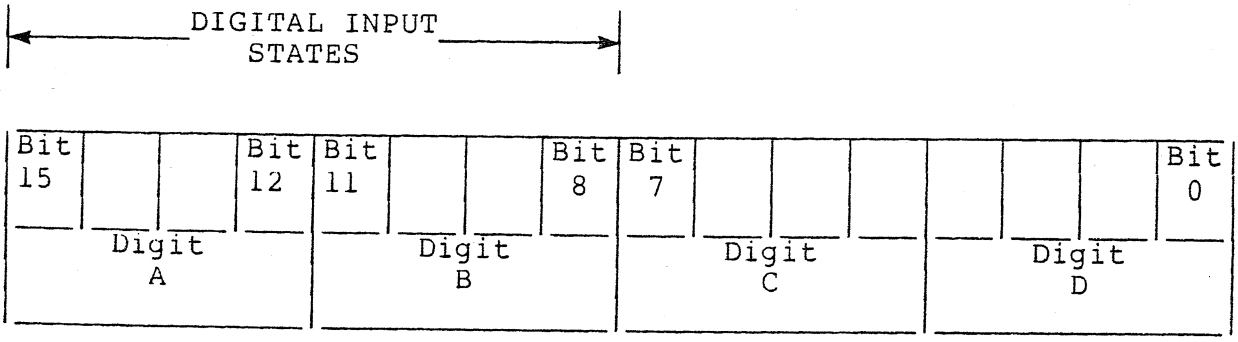
The AM parameter may be displayed on the Front-panel alphanumeric display in the Secondary Display format as described in Section 3.3.3 b) (i), but its value can only be changed via the Hand-held terminal or serial data link.

The following examples illustrate the use of the AM Command parameter:-

AM > 0000	-	this inhibits any alarms ever being generated by the digital input channels.
AM > 8000	-	this generates an alarm when the Channel 1 digital input changes from the low to the high state.
AM > 0080	-	this generates an alarm when the Channel 1 digital input changes from the high to the low state.
AM > 8080	-	this generates an alarm every time the Channel 1 digital input changes state.

4.6.3 DS - Digital Input states

The Digital Input States parameter, DS, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FF00 with a positive sign character for parameter entry. DS is a read-only parameter and the two most-significant digits indicate the logic states of the digital inputs in the format given below:-



DIGIT	BIT	CHANNEL	FUNCTION
A	15	1	Digital Input States (0 = 0V; 1 = 15V)
	14	2	
	13	3	
	12	4	
B	11	5	
	10	6	
	9	7	
	8	8	
C	4-7		Unallocated
D	0-3		Unallocated

The exact functions of the individual digits within the DS parameter are described in the following sections:-

a) Digital Input States (digits A, B)

Each bit of digit A and B is used to indicate the current state of all 8 channels of the digital input Block. The most-significant bit of digit A represents the channel 1 input state and the least-significant bit of digit B represents the channel 8 input state and so on. These 8 input states are also continuously displayed on the two rows of LED's in either the Primary or Secondary display formats as described in Section 3.3.3 a) (iii) and (iv) and 3.3.3 b) (iii) and (iv). This is illustrated in the following example where the LED pattern is as shown below:-

CHANNEL	:-	1	2	3	4	5	6	7	8
UPPER LEDs	:-	ON	OFF	ON	ON	OFF	ON	ON	OFF
LOWER LEDs	:-	OFF	ON	OFF	OFF	ON	OFF	OFF	ON

This would correspond to a DS parameter reading:-

DS > B600

The LED's can be made to flash on input state changes depending upon the setting of the Alarm Masking parameter, AM as described in Section 4.6.2. The DS parameter cannot be displayed on the Front-panel alphanumeric display but it may be accessed via the Hand-held terminal or serial data link.

b) Digit C

This is unallocated and reads back as zero.

c) Digit D

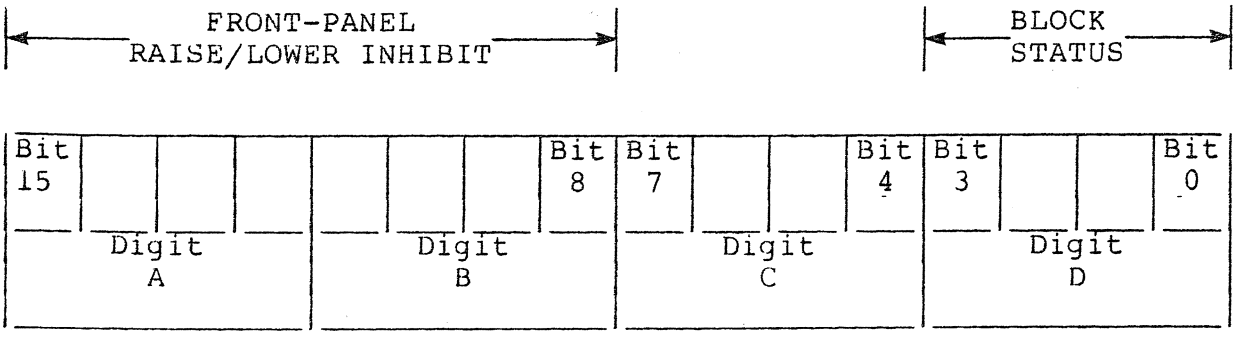
This is unallocated and reads back as zero.

4.7 Digital Output Block Command Parameters

The list of the 4 Block Command Parameters associated with an 8 channel Digital Output Board is given in Table 4.8. It should be noted that these parameters are associated with the complete 8 channel block and read back the same for all of the 8 channels with the exception of the Tag parameters 1T and 2T. The means of accessing the parameters via the Hand-held terminal is given in Section 4.2.3, and detailed descriptions of each of them are given in the following sections.

4.7.1 ST - Block Status

The Block Status parameter, ST, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. The ST parameter is used to inhibit output state changes and to provide status information in the format given below:-



DIGIT	BIT	CHANNEL	FUNCTION
A	15	1	Front Panel Raise/Lower inhibit (0 = enable; 1 = inhibit)
	14	2	
	13	3	
	12	4	
B	11	5	
	10	6	
	9	7	
	8	8	
C	4-7		Unallocated
	3		I/O block parameters sumcheck fail (0 = O.K.; 1 = fail)
D	2		Unallocated
	1		Unallocated
	0		Unallocated

COMMAND MNEMONIC	COMMAND PARAMETER FUNCTION	UNITS	FORMAT	PARAMETER TYPE
CN(1)	Block/Channel number	-	6	
ST	Block status	-	5	Digital
AM	Alarm masking bits	-	5	Output
DS	Digital Output states and enable bits	-	5	channels
1T(2)	Channel Tag characters 1-4	ASCII	8	Channel Tag
2T(2)	Channel Tag characters 5-8	ASCII	8	names

TABLE 4.8 List of Digital Output Block Command Parameters and their respective mnemonics

NOTES

(1) CN does not appear in the parameter list when accessing parameters via the serial data link.

(2) The 1T and 2T Channel Tag characters do not appear when the parameter list is scrolled via the (W ↓) command of the 8260 Hand-held terminal. Instead, they must be accessed individually by first using the ?? CMD prompt once the required Block and Channel number (CN) has been selected previously. (see Section 4.8)

The exact functions of the digits within the ST parameter are discussed in the following sections:-

a) Front Panel Raise/Lower inhibit (digits A, B)

Each bit of digit A and B is set to a logic "1" when it is required to inhibit an operator from changing the output state of the corresponding digital output channel by means of the Raise/Lower buttons. The most-significant bit of digit A corresponds to the channel 1 output and the least-significant bit of digit B corresponds to channel 8 and so on. For example:-

ST > 3C00

enables channels 1,2,7 and 8 only to be set via the Front-panel Raise/Lower buttons as described in Section 3.3.4 a) (iii) and (iv).

It should be noted that whenever an analogue input alarm is routed to a digital output channel, (see Section 4.4.4) then the corresponding bit of the ST parameter is automatically set to a logic "1" and cannot be reset as long as the routing is present. For example if a digital output card is fitted in Slot 4, then:-

AR > 4142

for an analogue input channel forces:-

ST > C000

for the digital output Block as channels 1 and 2 are used for alarm routing.

b) Digit B

This is unallocated and reads back as zero.

c) Digit C

This is unallocated and reads back as zero.

d) Status bits (digit D)

The fourth or least-significant digit of ST is used as four separate bits for status information as follows:-

i) Bit 3

This bit is automatically set to a logic 1 by the CPU whenever a sumcheck failure is detected on any of the command parameters associated with the selected I/O block. The diagnostic messages generated on the front panel and the indications via the serial data links are described in Section 2.6.2 d). This condition is rectified by re-entering any corrupted block command parameters and re-setting bit 3 to logic 0.

ii) Bit 2

This bit is unallocated and reads back as zero.

iii) Bit 1

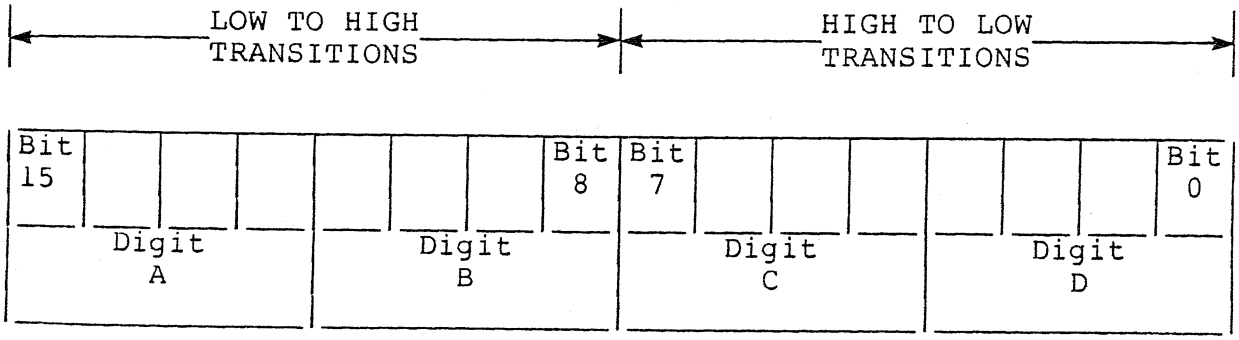
This bit is unallocated and reads back as zero.

iv) Bit 0

This bit is unallocated and reads back as zero.

4.7.2 AM - Alarm Mask

The Alarm Masking Parameter, AM, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. The function of the AM parameter is to determine which logic state transition of each digital output channel will generate an alarm condition. The format of the AM parameter is given below:-



DIGIT	BIT	CHANNEL	FUNCTION
A	15	1	Low to High transition Alarm mask. (0 = disable alarm; 1 = enable alarm)
	14	2	
	13	3	
	12	4	
B	11	5	
	10	6	
	9	7	
	8	8	
C	7	1	High to Low transition Alarm mask. (0 = disable alarm; 1 = enable alarm)
	6	2	
	5	3	
	4	4	
D	3	5	
	2	6	
	1	7	
	0	8	

These alarm facilities on the change of state of a digital output have been provided because the output may represent a comparison of a function of two input variables against a limit. The two input variables may not exceed alarm limits, but the calculated function may exceed a limit and this occurence may possibly require a re-transmitted digital alarm state.

The exact function of the individual digits within the AM parameter are described in the following sections:-

a) Low to High transition Alarm mask (digits A, B)

Each bit of digits A and B is set to a logic "1" when it is required that the corresponding digital output signal generates an alarm condition when it changes from the low state to the high state. The most-significant bit of digit A corresponds to the channel 1 digital output and the least-significant bit of digit B corresponds to the channel 8 digital output and so on. The alarm condition will be indicated by flashing the appropriate upper row LED and the common alarm LED in the ALM button, unless the channel alarm is set for automatic acknowledgement (see Section 4.3.6).

An acknowledged alarm will go steady but if the output returns to the low level first then the lower row LED will go steady leaving the upper row LED flashing in anti-phase with the common alarm LED. Subsequent acknowledgement will extinguish the upper row LED.

b) High to Low transition Alarm mask (digits C, D)

Each bit of digits C and D is set to a logic "1" when it is required that the corresponding digital output signal generates an alarm condition when it changes from the high state to the low state. The most-significant bit of digit C corresponds to the channel 1 digital output and the least-significant bit of digit D corresponds to the channel 8 digital output and so on. The alarm conditions are indicated in the same way as described in a) above except that they occur on high to low going transitions of the selected digital output channels.

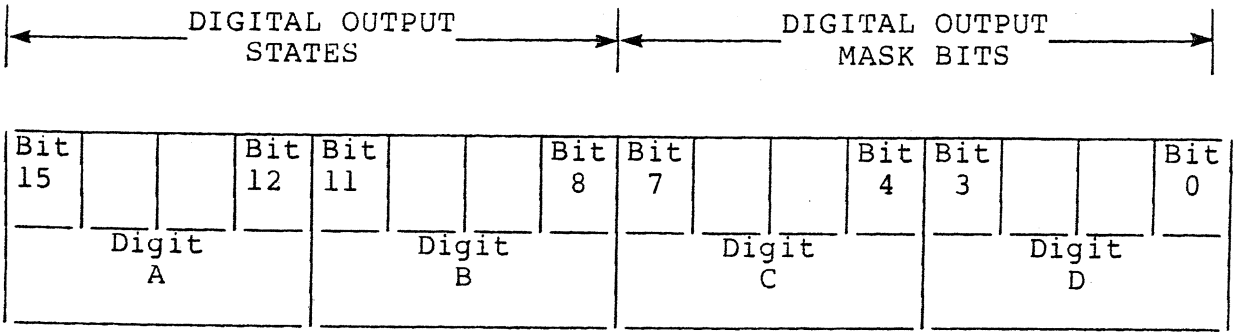
The AM parameter may be displayed on the Front-panel alphanumeric display in the Secondary Display format as described in Section 3.3.4 b) (i), but its value can only be changed via the Hand-held terminal or serial data link.

The following examples illustrate the use of the AM Command parameter:-

AM > 0000	-	this inhibits any alarms ever being generated by the digital output channels.
AM > 8000	-	this generates an alarm when the Channel 1 digital output changes from the low to the high state.
AM > 0080	-	this generates an alarm when the Channel 1 digital output changes from the high to the low state.
AM > 8080	-	this generates an alarm every time the Channel 1 digital output changes state.

4.7.3 DS - Digital Output states

The Digital Output States parameter, DS, is of the format 5 type and consists of 4 hexadecimal digits in the range 0000 to FFFF with a positive sign character for parameter entry. The two most-significant digits of the DS parameter are read-only and indicate the logic states of the digital outputs. The two least-significant digits hold individual mask bits for each output bit in the format given below:-



DIGIT	BIT	CHANNEL	FUNCTION
A	15	1	Digital Output States (0 = 0V; 1 = 15V)
	14	2	
	13	3	
	12	4	
B	11	5	
	10	6	
	9	7	
	8	8	
C	7	1	Digital Output mask bits (0 = enable; 1 = mask)
	6	2	
	5	3	
	4	4	
D	3	5	
	2	6	
	1	7	
	0	8	

The exact functions of the individual digits within the DS parameter are described in the following sections:-

a) Digital Output States (digits A, B)

Each bit of digit A and B is used to indicate the current state of all 8 channels of the digital output Block. The most-significant bit of digit A represents the channel 1 output state and the least-significant bit of digit B represents the channel 8 output state and so on. These 8 output states are also continuously displayed on the two rows of LED's in either the Primary or Secondary display formats as described in Section 3.3.4 a) (iii) and (iv) and 3.3.4 b) (iii) and (iv). This is illustrated in the following example where the LED pattern is as shown below:-

CHANNEL	:-	1	2	3	4	5	6	7	8
UPPER LEDs	:-	ON	OFF	ON	ON	OFF	ON	ON	OFF
LOWER LEDs	:-	OFF	ON	OFF	OFF	ON	OFF	OFF	ON

This would correspond to a DS parameter reading:-

DS > B600

The LED's can be made to flash on output state changes depending upon the setting of the Alarm Masking parameter, AM as described in Section 4.7.2.

It is possible to change the states of the digital outputs by means of the Front-panel Raise/Lower buttons in conjunction with the PAR button in Primary Display format as described in Sections 3.3.4 a) (iii) and (iv). Each bit can only be altered via the Front-panel if the corresponding enable bit is set in digit A or B of the ST parameter as described in Section 4.7.1 a). Furthermore each bit can only be altered via the Front-panel, Hand-held terminal or RS 422 data link if the corresponding mask bit is set in digit C or D of the DS parameter as described in Section 4.7.3 b).

It should be noted that whenever an analogue input alarm is routed to a digital output channel (see Section 4.4.4), then that output will be automatically set to logic "1" and only fall to logic "0" when the analogue input is in alarm. It cannot then be altered via the Front-panel Raise/Lower buttons, Hand-held terminal, or serial data link while the alarm routing is present.

b) Digital Output Mask Bits (digits C, D)

Each bit of digit C and D of the DS parameter is used to hold individual mask bits for each corresponding digital output. To enable any of the 8 output bits to be changed via the 8260 Hand-held terminal or RS 422 data link the corresponding mask bit must be set to logic "0". When the mask bit is set to logic "1" the corresponding digital output bit cannot have its state changed. This is illustrated by the following examples:-

Action		DS Parameter data entry	Previous DS Output State	Resultant DS Output State
(i)	Set L.S. bit	0100	00	01
(ii)	Inhibit L.S. bit	0101	00	00
(iii)	Set M.S. bit	8000	00	80
(iv)	Inhibit M.S. bit	8080	00	00
(v)	Set M.S. bit only (all others inhibited)	FF7F	00	80

4.8 1T, 2T - Channel Tag Characters

Section 3.2.1 a) (ii) describes how the address/identity display can be used to display an 8 character label to identify each of the 64 input/output channels when S2 no. 4 is ON. These 8 character labels or tags can consist of any combination of the 64 character ASCII set, i.e. numerals 0-9, upper case letters A-Z, plus 28 other symbols. Typical examples of such tags would be:-

FIC 001
PUMP 2
ZONE 5
CU.M/HR etc

The 1T and 2T channel tag parameters are used to enter the first 4 and last 4 characters respectively of these tags into the memory of the 6433 Programmable Signal Processor. The means of accessing the channel tag parameters depends upon whether the 8260 Hand-held terminal or serial data link is being used as follows:-

4.8.1 1T, 2T Access via the 8260 Hand-held terminal

When setting up the 1T and 2T parameters via the 8260 Hand-held terminal it should be noted that they cannot be accessed by scrolling (W) through the parameter list of any of the input/output channels. Instead, the following procedure must be adopted:-

a) Select the required input/output channel for front-panel display be means of the appropriate CN parameter entry (see section 4.2.3)

b) Re-initialise the terminal by means of the Z key (Z?), so that the 6433 issues the usual prompt:-

?? CMD

c) Enter the first half of the 8 characters tag name by specifying the 1T mnemonic.

d) The 6433 will respond with 1T followed by the first 4 characters of the existing tag name. At this stage the user must enter four ASCII characters to complete the data entry.

e) After entering the fourth character the 6433 will clear the 8260 terminal display and issue the prompt:-

?? CMD

The 4 characters entered at step c) will now appear in the left hand half of the alphanumeric display.

f) Enter the second half of the 8 character tag name by specifying the 2T mnemonic.

g) The 6433 will respond with 2T followed by the last 4 characters of the existing tag name. At this stage the user must enter four ASCII characters to complete the data entry as described in step d) above.

NOTES

1) When entering all other parameters via the 8260 terminal, some of the keys have specific functions, e.g. Q is the back-space key, W is the scroll mode key etc. (See the System 6000 Communications Handbook section 3.5). However, when 1T or 2T are being entered these functions are disabled so that all the alphanumeric characters are available for the tag fields. This means that once the 1T and 2T parameters are started, they must be completed or can only be aborted by pulling out the 8260 terminal plug.

2) It is often required to programme non alphanumeric characters like spaces or asterisks within a tag field. The 8260 keyboard layout of Fig 4. shows that these are not normally available. However, if the SHIFT key is pressed an additional set of shift mode characters are available as illustrated by the keyboard overlay shown in Fig 4.2. Additional information on the shift mode is given in Section 2.4 of the System 6000 Communications Handbook.

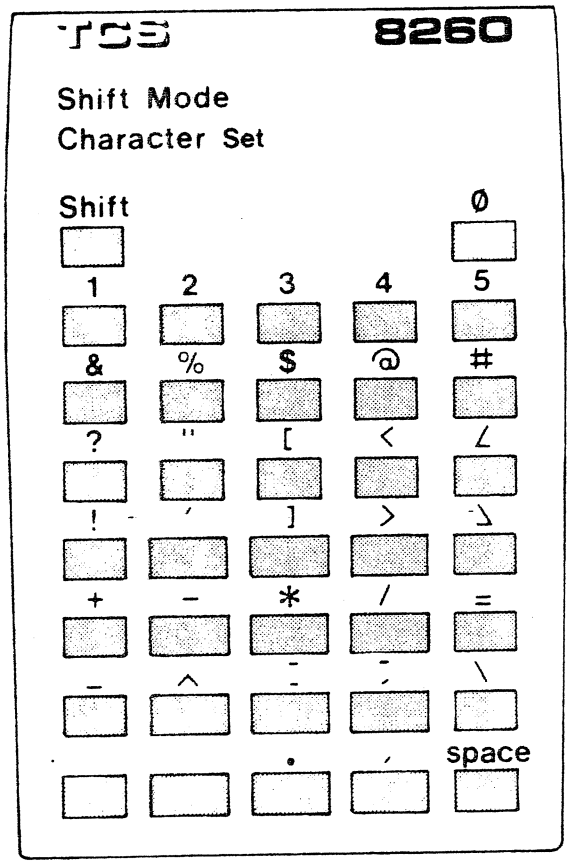


FIG. 4.2 SHIFT MODE CHARACTER SET KEYBOARD OVERLAY

4.8.2 1T, 2T Access via the RS 422 Supervisory Link

The exact means of access of the Channel Tag parameters via the RS 422 supervisory link depends upon whether the ASCII or binary modes of the communications protocol are employed as follows:-

a) ASCII Mode Protocol (S1 no. 5 - OFF)

The 1T or 2T parameters of any input/output channel may be polled or updated in the same manner as any other parameter discussed in Section 5 of the System 6000 Communications Handbook. It therefore follows that the 1T or 2T parameters of consecutive channels in the same block may also be accessed via the Scroll-mode facility (ACK) during a Poll or Select sequence. This may be demonstrated by the following example:-

Block 1, Channel 1 tag = PUMP ONE

Block 1, Channel 2 tag = OIL FLOW

Block 1, Channel 3 tag = ZONE TWO

If the previous command parameter polled was:-

11T'PUMP - 1T parameter of Channel 1

then after an ACK response the 6433 replies:-

21T'OIL - 1T parameter of Channel 2

while a second ACK response elicits:-

31T'ZONE - 1T parameter of Channel 3

It should be noted that 1T and 2T are format 8 parameters so that the 5 character "D" field in the Poll or Select Message Transfer Procedure are as follows:-

(i) D1

The first character is always ' - a single quotation mark (hex 27) to denote an ASCII parameter.

(ii) D2 - D5

The last 4 characters are any combination of the 64 character ASCII set with hexadecimal equivalents from 20 to 5F inclusive.

b) Binary Mode Protocol (S1 no. 5 - ON)

With the Binary mode of the protocol ASCII characters are transmitted as two 8 bit pairs which may be illustrated by the following example:-

Block 1, Channel 1 tag = ABCDEFGH

This would be split up into 8 bit pairs as follows:-

T1 = AB; T2 = CD;

T3 = EF; T4 = GH;

- and these are shown in the 6433 parameter number (PNO) Tables 5.1 to 5.8 inclusive.

Using the same tag field as in the above example, the corresponding 1T and 2T parameters for the ASCII mode of the protocol would be as follows:-

1T = ABCD

2T = EFGH

Thus it can be deduced that the relationship between the tag character fields for the two protocol modes is as follows:-

1T = T1 + T2

2T = T3 + T4

Section 5 Computer Supervision of 6433 Programmable Signal Processors

In common with all System 6000 instruments the 6433 Programmable Signal Processor is fitted with 2 ports for serial data communications. The first of these is the RS232 port available on the front-panel which is used for connection of the 8260 Hand-held terminal as described in Section 4, or a BBC microcomputer as described in the 6433 User Manual. This port allows local operators to communicate on a one-to-one basis when entering the Command Parameters which are used to characterise the 6433 for a particular application.

The second communications port is an RS422 serial interface available on the module rear connector pins 45 to 48 inclusive. The RS422 ports of a number of 6433 instruments may be bussed onto a supervisory data link connected to a remote Supervisory Computer or other intelligent device. This bus structure then allows the Supervisory Computer to monitor or update the Command Parameters of a whole network of 6433's and other System 6000 instruments. As the means of implementing the Supervisory link are common to all System 6000 instruments, these are described in other TCS documents as follows:-

5.1 Serial Data Bus Hardware Installation

A full definition of the RS422 transmission standards are given in Section 7 of the System 6000 Installation Guide together with a discussion of:-

a) Interface connections.

b) Cable impedance and termination.

c) Interface signal polarity.

5.2 Serial Data Transmission

Section 2.3.2 a) briefly mentions the role of Switch bank S1 in setting up the RS422 baud rate and Group Identifier (GID). A more complete description is given in Section 4 of the System 6000 Communications Handbook together with a discussion of:-

a) RS422 characteristics and technical specification.

b) Serial data transmission.

c) Binary Synchronous Communications Data Link Control.

d) Instrument Group and Unit addressing.

		0	1	2	3	4	5	6	7
	0	II	S1	A1	S2	A2	S3	A3	S4
	8	A4	SW	MD					
CHAN 1	16	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 2	24	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 3	32	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 4	40	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 5	48	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 6	56	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 7	64	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 8	72	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.1 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for Analogue Input Boards

5.3 Communication Protocols

All data transfers between the 6433 and a Supervisory Computer via the RS422 data link are carried out using a communications protocol. TCS has chosen an ANSI standard protocol called BISYNC (Binary Synchronous) for System 6000 instruments and this is known by the abbreviation X3.28. The 6433 Programmmable Signal Processor can operate this protocol in either the ASCII or Binary mode depending upon the setting of S1 no. 5 (see Section 2.3.2 a) (iii)). A full definition of these two protocol modes may be found as follows:-

a) ASCII protocol

This is discussed in Section 5 of the System 6000 Communications Handbook, while the lists of ASCII Command Mnemonics are given in Tables 4.2, 4.3, 4.6, 4.7 and 4.8 of this manual.

b) Binary Protocol

This is discussed in Section 6 of the System 6000 Communications Handbook, while the associated lists of Parameter Numbers are given in Tables 5.1 to 5.8 inclusive of this manual.

NOTES

The following points should be noted with regards to tables 5.1 to 5.8 inclusive:-

(*) Only those parameters marked (*) are available with Enquiry Polling.

(1) Channel Tag Characters

As described in Section 4.8 it should be noted that for each Channel:-

$$1T = T1 + T2$$

and

$$2T = T3 + T4$$

Instrument Parameters

a) It can be seen from Tables 5.1 to 5.4 inclusive that II, SW, MD and those Instrument parameters relating to the real Input/Output Blocks can be accessed from each of the 4 types.

b) It can be seen from Tables 5.5 to 5.8 inclusive that II, SW, MD and those Instrument parameters relating to the pseudo-Input/Output Blocks can be accessed from each of the 4 types.

		0	1	2	3	4	5	6	7
	0	II	S1	A1	S2	A2	S3	A3	S4
	8	A4	SW	MD	C1	C2	C3	C4	
CHAN 1	16	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 2	24	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 3	32	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 4	40	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 5	48	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 6	56	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 7	64	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 8	72	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.2 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for Analogue Output Boards

		0	1	2	3	4	5	6	7
	0	II	S1	A1	S2	A2	S3	A3	S4
	8	A4	SW	MD	C1	C2	C3	C4	
CHAN 1-8	16	(*) ST	(*) AM	(*) DS					
	24								
	32								
	40								
	48								
	56								
	64								
	72								
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.3 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for Digital Input Boards

		0	1	2	3	4	5	6	7
	0	II	S1	A1	S2	A2	S3	A3	S4
	8	A4	SW	MD	C5	C6	C7	C8	
CHAN 1-8	16	(*) ST	(*) AM	(*) DS					
	24								
	32								
	40								
	48								
	56								
	64								
	72								
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.4 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for Digital Output Boards

		0	1	2	3	4	5	6	7
	0	II	S5	A5	S6	A6	S7	A7	S8
	8	A8	SW	MD	C5	C6	C7	C8	
CHAN 1	16	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 2	24	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 3	32	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 4	40	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 5	48	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 6	56	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 7	64	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 8	72	(*) ST	(*) HR	(*) LR	(*) HA	(*) LA	(*) PV	(*) AR	
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.5 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for pseudo-Analogue Input Boards

		0	1	2	3	4	5	6	7
	0	II	S5	A5	S6	A6	S7	A7	S8
	8	A8	SW	MD	C5	C6	C7	C8	
CHAN 1	16	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 2	24	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 3	32	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 4	40	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 5	48	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 6	56	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 7	64	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 8	72	(*) ST	(*) HR	(*) LR	(*) OP	(*) HO	(*) LO		
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.6 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for pseudo-Analogue Output Boards

		0	1	2	3	4	5	6	7
	0	II	S5	A5	S6	A6	S7	A7	S8
	8	A8	SW	MD	C5	C6	C7	C8	
CHAN 1-8	16	(*) ST	(*) AM	(*) DS					
	24								
	32								
	40								
	48								
	56								
	64								
	72								
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

TABLE 5.7 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for pseudo-Digital Input Boards

		0	1	2	3	4	5	6	7
	0	II	S5	A5	S6	A6	S7	A7	S8
	8	A8	SW	MD	C5	C6	C7	C8	
CHAN 1-8	16	(*) ST	(*) AM	(*) DS					
	24								
	32								
	40								
	48								
	56								
	64								
	72								
CHAN 1-2	80	(1) T1	(1) T2	(1) T3	(1) T4	T1	T2	T3	T4
CHAN 3-4	88	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 5-6	96	T1	T2	T3	T4	T1	T2	T3	T4
CHAN 7-8	104	T1	T2	T3	T4	T1	T2	T3	T4

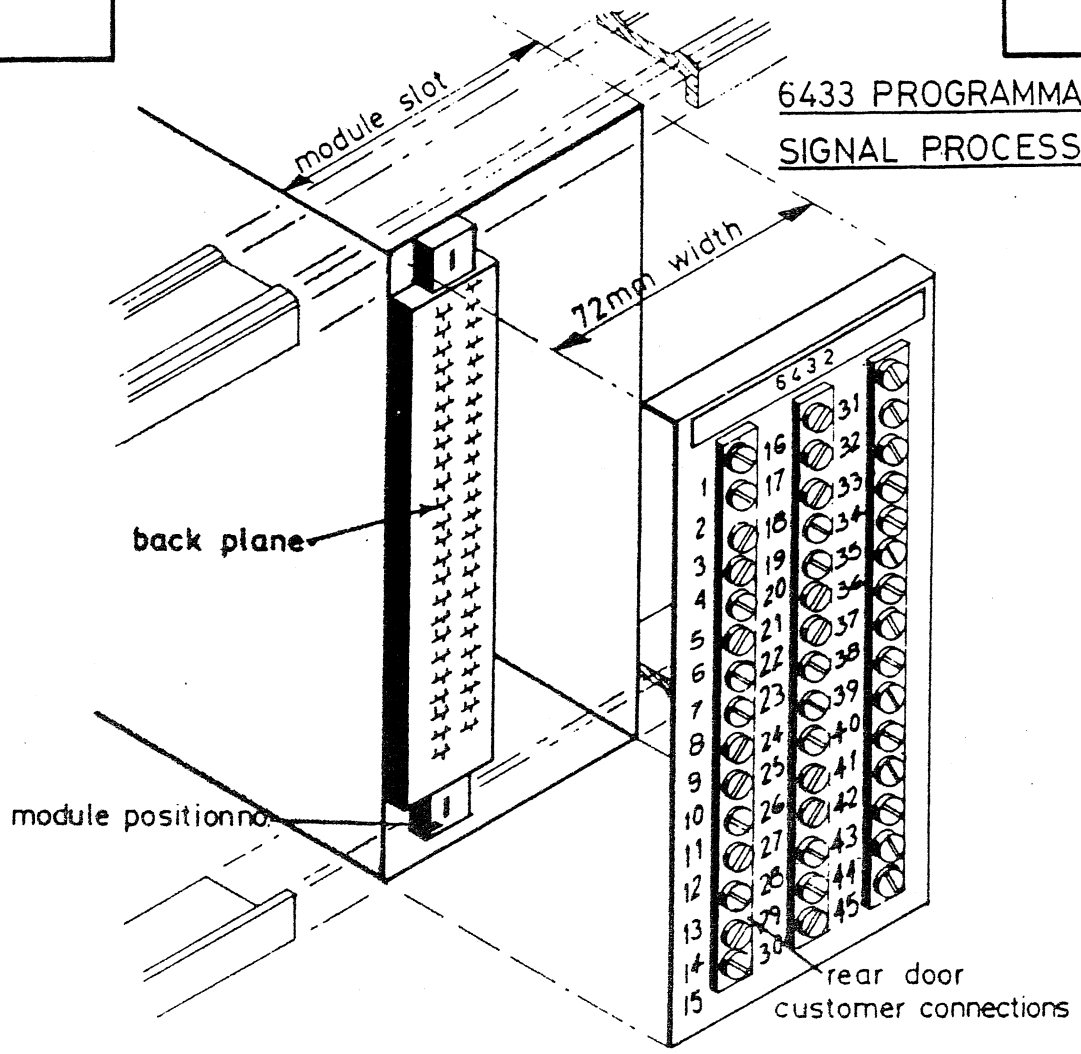
TABLE 5.8 List of 6433 Parameter Numbers, [PNO]s, and their respective mnemonics for pseudo-Digital Output Boards

Pin No.	Designation	Function	
1			
2	0VR	0V Reference	POWER SUPPLIES
3	0VP	0V Power	
4			
5			
6			
7			
8	DC SUPP.IN	DC Supply (20-30V) input	
9	W.DOG.OUT(1)	Watchdog Timer output	
10	CHN.1		
11	CHN.2		
12	CHN.3		
13	CHN.4	Input/Output Block 1	
14	CHN.5	Channels 1 to 8	
15	CHN.6		
16	CHN.7		
17	CHN.8		
18	CHN.1		
19	CHN.2		
20	CHN.3		
21	CHN.4	Input/Output Block 2	
22	CHN.5	Channels 1 to 8	
23	CHN.6		
24	CHN.7		
25	CHN.8		
26	CHN.1		
27	CHN.2		
28	CHN.3		
29	CHN.4	Input/Output Block 3	
30	CHN.5	Channels 1 to 8	
31	CHN.6		
32	CHN.7		
33	CHN.8		
34	CHN.1		
35	CHN.2		
36	CHN.3		
37	CHN.4	Input/Output Block 4	
38	CHN.5	Channels 1 to 8	
39	CHN.6		
40	CHN.7		
41	CHN.8		
42			
43			
44			
45	XMT.OUT(-)	Transmit Outputs	RS 422 SUPERVISORY SERIAL DATA BUS
46	XMT.OUT(+)		
47	RCV.IN(-)	Receive Inputs	
48	RCV.IN(+)		

	SIGNAL PROCESSOR																	
	6433																	
PIN NO	FUNCT	FROM	TO	FUNCT	FROM	TO	FUNCT	FROM	TO	FUNCT	FROM	TO	FUNCT	FROM	TO	FUNCT	FROM	TO
1																		
2	OVR																	
3	OVP																	
4																		
5																		
6																		
7	+15V OUT																	
8	DC SUP IN																	
9	W.DOG. OUT 1																	
10	BLK 1 CH 1																	
11	BLK 1 CH 2																	
12	BLK 1 CH 3																	
13	BLK 1 CH 4																	
14	BLK 1 CH 5																	
15	BLK 1 CH 6																	
16	BLK1 CH 7																	
17	BLK 1 CH 8																	
18	BLK 2 CH 1																	
19	BLK 2 CH 2																	
20	BLK 2 CH 3																	
21	BLK 2 CH 4																	
22	BLK 2 CH 5																	
23	BLK 2 CH 6																	
24	BLK 2 CH 7																	
25	BLK 2 CH 8																	
26	BLK 3 CH 1																	
27	BLK 3 CH 2																	
28	BLK 3 CH 3																	
29	BLK 3 CH 4																	
30	BLK 3 CH 5																	
31	BLK 3 CH 6																	
32	BLK 3 CH 7																	
33	BLK 3 CH 8																	
34	BLK 4 CH 1																	
35	BLK 4 CH 2																	
36	BLK 4 CH 3																	
37	BLK 4 CH 4																	
38	BLK 4 CH 5																	
39	BLK 4 CH 6																	
40	BLK 4 CH 7																	
41	BLK 4 CH 8																	
42																		
43																		
44																		
45	XMT OUT -																	
46	XMT OUT +																	
47	RCV IN -																	
48	RCV IN +																	

loop identifier

rack & module no.



The B6433 termination assembly consists of a 48 pin back plane connector with wire looms linking the module connections on the back plane to three rows of 15 customer terminals.

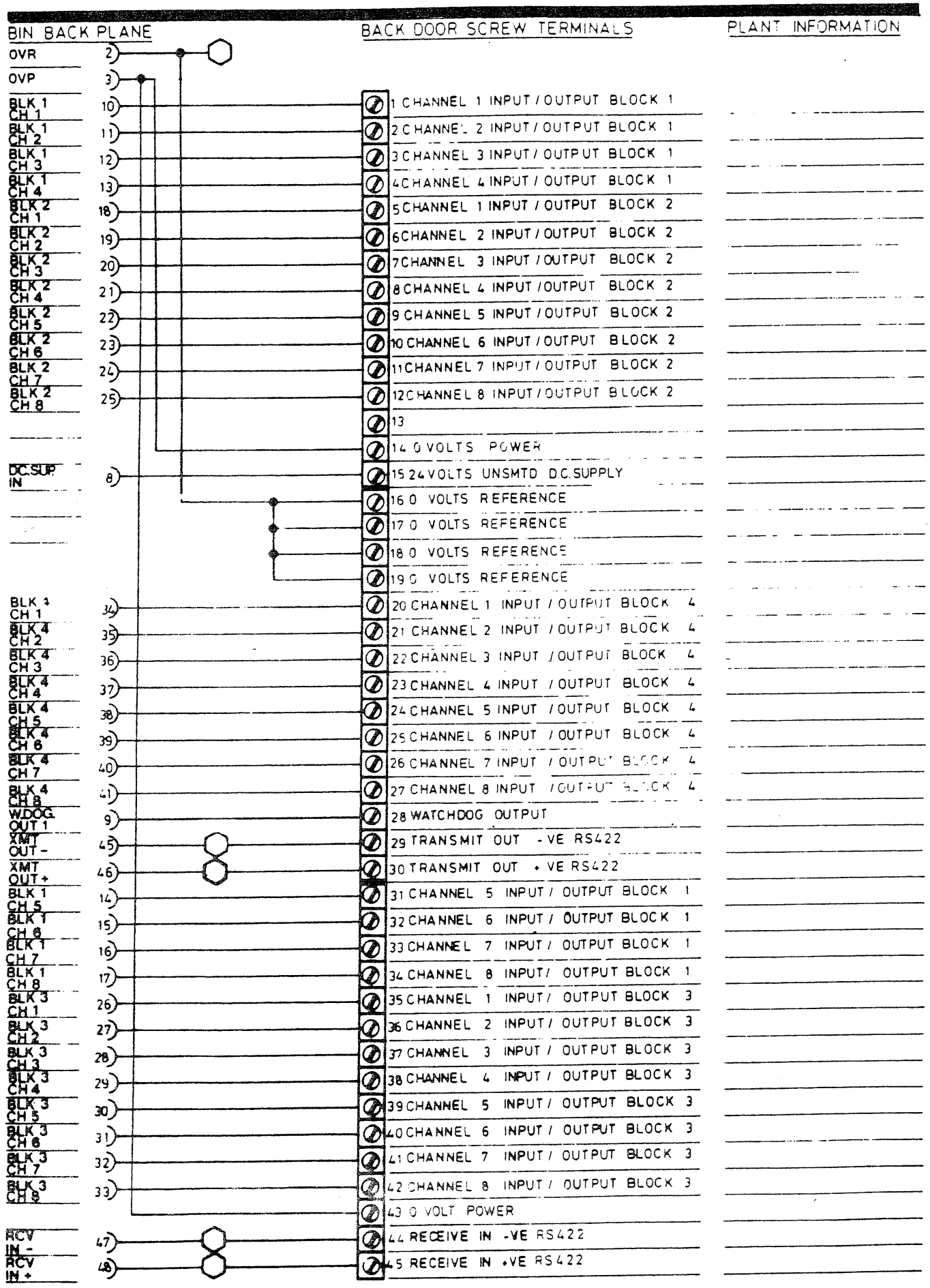
The assembly is used to mount 6433 signal processors into 7600 bin units and can only be ordered as part of a 7600 bin system.

Detailed technical and mechanical specifications can be found in the following documents :-

7600 Sales Literature
6433 Module data sheet
6433 Module technical manual

Turnbull Control Systems Limited
Broadwater Trading Estate Worthing Sussex BN14 8NW
Telephone Worthing (0903)205277
Telex 87437

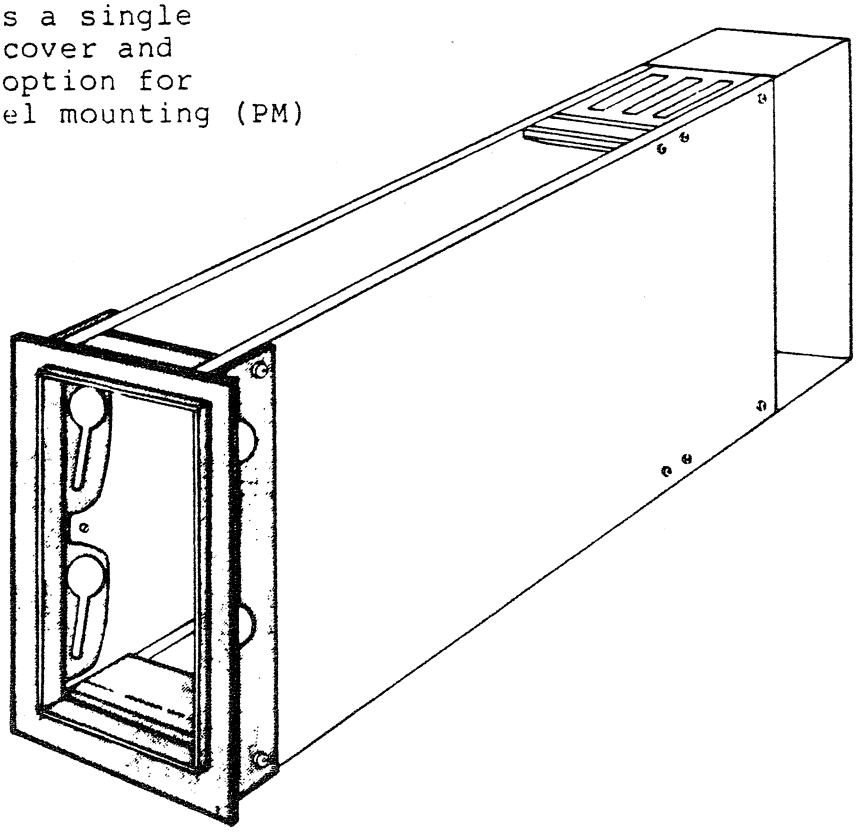
BIN INTERCONNECTIONS



⬡ THESE LINES MAY BE BUSED TO OTHER MODULES IN THE BIN

SINGLE OR MULTI-WAY SLEEVE ASSEMBLY FOR MICROPROCESSOR BASED INSTRUMENTATION

NOTE
Drawing shows a single sleeve with cover and gland plate option for standard panel mounting (PM)



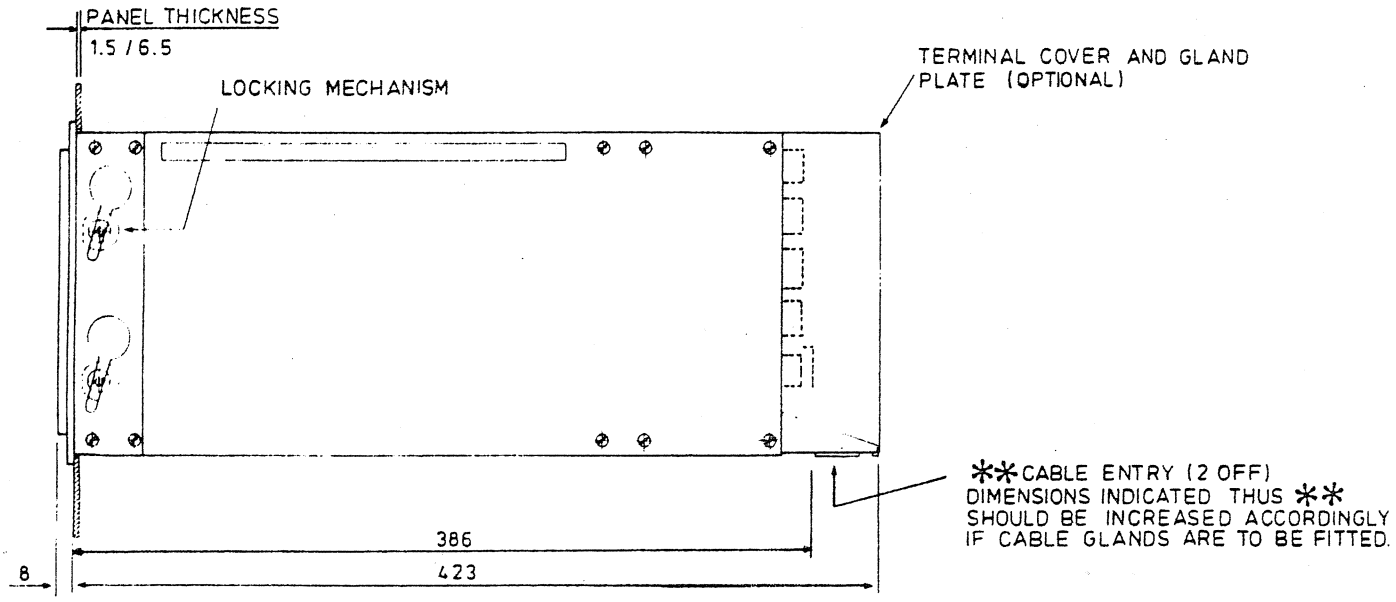
* Single, 3-way or 6-way panel mounting versions
* 6-way 19" rack mounting version
* all module connections available via screw terminals
* each module individually powered from 24V d.c. or mains

The 7900 assembly enables from 1 to 6 modules from the TCS System 6000 range of microprocessor based instruments to be panel or rack mounted in sleeves. Any combination of modules can be specified; 6350, 6351, 6352, 6353, 6358 and 6360 Controllers, 6432 and 6433 Signal Processors, 6434 Flow Totaliser and 6850 Programmer. Each instrument within the 7900 unit is individually powered via its own rear termination assembly, which also gives access to all the module connections.

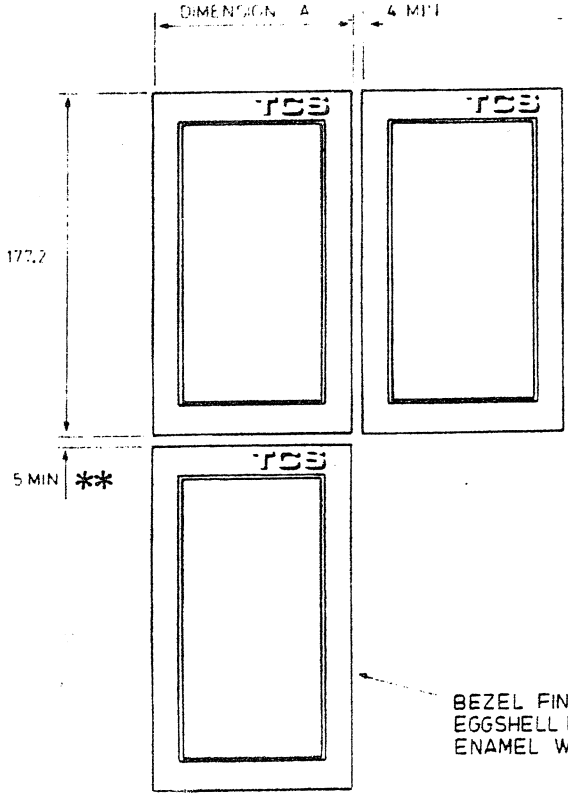
Turnbull Control Systems Limited
Broadwater Trading Estate Worthing Sussex BN14 8NW
Telephone Worthing (0903)205277
Telex 87437

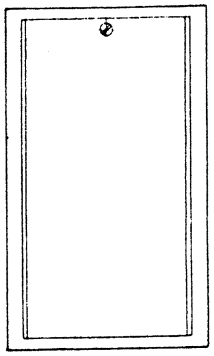
TECHNICAL SPECIFICATION

1) Installation Details for Panel Mounting Sleeves



SIDE VIEW





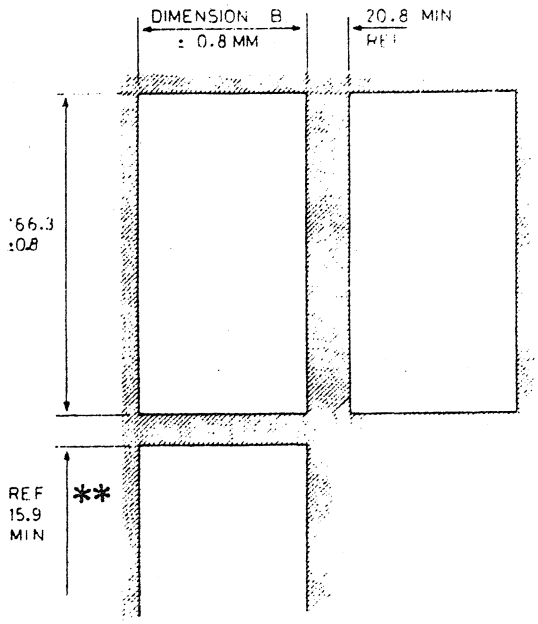
REAR VIEW

DIMENSION A	SLEEVE WIDTH
105	1-WAY
249	3-WAY
465	6-WAY

FRONT VIEW SHOWING OTHER POSSIBLE ADJACENT SLEEVES

2) Mounting Instructions

The dimensions of the various 7900 assemblies can be ascertained from the side and front view diagrams which also show the closest positioning of adjacent units. The diagram below gives the panel cut-out dimensions corresponding with the closest unit positioning.



DIMENSION B	SLEEVE WIDTH
88.2	1-WAY
232.2	3-WAY
448.2	6-WAY

PANEL CUT-OUT DETAILS

To position a 7900 assembly in a panel and subsequently mount a microprocessor based instrument within it, the following installation procedure is carried out:-

(i) Press an empty 7900 sleeve assembly firmly into the panel cut-out.

(ii) On the 1-way sleeves, insert the 2 locking mechanisms into the lower keyhole slots on either side and push them down as far as possible. On 3 and 6 way sleeves, fit locking mechanisms in all four positions.

(iii) Tighten the socket screw inside each locking mechanism in a clockwise direction using the 2.5 A/F Hex Key provided.

(iv) For the TPM option fit the locating spigot on the DIN clip into the slot on the side plates, with the face pressed against the rear of the panel then tighten the screw until the assembly is secure.

(v) Slide the instrument, with its own 72mm module sleeve firmly into the recess using the catch-handle to lock it into position.

(vi) The optional rear-terminal cover may be removed to allow wiring access for power-supply and plant connections which may be brought in via the 2 cable entry glands provided. Rear supporting is recommended especially on mains powered versions.

TECHNICAL SPECIFICATION

a) Length : 423mm with CGP option
: 386mm without CGP option

b) Width
(i) 1-Way PM or TPM : 105mm
(ii) 3-Way PM or TPM : 249mm
(iii) 6-Way PM or TPM : 465mm
(iv) 6-Way 19" RM : 482.6mm (19")

c) Height (all versions) : 177.2mm (7")

d) Panel cut-out dimensions
(i) 1-Way : 88.2 x 166.3 + 0.8mm
(ii) 3-Way : 232.2 x 166.3 + 0.8mm
(iii) 6-Way : 448.2 x 166.3 + 0.8mm

e) Panel thickness
(i) PM version : 1.5 to 6.5mm
(ii) TPM version : 6.5 to 24mm

f) Permissible mounting angle : Panel may slope from vertical by -45 to +90 degrees

g) Customer cable size : 0.5 to 1.5mm

h) Bezel finish : Eggshell black stove enamel with silver trim

i) Weight

	DC VERSION	MAINS VERSION
(i) 1-Way PM or TPM :	3.6Kg	4.3Kg
(ii) 3-Way PM or TPM :	8.4Kg	10.5Kg
(iii) 6-Way PM or TPM or RM :	15.6Kg	19.8Kg

DESCRIPTION	ORDER CODE
Single or Multi-way Sleeve Assembly	7900
Sleeve Width a) Single Sleeve or b) 3-Way Sleeve Panel Mounting or c) 6-Way Sleeve Panel Mounting or d) 6-Way Sleeve Rack Mounting or e) 1-Way Sleeve Thick Panel Mounting or f) 3-Way Sleeve Thick Panel Mounting or g) 6-Way Sleeve Thick Panel Mounting	 1-WAY PM 3-WAY PM 6-WAY PM 6-WAY 19" RM 1-WAY TPM 3-WAY TPM 6-WAY TPM
Supply Voltage a) 24V DC or b) 110V AC or c) 240V AC N.B. Multi-Way assemblies all have the same supply voltage	 24V 110V 240V
Rear door cover and gland plate option for the rear termination assemblies N.B. Option only applies to panel mounting assemblies	CGP

DESCRIPTION	ORDER CODE
Rear Termination Assemblies Specify which instrument is to fit into each sleeve position starting from the left-hand end (front view). Select from the following:-	
a) 6350 Process Controller	7350
or b) 6351 Incremental Controller	7351
or c) 6352 Bushing/Averaging Controller	7352
or d) 6353 Flow Controller	7353
or e) 6358 8-Loop Controller	7358
or f) 6360 Bar-Graph Process Controller	7360
or g) 6432 Signal Processor	7432
or h) 6433 Programmable Signal Processor	7433
or i) 6434 Flow Totaliser	7434
or j) 6850 Setpoint Programmer	7850
or k) Blank slot	BLANK
Current Inputs For the following modules the option of 1-5V or 4-20mA is provided. (All channels to be the same) a) 7350 b) 7351 c) 7352 d) 7353 e) 7360 f) 7850	
1-5V (Standard)	--
4-20mA (Option)	BR
N.B. Every slot must be specified in order:- /slot 6 /slot 5 /...../slot 2 /slot 1 / where slot 1 is in the most right-hand position viewed from the front. These options form the second line of the Ordering Code.	

ORDER CODE EXAMPLES

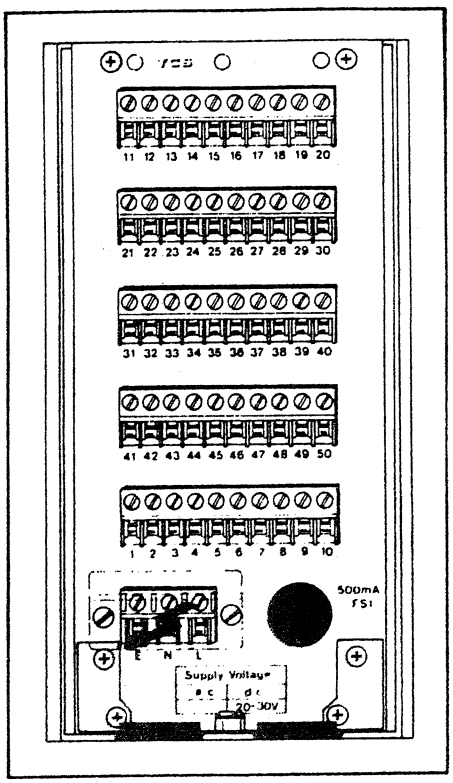
a) A 6350 Process Controller in a single sleeve (Formally; 7350) with 4-20mA current input on all three channels:-
7900/1-WAY PM/240V/CGP/7350/BR

b) A 3-way panel mounting assembly with two Controllers and a Programmer:-
7900/3-WAY PM/240V/CGP/7350/7350/BR/7850

c) A 6-way 19" rack mounting assembly:-
7900/6-WAY 19" RM/240V/7350/7350/7350/7350/BR/7432/7850/BR

d) A 1-way thick-panel mounting sleeve:-
7900/1-WAY TPM/24V/CGP/7432

PROGRAMMABLE SIGNAL PROCESSOR REAR TERMINATION ASSEMBLY



* Panel Mounting
* Modular Construction
* All Module Connections Available Via Screw Terminals
* 24V DC and Mains Powered
* Input/Output terminals ergonomically arranged in blocks of 8

REAR VIEW WITH TERMINAL COVERS REMOVED
DRAWING SHOWS 1WAY/MAINS POWERED VERSION

The 7433 Rear Termination assembly enables 6433 Programmable Signal Processors to be fitted into 7900 single or multi-way sleeves. Each 7433 assembly allows an associated 6433 module to function as a stand-alone instrument and enables it to be fitted into conventional panel cut-outs.

The Block Diagram shows that the 7433 contains a mains transformer and bridge rectifier assembly. A 0.5A screw-in type fuse is provided and 110V or 240V AC operation is selected internally. The mains input terminals have a separate 3-way connector block (51-53), while a further terminal (2) may be used for a 24V DC input or back-up supply, if required.

The input/output connections are arranged in 4 rows of 10 terminals for Block 1, Channels 1-8 (11-18), Block 2 (21-28), Block 3 (31-38) and Block 4 (41-48). Each row also has a 0V ref. terminal (19,29,39,49), and a 0V power terminal (20,30,40,50), to facilitate plant wiring.

The inter-connections between the 7433 screw terminals and the 6433 module pins are given in the cross-reference table which lists all those connections not shown in the Block Diagram.

Turnbull Control Systems Limited
Broadwater Trading Estate Worthing Sussex BN14 8NW
Telephone Worthing (0903)205277
Telex 87437

SLEEVE TERMINAL NUMBER	MODULE PIN NUMBER	FUNCTION		OPTION (S3)
1	3	0V.POW	POWER SUPPLIES	
2		DC.SUPP.IN		
3	7	+15V.OUT		
4	5			
5	43			
6	9	W.DOG.OUT(1)		
7	45	XMT.OUT(-)	RS422 SERIAL BUS	
8	46	XMT.OUT(+)		
9	47	RCV.IN(-)		
10	48	RCV.IN(+)		
11	10	CHN.1	INPUT/ OUTPUT BLOCK 1	
12	11	CHN.2		
13	12	CHN.3		
14	13	CHN.4		
15	14	CHN.5		
16	15	CHN.6		
17	16	CHN.7		
18	17	CHN.8		
19	2	0V.REF		
20	3	0V.POW		
21	18	CHN.1	INPUT/ OUTPUT BLOCK 2	
22	19	CHN.2		
23	20	CHN.3		
24	21	CHN.4		
25	22	CHN.5		
26	23	CHN.6		
27	24	CHN.7		
28	25	CHN.8		
29	2	0V.REF		
30	3	0V.POW		
31	26	CHN.1	INPUT/ OUTPUT BLOCK 3	
32	27	CHN.2		
33	28	CHN.3		
34	29	CHN.4		
35	30	CHN.5		
36	31	CHN.6		
37	32	CHN.7		
38	33	CHN.8		
39	2	0V.REF		
40	3	0V.POW		
41	34	CHN.1	INPUT/ OUTPUT BLOCK 4	
42	35	CHN.2		
43	36	CHN.3		
44	37	CHN.4		
45	38	CHN.5		
46	39	CHN.6		
47	40	CHN.7		
48	41	CHN.8		
49	2	0V.REF		
50	3	0V.POW		
51		EARTH	AC MAINS	
52		NEUTRAL		
53		LINE		

1.2 Issue 1

TECHNICAL SPECIFICATION

(A) Electrical

The 6433 Programmable Signal Processor Module which is plugged into the 7433 sleeve, is configured for a specific application by fitting the appropriate input/output personality cards into the four I/O slots available. These blocks of input/output channels come in four basic categories, with the following electrical specifications:-

a) Analogue Input Cards

Number of channels	: 8 direct, non-isolated inputs
Input signal levels	: 0-10V or 1-5V selected by software

b) Analogue Output Cards

Number of channels	: 8 direct non-isolated outputs
Output signal levels	: 0-10V or 1-5V selected by software

c) Digital Input Cards

No. of inputs	: 8 non-latched, non-isolated inputs
Input signal levels	: Logic zero = 0V : Logic one = 5-15V

d) Digital Output Cards

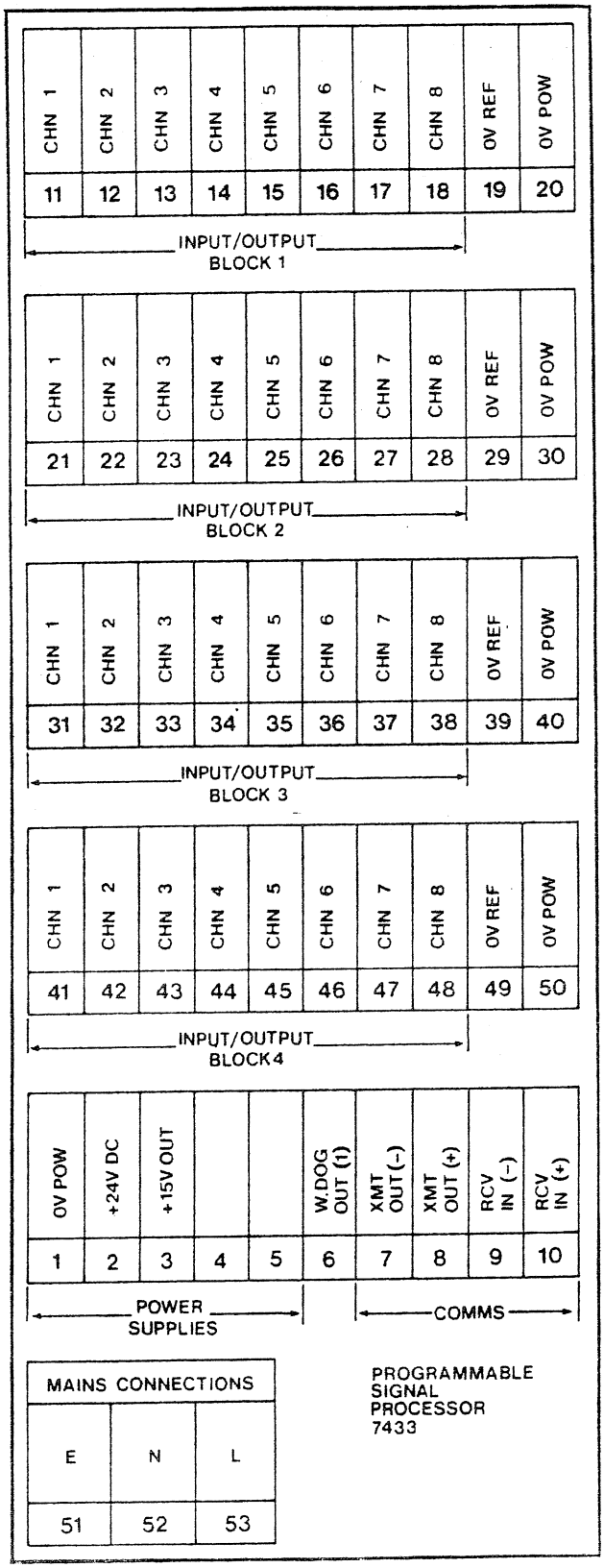
No. of outputs	: 8 non-latched,non-isolated outputs
Output signal levels	: Logic zero = 0V : Logic one = 15V

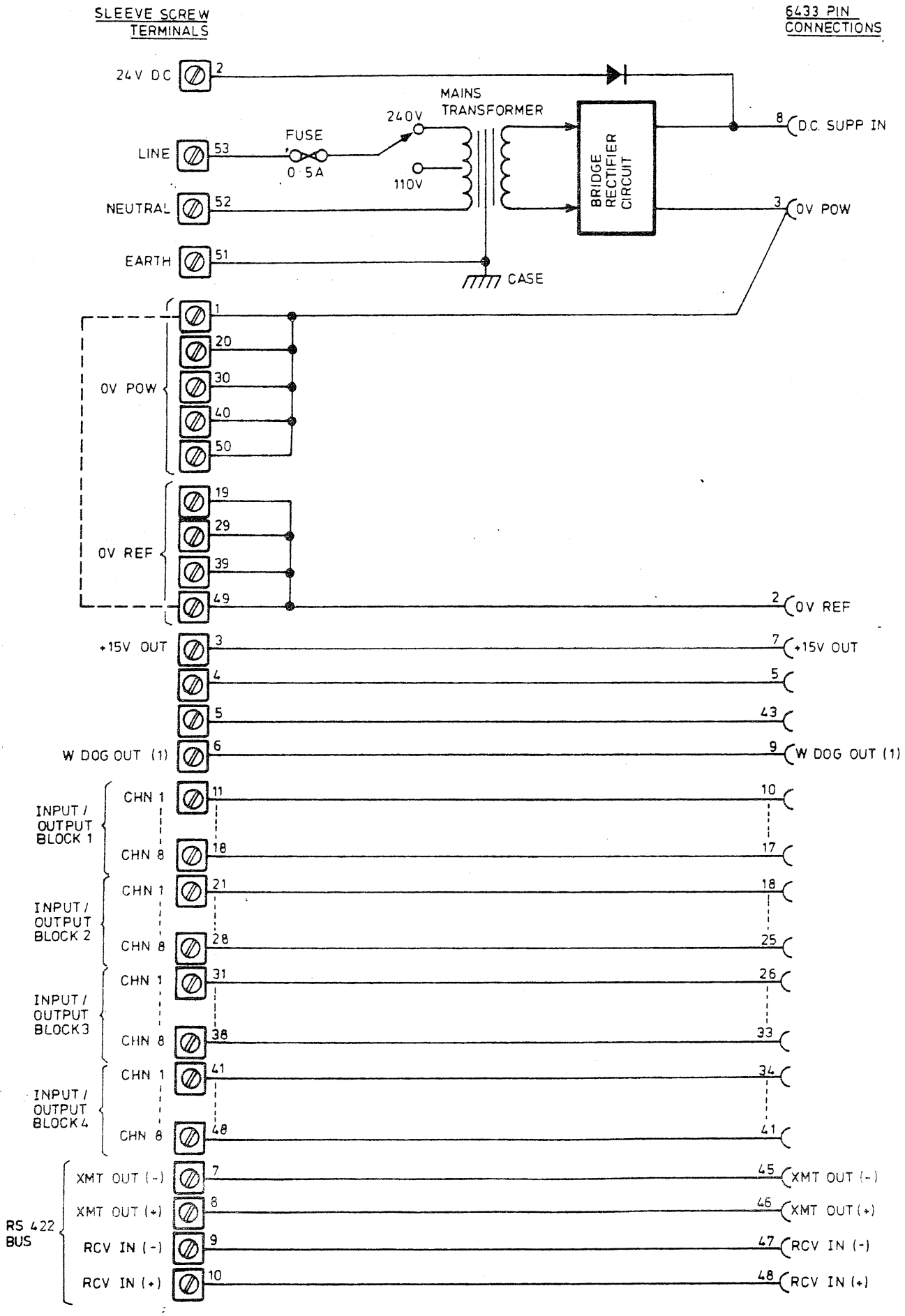
2.1 Issue 1

(B) Power Supplies

a) Supply Inputs

Mains Version	:	110V AC at 220mA rms 240V AC at 100mA rms
24V DC Version	:	20-30V DC at 650mA
Back-up Supply Input	:	20-30V DC on mains versions only
b) Supply Outputs	:	15V DC ± 0.5V at 100mA max
c) Fuse Rating	:	Separate 0.5A screw-in type fuse provided with mains versions only


CHN 1
CHN 2
CHN 3
CHN 4
CHN 5
CHN 6
CHN 7
CHN 8
0V REF
0V POW
11 12 13 14 15 16 17 18 19 20
INPUT/OUTPUT BLOCK 1
21 22 23 24 25 26 27 28 29 30
INPUT/OUTPUT BLOCK 2
31 32 33 34 35 36 37 38 39 40
INPUT/OUTPUT BLOCK 3
41 42 43 44 45 46 47 48 49 50
INPUT/OUTPUT BLOCK4
0V POW
+24V DC
+15V OUT
W.DOG OUT (1)
XMT OUT (-)
XMT OUT (+)
RCV IN (-)
RCV IN (+)
1 2 3 4 5 6 7 8 9 10
POWER SUPPLIES
COMMS
MAINS CONNECTIONS
E N L
51 52 53
PROGRAMMABLE SIGNAL PROCESSOR 7433


SLEEVE SCREW TERMINALS
6433 PIN CONNECTIONS
24V DC
2
MAINS TRANSFORMER
240V
110V
FUSE
0·5A
LINE
53
NEUTRAL
52
EARTH
51
CASE
BRIDGE RECTIFIER CIRCUIT
8 D.C. SUPP IN
3 0V POW
0V POW
1
20
30
40
50
0V REF
19
29
39
49
2 0V REF
+15V OUT
3
7 +15V OUT
4
5
5
43
W DOG OUT (1)
6
9 W DOG OUT (1)
INPUT / OUTPUT BLOCK 1
CHN 1
11
10
CHN 8
18
17
INPUT / OUTPUT BLOCK 2
CHN 1
21
18
CHN 8
28
25
INPUT / OUTPUT BLOCK3
CHN 1
31
26
CHN 8
38
33
INPUT / OUTPUT BLOCK4
CHN 1
41
34
CHN 8
48
41
RS 422 BUS
XMT OUT (-)
7
45 XMT OUT (-)
XMT OUT (+)
8
46 XMT OUT (+)
RCV IN (-)
9
47 RCV IN (-)
RCV IN (+)
10
48 RCV IN (+)

OPERATOR SET

BOARD CODE 08 | BOARD TYPE AN OUT

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM/OP HA/HO	LOW ALM/OP LA/LO	ALM ROUTING/ ARV	PRIME VAR PV/OP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT					ALM MASKING AM/AM	DIG STATUS DS/DS					
51	2000	99.99	00.00	10.00	00.00		05.00	A-F	BIAS	%		AIR LIM TO FUEL BIAS
52	2000	99.99	00.00	10.00	00.00		05.00	F-A	BIAS	%		FUEL LIM TO AIR BIAS
53												
54												
55												
56												
57												
58												

DERIVED VALUES

BOARD CODE 00 | BOARD TYPE AN IN

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM/OP HA/HO	LOW ALM/OP LA/LO	ALM ROUTING ARV	PRIME VAR PV/OP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT					ALM MASKING AM/AM	DIG STATUS DS/DS					
61	2000	99.99	00.00	99.99	00.00	0000		AIR	DEM %	%		LIMITED AIR DEMAND
62	2000	99.99	00.00	99.99	00.00	0000		FUEL	DEM %	%		LIMITED FUEL DEMAND
63	2000	99.99	00.00	99.99	00.00	0000		NORM	AIR	%		NORMALISED AIR FLOW
64	2000	99.99	00.00	99.99	00.00	0000		NORM	FUEL	%		NORMALISED FUEL FLOW
65												
66												
67												
68												

BOARD CODE | BOARD TYPE

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM/OP HA/HO	LOW ALM/OP LA/LO	ALM ROUTING ARV	PRIME VAR PV/OP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT					ALM MASKING AM/AM	DIG STATUS DS/DS					
71												
72												
73												
74												
75												
76												
77												
78												

BOARD CODE | BOARD TYPE

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM/OP HA/HO	LOW ALM/OP LA/LO	ALM ROUTING ARV	PRIME VAR PV/OP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT					ALM MASKING AM/AM	DIG STATUS DS/DS					
81												
82												
83												
84												
85												
86												
87												
88												

☐ - READ ONLY

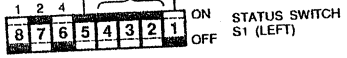
TCS TURNBULL CONTROL SYSTEMS LTD | 6433 SIGNAL PROCESSOR CHANNEL PARAMETERS

SERIAL COMMS

* DELETE AS APPLICABLE

GID: 2

BAUD RATE: 9600



STATUS SWITCH S1 (LEFT)

STATUS SWITCH S2 (RIGHT)

MODE SELECTION

FUNCTION	OFF *	ON *
PROTOCOL MODE	ASCII	BINARY
TERMINAL BAUD RATE	300	SW-SEL
TAG DISPLAY	DISABLE	ENABLE
BASE UID SELECT	0	8

BOARD FUNCTION: REAL INPUT / OUTPUT CHANNELS

SIGNAL TYPES / BOARD CODE / TYPE	00 ANALOG IN	CHAN ACTIVE	08 ANALOG OUT	CHAN ACTIVE	10 DIGITAL IN	CHAN ACTIVE	18 DIGITAL OUT	CHAN ACTIVE
CHANNEL	BLOCK 1		BLOCK 2		BLOCK 3		BLOCK 4	
1	0-10V		0-10V		0/15V		0/15V	
2	1-5V		0-10V		0/15V			
3	1-5V							
4	±5V (WRT+5V)							
5								
6								
7								
8								

INSTRUMENT PARAMETERS

PARAMETER TYPE	PARAMETER FUNCTION	MNEMONIC	VALUE (4 CHARS)	UNITS
BLOCK 1	CHANNEL SCAN + BOARD TYPE	S1	0400	
	HISTORIC ALARMS	A1		
BLOCK 2	CHANNEL SCAN + BOARD TYPE	S2	0208	
	HISTORIC ALARMS	A2		
BLOCK 3	CHANNEL SCAN + BOARD TYPE	S3	0210	
	HISTORIC ALARMS	A3		
BLOCK 4	CHANNEL SCAN + BOARD TYPE	S4	0118	
	HISTORIC ALARMS	A4		

CONTINUED ON SHEET 2

▒ = READ ONLY OR READ / WRITE

ISS.	DATE	COMPILED	INSTRUMENT IDENTITY II	FUNCTION
			6433/2	LEAD / LAG COMBUSTION CONTROL
		CHECKED	SERIAL NO. INT 082/1/1/18/83	

TCS TURNBULL CONTROL SYSTEMS LTD | 6433 PROGRAMMABLE SIGNAL PROCESSOR SET-UP DATA SHT

BOARD CODE 00 — BOARD TYPE AN IN

BLOCK/CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM OP HAHO	LOW ALM OP LALO	ALM ROUTING ARV	PRIME VAR PVOP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AMAM	DIG STATUS DSDS					
11	2000	99.99	00.00	99.99	00.00	0000		COMB	DEM	%		COMBUSTION DEMAND
12	0001	9999	0000	9999	0000	0000		AIR	FLOW	M3/H		AIR FLOW
13	0001	2000	0000	2000	0020	0041		FUEL	FLOW	M3/H		FUEL FLOW
14	2000	10.00	10-00	10.00	10-00	0000		RAT	TRIM	%		RATIO TRIM
15												
16												
17												
18												

BOARD CODE 08 — BOARD TYPE AN OUT

BLOCK/CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM OP HAHO	LOW ALM OP LALO	ALM ROUTING ARV	PRIME VAR PVOP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AMAM	DIG STATUS DSDS					
21	0000	9999	0000	9999	0000			AIR	DEM	M3/H		AIR DEMAND
22	0000	2000	0000	2000	0000			FUEL	DEM	M3/H		FUEL DEMAND
23												
24												
25												
26												
27												
28												

BOARD CODE 10 — BOARD TYPE DIG IN

BLOCK/CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM OP HAHO	LOW ALM OP LALO	ALM ROUTING ARV	PRIME VAR PVOP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT DIG INPUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AMAM	DIG STATUS DS/DS					
31	0000					0000		AIR	LOW			AIR PRESSURE LOW
32								FUEL	LOW			FUEL PRESSURE LOW
33												
34												
35												
36												
37												
38												

BOARD CODE 18 — BOARD TYPE DIG OUT

BLOCK/CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH ALM OP HAHO	LOW ALM OP LALO	ALM ROUTING ARV	PRIME VAR PVOP	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AMAM	DIG STATUS DS/DS					
41	0000					0080		FUEL	ALM			FUEL LOW ALARM
42												
43												
44												
45												
46												
47												
48												

☐ = READ ONLY

TCS TURNBULL CONTROL SYSTEMS LTD | 6433 SIGNAL PROCESSOR CHANNEL PARAMETERS

PROGRAMMING TERMINAL SET-UP

FUNCTION	STATE
SCROLL STYLE	JUMP
AUTO REPEAT	ON
AUTO WRAPAROUND	ON
NEW LINE	OFF
INTERLACE	OFF
ANSI	YES
AUTO XON-XOFF	OFF
PARITY (ENABLED)	EVEN
BITS/CHAR	7
STOP/BITS	1

FUNCTION	VALUE	6433 WORD WINDOW	VALUE
LINE LENGTH	80		79
BAUD RATE	9600		

DEC VT 100 SETUP:

1	2	3	4
0 1	1 0	1 0 0	1 1 0 1

BOARD FUNCTION: INTERNAL 'PSEUDO' CHANNELS

BOARD CODE / TYPE								
CHANNEL	BLOCK 5	CHAN ACTIVE	BLOCK 6	CHAN ACTIVE	BLOCK 7	CHAN ACTIVE	BLOCK 8	CHAN ACTIVE
1								
2								
3								
4								
5								
6								
7								
8								

INSTRUMENT PARAMETERS

PARAMETER TYPE	PARAMETER FUNCTION	MNEMONIC	VALUE (4 CHARS)	UNITS
BLOCK 5	CHANNEL SCAN + BOARD TYPE	S5	0208	
	HISTORIC ALARMS	A5		
BLOCK 6	CHANNEL SCAN + BOARD TYPE	S6	0400	
	HISTORIC ALARMS	A6		
BLOCK 7	CHANNEL SCAN + BOARD TYPE	S7	0000	
	HISTORIC ALARMS	A7		
BLOCK 8	CHANNEL SCAN + BOARD TYPE	S8	0000	
	HISTORIC ALARMS	A8		
MONITOR ONLY	SWITCH BANK S1 & S2 SETTINGS	SW		
	6433 OPERATING STATUS	MD		
ALARMS STATUS WORDS	ALARM AUTO ACKNOWLEDGE	C1		
	ALARM AUTO ACKNOWLEDGE	C2		
	ALARM AUTO ACKNOWLEDGE	C3		
	ALARM AUTO ACKNOWLEDGE	C4		
	ALARM AUTO ACKNOWLEDGE	C5		
	ALARM AUTO ACKNOWLEDGE	C6		
	ALARM AUTO ACKNOWLEDGE	C7		
	ALARM AUTO ACKNOWLEDGE	C8		

▒ = READ ONLY OR READ / WRITE

ISS.	DATE	COMPILED	PROGRAM FILE REF.	FUNCTION
			Z006	LEAD /LAG COMBUSTION CONTROL
		CHECKED		

TCS TURNBULL CONTROL SYSTEMS LTD | 6433 PROGRAMMABLE SIGNAL PROCESSOR SET-UP DATA SHT

BOARD CODE	BOARD TYPE

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/- / ALM MASKING AM/AM	PRIME VAR PV/OP / DIG STATUS DS/DS	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT										
11												
12												
13												
14												
15												
16												
17												
18												

BOARD CODE	BOARD TYPE

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/- / ALM MASKING AM/AM	PRIME VAR PV/OP / DIG STATUS DS/DS	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT										
21												
22												
23												
24												
25												
26												
27												
28												

BOARD CODE	BOARD TYPE

BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/- / ALM MASKING AM/AM	PRIME VAR PV/OP / DIG STATUS DS/DS	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT										
31												
32												
33												
34												
35												
36												
37												
38												

BOARD CODE	BOARD TYPE

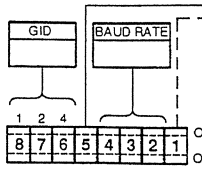
BLOCK/ CHN CN	CHAN STATUS ST / BLOCK STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/- / ALM MASKING AM/AM	PRIME VAR PV/OP / DIG STATUS DS/DS	CHANNEL TAG CHAR 1T	CHANNEL TAG CHAR 2T	UNITS N/A	AN IN/OUT / DIG IN/OUT	FUNCTION
		NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT										
41												
42												
43												
44												
[illegible]												
46												
47												
48												

☐ = READ ONLY

TCS TURNBULL CONTROL SYSTEMS LTD | EI | 6433 SIGNAL PROCESSOR CHANNEL PARAMETERS

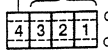
SERIAL COMMS

* DELETE AS APPLICABLE



MODE SELECTION

FUNCTION	OFF *	ON *
PROTOCOL MODE	ASCII	BINARY
TERMINAL BAUD RATE	300	SW.SEL.
TAG DISPLAY	DISABLE	ENABLE
BASE UID SELECT	0	8



BOARD FUNCTION: REAL INPUT / OUTPUT CHANNELS

BOARD CODE / TYPE								
CHANNEL	BLOCK 1	CHAN ACTIVE	BLOCK 2	CHAN ACTIVE	BLOCK 3	CHAN ACTIVE	BLOCK 4	CHAN ACTIVE
1								
2								
3								
4								
5								
6								
7								
8								

INSTRUMENT PARAMETERS

PARAMETER TYPE	PARAMETER FUNCTION	MNEMONIC	VALUE (4 CHARS)	UNITS
BLOCK 1	CHANNEL SCAN + BOARD TYPE	S1	0 _ _ _	
	HISTORIC ALARMS	A1		
BLOCK 2	CHANNEL SCAN + BOARD TYPE	S2	0 _ _ _	
	HISTORIC ALARMS	A2		
BLOCK 3	CHANNEL SCAN + BOARD TYPE	S3	0 _ _ _	
	HISTORIC ALARMS	A3		
BLOCK 4	CHANNEL SCAN + BOARD TYPE	S4	0 _ _ _	
	HISTORIC ALARMS	A4		

CONTINUED ON SHEET 2

▒ = READ ONLY OR READ / WRITE

ISS.	DATE	COMPILED	INSTRUMENT IDENTITY II	FUNCTION
			6433/2	
		CHECKED	SERIAL NO.	

TCS TURNBULL CONTROL SYSTEMS LTD | EI | 6433 PROGRAMMABLE SIGNAL PROCESSOR SET-UP DATA SHT

BOARD CODE		BOARD TYPE										
BLOCK/ CHN CN	CHAN STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/-	PRIME VAR PV/OP	CHANNEL TAG CHAR		UNITS	AN IN/OUT	FUNCTION
	BLOCK STATUS ST	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AM/AM	DIG STATUS DS/DS	1T	2T	N/A	DIG IN/OUT	
51												
52												
53												
54												
55												
56												
57												
58												

BOARD CODE		BOARD TYPE										
BLOCK/ CHN CN	CHAN STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/-	PRIME VAR PV/OP	CHANNEL TAG CHAR		UNITS	AN IN/OUT	FUNCTION
	BLOCK STATUS ST	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AM/AM	DIG STATUS DS/DS	1T	2T	N/A	DIG IN/OUT	
61												
62												
63												
64												
65												
66												
67												
68												

BOARD CODE		BOARD TYPE										
BLOCK/ CHN CN	CHAN STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/-	PRIME VAR PV/OP	CHANNEL TAG CHAR		UNITS	AN IN/OUT	FUNCTION
	BLOCK STATUS ST	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AM/AM	DIG STATUS DS/DS	1T	2T	N/A	DIG IN/OUT	
71												
72												
73												
74												
75												
76												
77												
78												

BOARD CODE		BOARD TYPE										
BLOCK/ CHN CN	CHAN STATUS ST	HIGH RANGE HR	LOW RANGE HR	HIGH/ALM/OP HA/HO	LOW/ALM/OP LA/LO	ALM ROUTING AR/-	PRIME VAR PV/OP	CHANNEL TAG CHAR		UNITS	AN IN/OUT	FUNCTION
	BLOCK STATUS ST	NOT APPLICABLE FOR DIGITAL INPUT/OUTPUT				ALM MASKING AM/AM	DIG STATUS DS/DS	1T	2T	N/A	DIG IN/OUT	
81												
82												
83												
84												
85												
86												
87												
88												

☐ = READ ONLY

TCS TURNBULL CONTROL SYSTEMS LTD | 6433 SIGNAL PROCESSOR CHANNEL PARAMETERS

PROGRAMMING TERMINAL SET-UP

FUNCTION	STATE
SCROLL STYLE	JUMP
AUTO REPEAT	ON
AUTO WRAPAROUND	ON
NEW LINE	OFF
INTERLACE	OFF
ANSI	YES
AUTO X ON - X OFF	OFF
PARITY (ENABLED)	EVEN
BITS / CHAR	7
STOP/BITS	1

FUNCTION	VALUE	6433 WORD	VALUE
LINE LENGTH		WINDOW	
BAUD RATE			

DEC VT 100 SETUP:

1	2	3	4
0 1	1 0	1 0 0	1 1 0 1

BOARD FUNCTION: INTERNAL 'PSEUDO' CHANNELS

BOARD CODE / TYPE								
CHANNEL	BLOCK 5	CHAN ACTIVE	BLOCK 6	CHAN ACTIVE	BLOCK 7	CHAN ACTIVE	BLOCK 8	CHAN ACTIVE
1								
2								
3								
4								
5								
6								
7								
8								

INSTRUMENT PARAMETERS

PARAMETER TYPE	PARAMETER FUNCTION	MNEMONIC	VALUE (4 CHARS)	UNITS
BLOCK 5	CHANNEL SCAN + BOARD TYPE	S5	0 _ _ _	
	HISTORIC ALARMS	A5		
BLOCK 6	CHANNEL SCAN + BOARD TYPE	S6	0 _ _ _	
	HISTORIC ALARMS	A6		
BLOCK 7	CHANNEL SCAN + BOARD TYPE	S7	0 _ _ _	
	HISTORIC ALARMS	A7		
BLOCK 8	CHANNEL SCAN + BOARD TYPE	S8	0 _ _ _	
	HISTORIC ALARMS	A8		
MONITOR ONLY	SWITCH BANK S1 & S2 SETTINGS	SW		
	6433 OPERATING STATUS	MD		
ALARMS STATUS WORDS	ALARM AUTO ACKNOWLEDGE	C1		
	ALARM AUTO ACKNOWLEDGE	C2		
	ALARM AUTO ACKNOWLEDGE	C3		
	ALARM AUTO ACKNOWLEDGE	C4		
	ALARM AUTO ACKNOWLEDGE	C5		
	ALARM AUTO ACKNOWLEDGE	C6		
	ALARM AUTO ACKNOWLEDGE	C7		
	ALARM AUTO ACKNOWLEDGE	C8		

▒ = READ ONLY OR READ / WRITE

ISS.	DATE	COMPILED	PROGRAM FILE REF.	FUNCTION
		CHECKED		

TCS TURNBULL CONTROL SYSTEMS LTD | 6433 PROGRAMMABLE SIGNAL PROCESSOR SET-UP DATA SHT

Software part No. RD 069748 issue 1, release 1

Table 4.2 lists the 2 character Instrument command parameters of the 6433 Programmable Signal Processor used when accessing data via the 8260 Hand-held Terminal or the ASCII mode of the RS 422 serial link protocol (see Section 5 of the System 6000 Communications Handbook). The similarly accessed Channel command parameters for the 4 different types of Input/Output Blocks are given in Tables 4.3, 4.6, 4.7, and 4.8.

Tables 5.1 to 5.4 inclusive give the corresponding Parameter Numbers for the 4 types of real Input/Output Blocks used with the Binary mode of the protocol (see Section 6 of the System 6000 Communications Handbook). Tables 5.5 to 5.8 inclusive give the corresponding Parameter Numbers for the 4 types of pseudo-Input/Output Blocks when accessed in the same way.

The table below shows the modification history of the 6433 software with respect to changes in these parameter tables:-

SOFTWARE		DATE	MEMORY BOARD	PROMS		REMARKS
ISS.	REL			TYPE	NO	
F	-	23/08/83	Mk 5 (006)	27128 2764	1 1	Pre-production release
1	1	06/01/84	Mk 5 (006)	27128 2764	1 1	Initial production release
1	2	13/05/85	Mk 5 (006)	27128 2764	1 1	Cure two comms bugs i) Conflicts between front & rear ii) Enquiry poll on 'ST'
			Mk 6 (006)	27128 2764	1 1	[Some units built with Mk 6 version 006 memories]
1	3	04/07/85	Mk 6 (011)	27128	2	As issue 1/2 but runs on Mk 6 memory version 011.
2	1	08/02/86	Mk 6 (011)	27128	2	8K program space; single precision multiply divide corrected. Non-configured channels do not reply on binary comms. F.P. test added. Improved enquiry poll flagging on SETAN
3	1	01/09/87	Mk 6 (011)	27128	2	Includes C1 to C8 Alarm Auto Acknowledge parameters. Runs with Mk 6 memory card.
3	2	12/10/87	Mk 6 (011)	27128	2	Alarm Auto Acknowledge extended to digital input and output.

MANUAL ISS.	MANUAL REV	DATE	PAGE	AMENDMENT
A		JUL 82		Initial release in form of new product proposal document
1	A	DEC 84		Initial release in standard Technical Manual format
2	A	AUG 87		Amended to cover issue 3 software

ISS.	DATE	ISS.	DATE	TECHNICAL MANUAL AMENDMENT RECORD SHEET		
1	14/12/84			DRAWN : MEE	MANUAL TITLE : Programmable Signal Processor	
				CHECKED :		
				APPROVED :	PRODUCT CODE : 6433	
				TURNBULL CONTROL SYSTEMS LTD.	DRAWING NO. ZZ 075417C	SHT 1 OF 1 SHTS