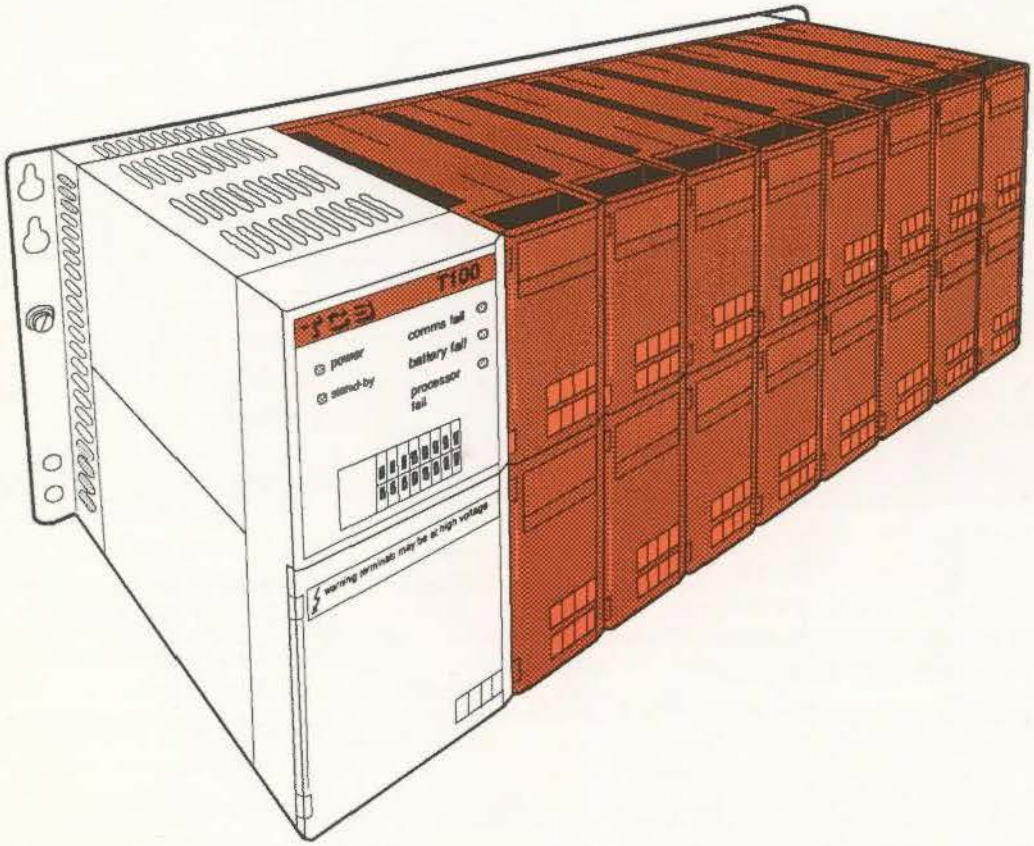
T100

RS422 Version

The Intelligent I/O System



product specification

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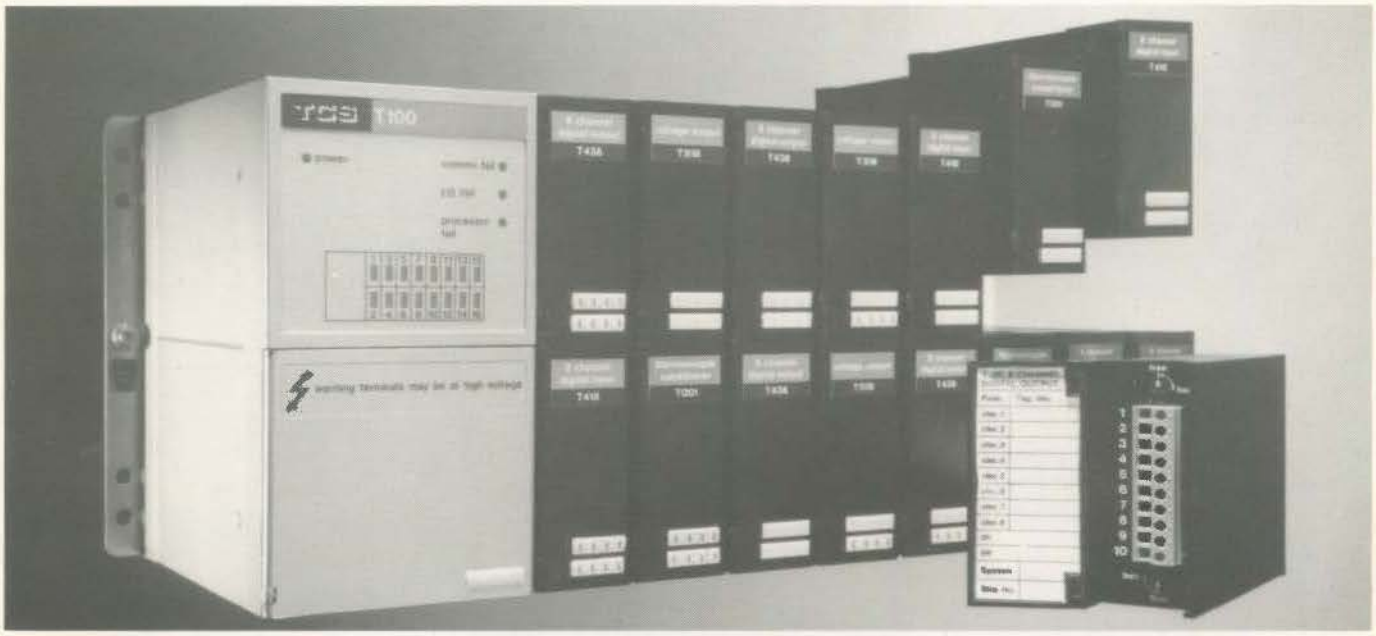
T100 FROM TCS

* Powerful multi-channel data acquisition & signal conditioning
* Single Base Unit with choice of plug-in-anywhere I/O Modules
* Programmable signal processing: ranging, filtering, characterisation, etc.
* Straightforward Block structured programming via inbuilt configurator — supports wide range of VDU terminals
* Redundant configuration capability
* Comprehensive built-in diagnostics and health monitoring
* Compact modular construction
* 440V Isolation: module-to-module, module-to-backplane
* Industrial screw terminals for plant wiring
* T100 RS422 serial multidrop comms. compatible with the full range of System 6000 Intelligent Instruments and Control Systems

T100, THE INTELLIGENT I/O SYSTEM



T100

The T100 is a powerful multi-channel instrument, able to acquire and condition a variety of analogue and digital signals and output them onto a communications bus.

T100 - RS422 has the same RS422 communications format and database structure as all TCS System 6000 instruments and is compatible with existing TCS systems (TACTICIAN T2000 and Maxi-Vis).

Building Block Structure

T100 has a building-block structure consisting of a backplane into which you can fit up to sixteen intelligent I/O modules. Plant lines plug into the front of each module.

The microprocessor with memory card, communications ports, power supplies and other electronics, is housed behind T100's uncluttered front panel. LEDs on the front panel are linked to the built-in diagnostics, keeping you informed about the health of the base unit, comms, and every I/O module.

Behind the lower part of the fascia door are the power supply fuse and input sockets, configuration switchbanks, watchdog terminals, and comprehensive product labelling.

Power Supplies

T100 - RS422 is powered from a 24V DC supply.

Intelligent I/O

The wide range of intelligent I/O modules available caters for single or multiple, input or output, analogue or digital signals.

A common interface across the isolation barrier allows any module to be plugged into any site, and makes it possible to achieve 440V working electrical isolation between modules, and between modules and the backplane.

FRONT PANEL

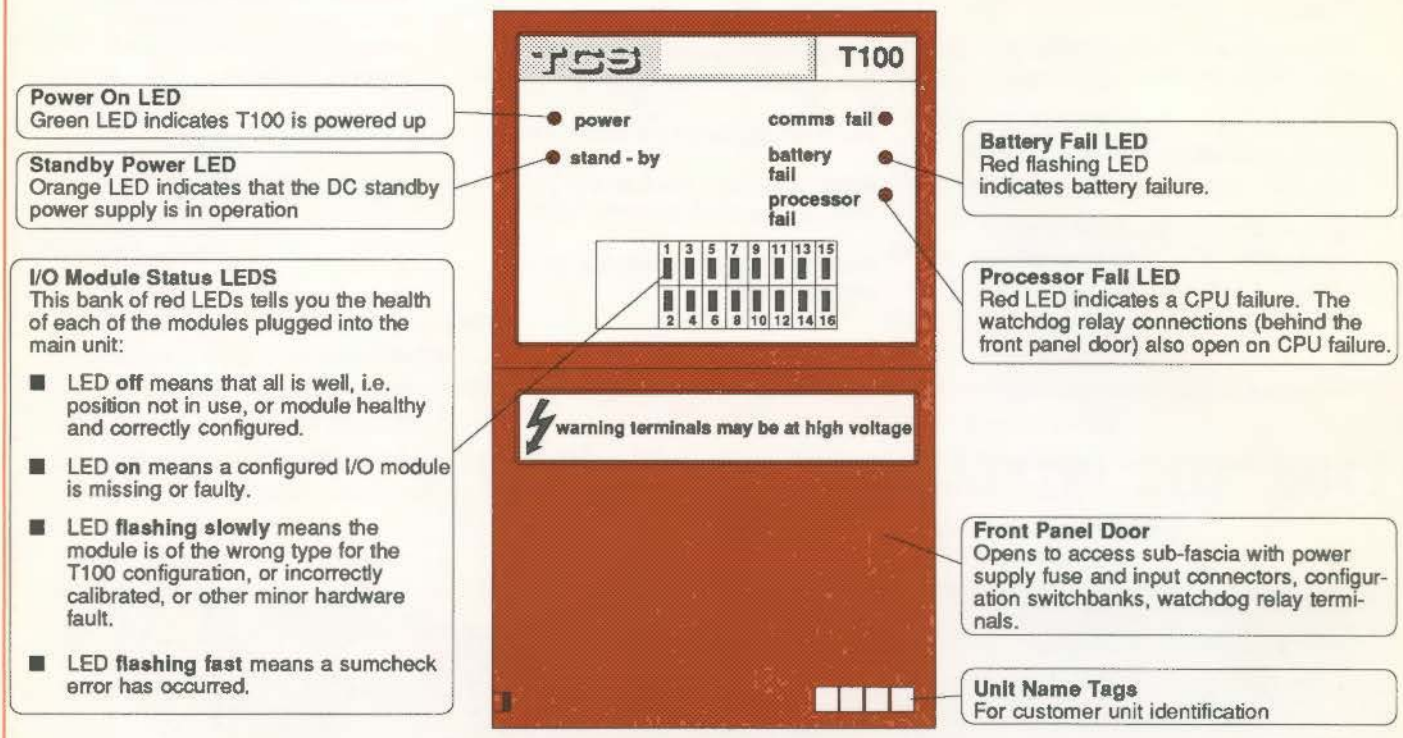


Figure 1 *T100 Front Panel*

SUB-FASCIA

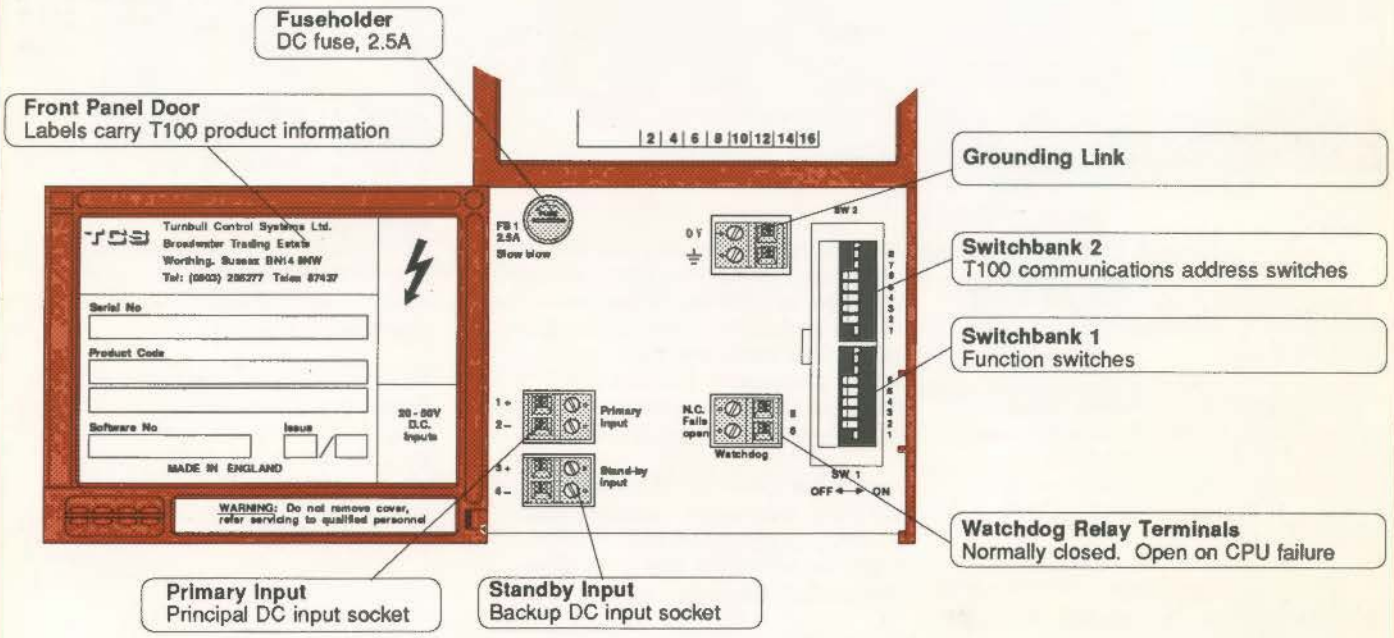


Figure 2 *T100 Sub-Fascia*

SPECIFICATION: BASE UNIT

T100 BASE UNIT

The base unit comprises a backplane, processor, indicators and switches, communications ports, and power supply.

Backplane

Interconnects the processor and power supply, and takes power and signals to the 16 I/O module connectors. There is no specialisation of the interface for different types of I/O.

Indicators

Function	LED	Indication
Power	Green	Unit powered
Stand-by	Orange	DC back-up supply in use
(Comms fail	Red	Not applicable in RS422 version)
Battery fail	Red	Battery fail
Processor fail	Red	CPU failure; watchdog alarm is triggered
I/O modules (16)	Red *off*:	Healthy
	slow flashing:	Configuration/ module mis-match, or (analogue only) calibration error, or (T111 & T130 only) Input open circuit
	on:	failed/missing
	fast flashing:	sumcheck error

Communications — RS232 Port

For accessing database, configuration, parameter inspection.

RS232 links: two, wired in parallel: 5-wire interface via 25-way D connector, plus 4-wire interface via TCS Hand-Held Terminal socket

Switches

Bit	Switchbank 1 Function Switches	Switchbank 2 Communications Switches
1	Not used	Extended Binary Comms
2	Not used	50/60Hz (off/on)
3	Semi-Auto Configuration	4 } UID
4	Configuration Protection	8 } UID
5	} Baud Rates	1 } GID
6	} Baud Rates	2 } GID
7	-	4 } GID
8	-	ASCII/Binary (off/on)

Table 1 *Switch Functions*

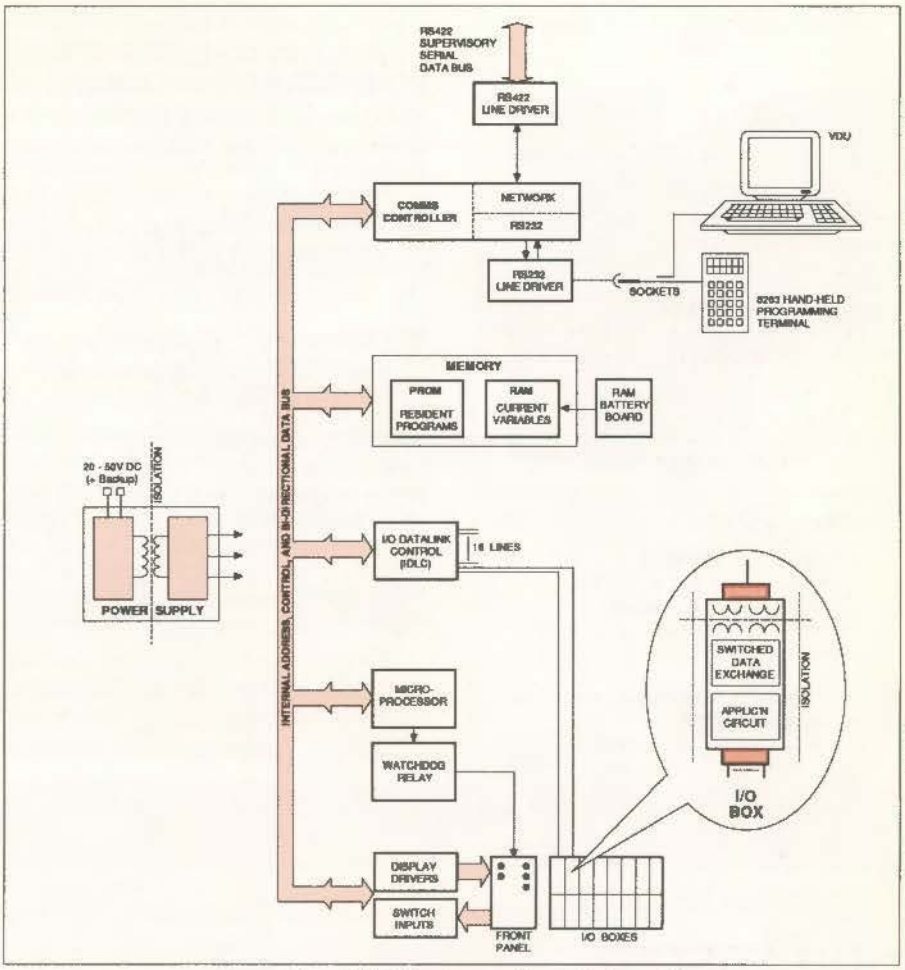


Figure 3 *T100 Hardware Block Schematic*

Baud Rate: automatic selection

Communications — RS422 Port

(see p.6)

Power Supplies — General

Isolation:
internal electronics isolated from power source
Input Power:
55W max, according to I/O load

DC Supply

Input Voltage: 20 - 50V DC
Backup DC Input:
takes over if its voltage > primary input
(Standby Power LED lights, and logic signal sent to CPU)
Input Fuse Rating: 2.5A

Memory Standby Battery

Lithium type.
8 - 10 year shelf life, typical.
5 year life typical on continuous standby.
20 minute holdup time minimum with battery board removed.

Mechanical Specification

Dimensions, overall:
438 W × 162 H × 141 D mm
Weight: 3.2kg (without I/O)

Environmental Specification

Operating Temperature: 0 to +50°C
Storage Temperature: –20 to +85°C
Relative Humidity: 5 to 95% (non-condensing)

SPECIFICATION: I/O MODULES

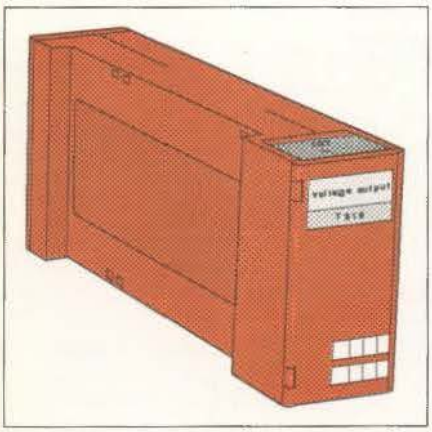


Figure 4 *I/O Module with front door closed*

I/O MODULES — General

All I/O modules share a common bi-directional interface with the main processor.

Isolation Flash Test: to 4kV (BS 4743, IEC 348)
Working Isolation Voltage: 440V DC or AC rms

RFI Immunity

To meet CEGB-DN5 Test methods as specified in IEC801.3.

Mechanical Specification

Dimensions, overall:
single height: 38 W x 81 H x 117 D mm
dble. height: 38 W x 162 H x 117 Dmm

Weight:
single height: 0.2kg (typical)
double height: 0.4kg (typical)

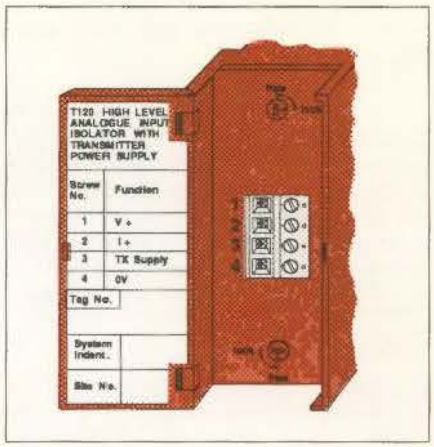


Figure 5 *I/O Module with front door open*

Environmental Specification

Operating Temperature: 0 to +50°C
Storage Temperature: –20 to +85°C
Relative Humidity: 5 to 95% (non-condensing)

TYPE	CHANNELS	CODE	SINGLE OR DOUBLE BOX	INPUTS	OUTPUTS	TX PSU	CHANNEL UPDATE TIME
Thermocouple Input	1	T110	S	TC/mV	–	–	0.125 sec.
PRT Input	1	T111	S	PRT/Ω	–	–	0.125 sec.
Thermocouple Input	8	T112	D	TC/mV	–	–	1 sec. †
High Level An. In.	1	T120	S	V or mA	–	An Tx PSU	0.111 sec.
High Level An. In.	2	T121	S	V	–	–	0.25 sec.
High Level An. In.	8	T122	S	V	–	–	1.0 sec.
Frequency Input	1	T130	S	Hz	–	Dig Tx PSU	♦
High Level Dig. In.	8	T140	S	V or A	–	Dig Tx PSU	0.10 sec.
High Level An. Out	1	T150	S	–	V or mA	–	0.10 sec.
High Level Dig. Out	8	T180	S	–	Open Drain*	–	0.10 sec.

Table 2 *I/O ModuleTypes*

*Selectable internal pull-up
† 2.4 seconds worst case
♦ Above 15Hz :–125mS max.
Below 15Hz:- waveform period +125mS max.

PROGRAMMING TERMINALS

RS422 Version

The TCS 8275 Instrument Database Configurator, based on an IBM PC, gives you great programming power. You can create configurations off-line, then document and store them on disk, using a word-processing package. Later, they may be block down-loaded to the T100 instrument.
You may also enter database configurations using any RS232/ANSI-compatible VDU plugged into the 25-way 'D' socket of the instrument. This lets you input statements, edit and list in Program mode as well as providing all the parameter configuration facilities normally available in Command (Hand-Held Terminal) mode.

Datalink Specification

Transmission Standard Character Length

10 bits made up of:
1 start + 7 data + 1 parity (even) + 1 stop.

Data Rate

Selectable from 300, 1200, 4800, or 9600 baud.

CONFIGURING T100

T100 - RS422

I/O Groupings

To facilitate efficient communications within a supervisory computer system, T100 groups the available I/O hardware into 8-channel 'cards', which are equivalent to the real cards in a TCS 6432 Signal Processor. Four 'cards' are in turn equivalent to one 32-channel 6432 'instrument'.

VDU Configurator

Configuring T100 is straightforward. You start by plugging in the I/O modules you need, connecting a dumb VDU terminal (or computer with terminal emulation software) to the RS232 socket, and powering up.

From the Main Menu on the terminal screen you access the software block representing the T100 and 'open it up' to see the four '6432' virtual instrument blocks. This is the maximum for each T100.

Block Allocation

You assign the four card blocks within each instrument block as analogue input or output, digital input or output, and so on. Then, you open up each card block to reveal its eight channels ('point' blocks), and allocate them to appropriate I/O modules by keying in site numbers, 1 to 16.

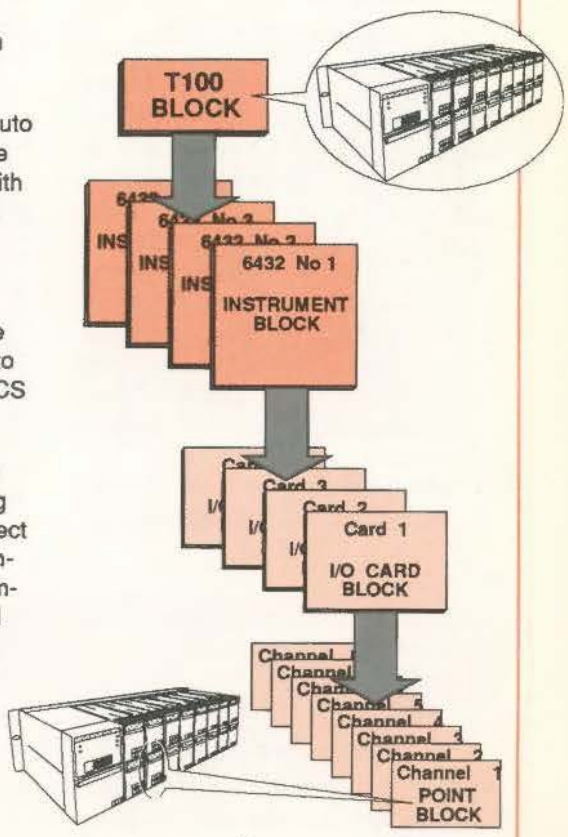
Alternatively, if you switch to Semi-Auto configuration before powering up, the allocations are done automatically with T100 creating virtual 6432s from the available modules.

Parameterisation

All that is left to do is to parameterise the point blocks, by keying values into fields on the VDU display, or via a TCS Hand-Held Terminal.

At any stage in the configuration you can look at an overview of all existing blocks, and open up any one to inspect and/or alter its sub-blocks and parameters. Instrument and channel parameters are like those of a conventional 6432, and have the well-established format used in all TCS System 6000 Intelligent Instrumentation.

Figure 6 *T100 Configuration*



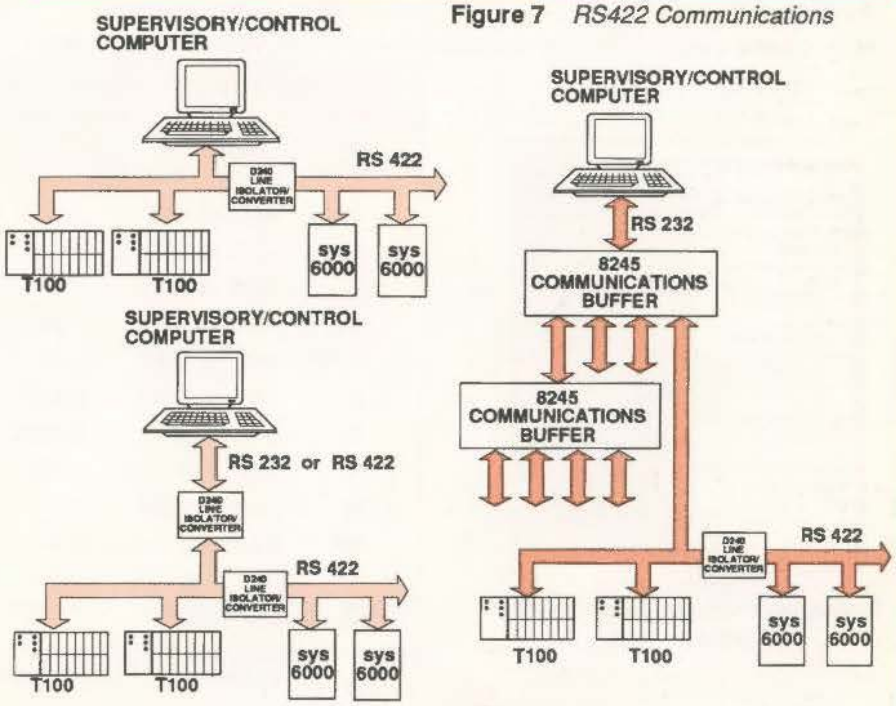
COMMUNICATIONS

The RS422 communications port built into the T100 Intelligent I/O System enables it to send and receive command parameters over a simple five-wire link connected to other intelligent devices.

Using RS422 and transmitting information in ASCII or binary data format makes it particularly easy to communicate with the T100. If you want to hook an instrument into a distributed control system, you don't have to modify it or spend any more on options.

The Figure 7 shows how you can connect an array of T100s, together with some System 6000 instruments, directly to a supervisory computer having an RS422 serial port and how the T100 is used with the D240 Line Isolator and the 8245 comms. buffer for increased fan out.

Figure 7 *RS422 Communications*



Specification

Transmission Standard

5 - wire RS422 (0 - 5V) non-isolated.

Line Impedance

120 - 240Ω twisted pair.

Line Length

4000 ft (1220m) max., at 9600 baud.

Number of Addresses per Line

128 maximum. 16 nodes per line (electrical limit) but this can be increased by line buffering.

Data Rate

Selectable from 300, 1200, 4800, or 9600 baud.

Character /Length (ASCII Binary)

10/11 bits – 300 to 9600 baud.
11/12 bits – 110 baud (2 stop).

T110 Module —Low Level Analogue Input

SPECIFICATION

Inputs: thermocouple or millivolt
A-to-D Converter: integrating type
A-to-D Resolution: >15 bit
(with integration period = 20ms)
Internal Ranges: 4 mV input ranges
12 thermocouple types
Converter Scan Rate: 8 per second
Integration Period: selectable for 50 or 60 Hz rejection
Calibration Values: in T110 E² PROM
Break Detection: up or down scale (software selectable)
Break Protection Current: ±200nA
Max. Break Protection Time: 4.8mV/sec
Common Mode Rejection: 120dB (50Hz to 5kHz)
Series Mode Rejection: 60dB @ 50Hz
Temperature Stability:
Gain Stability: 0.01% per °C max.
Offset Error: 0.9µV per °C max.

Thermocouple Input:

See Table 4 below for ranges available.
Temperature Stability:
CJC Rejection: 30.1 typically
Gain Stability: 0.01% of input per °C max.
Offset Error: 0.9µV/°C max.

DESCRIPTION

The T110 Low Level (Thermocouple) Input Conditioner accepts either direct thermocouple or millivolt signals. The thermocouple type or the input range are software selectable.

Table 4 shows the thermocouple ranges available and the input accuracy for each. The mV ranges are shown in Table 3; the correct hardware range is automatically selected with corresponding resolution.

Figure 8 shows the inside of the T110 module and Figure 9 illustrates the connections for the thermocouple or millivolt source.

Order Code. T110/TAG– – – – – – – –
(if the TAG is not specified it will be supplied blank).

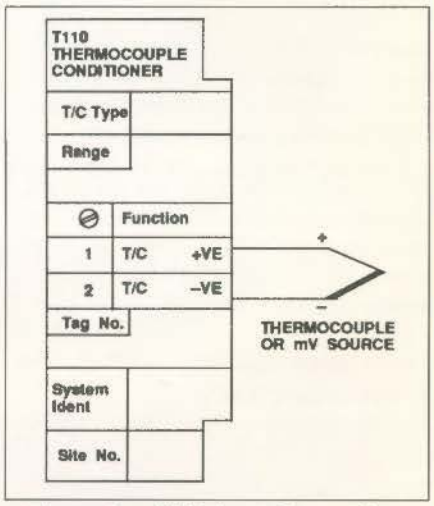


Figure 9 *T110 Input Connections*

mV Input

Input Range (mV)	Range specifications (50Hz¹) Resolution (µV)	Accuracy² (±µV)	Temperature stability Gain (ppm/°C)	Offset (µV/°C)
–100 to 100	4.6	100	45	0.9
–65 to 65	3	65	50	0.9
–30 to 30	1.4	30	68	0.9
–15 to 15	0.7	15	100	0.9

Table 3 *mV Input Ranges*

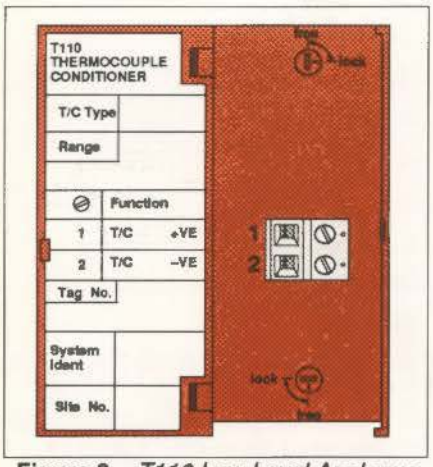


Figure 8 *T110 Low Level Analogue Input Module*

T/couple type T/C (°C)	Range (°C)	Range specs. (50Hz¹) Resolution (±°C)	Accuracy² (ppm/°C)	Temp. stability Gain (°C/°C)	Offset
J	–210 to 1200	0.05	0.4	45	0.017
K	–270 to 1372	0.05	0.4	50	0.03
T	–270 to 400	0.035	0.3	68	0.03
S	–50 to 1767	0.078	0.7	68	0.09
R	–50 to 1767	0.07	0.6	68	0.08
E	–270 to 1000	0.04	0.4	45	0.013
B	0 to 1820	0.055	0.5	100	0.12
N	0 to 1300	0.05	0.4	50	0.03
W	1000 to 2300	0.11	1.0	50	0.06
W³	0 to 2490	0.11	1.0	50	0.06
W⁵	0 to 2320	0.11	1.0	50	0.06
MoRe	0 to 1990	0.075	0.6	68	0.085

Table 4 *Thermocouple Ranges and Input Accuracy*

Note 1. For operation at 60Hz, multiply figures for Resolution and Accuracy by a factor of 1.2.

Note 2. These figures represent the worst case resolution averaged over full range.

T111 Module — RTD Input Conditioner

SPECIFICATION

Inputs: PT100/Ni20, Cu10 or 0-1kΩ sensors
(Ni20 & Cu10 RTDs are not yet supported by software)

A-to-D Converter: integrating type

A-to-D Resolution: >15 bit
(with integration period = 20ms)

Internal Ranges: 3

Converter Scan Rate: 8 per second

Integration Period: selectable for 50 or 60Hz rejection

Calibration Values: in T111 E² PROM

Break Detection Current: 740nA (nominal)

Maximum Break Detect Time:
Break detection is made within one scan cycle.

Up/Down Scale Break Protection generated in software.

Common Mode Rejection: 120dB (50Hz to 5kHz)

Series Mode Rejection: 60dB @ 50Hz

Temperature Stability: 0.003% of input per °C

DESCRIPTION

The T111 RTD Input Conditioner may be used with a two, three, or four wire RTD. It is able to detect a break in the circuit very rapidly, before any bad readings are used.

Table 5 shows the types of thermometers supported by the T111, and its performance in each range. The Ni20 and Cu10 thermocouples are not yet directly supported by the software, although a user characterisation may be created for them.

Figure 10 shows the inside of the T111 module, and Figures 11, 12 and 13 show the connections for the two, three, or four wire RTDs.

Order Code. T111/TAG– – – – – – – –
(if the TAG is not specified it will be supplied blank).

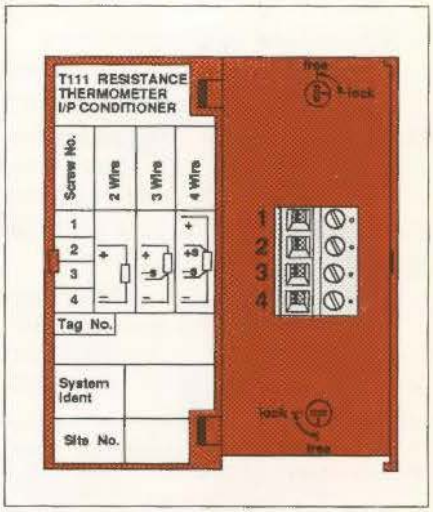


Figure 10 *T111 RTD Input Conditioner*

Sensor	Excitation Current mA	Maximum Lead* Ω /lead	Maximum Sensor Ω	Temperature °C	Accuracy
PT100/Ni20	0.4	25	420	–200 to 850**	±0.5°C
Cu10	1.67	20	60	–70 to +150	±0.7°C
0-1kΩ range	0.4	25	1k	—	0.5Ω

**For correct 3 or 4 wire rejection*
**This range may be increased from –220°C to +1050°C, but with reduced accuracy.*

Table 5 *Resistance Thermometers supported by T111 Analogue Input Module*

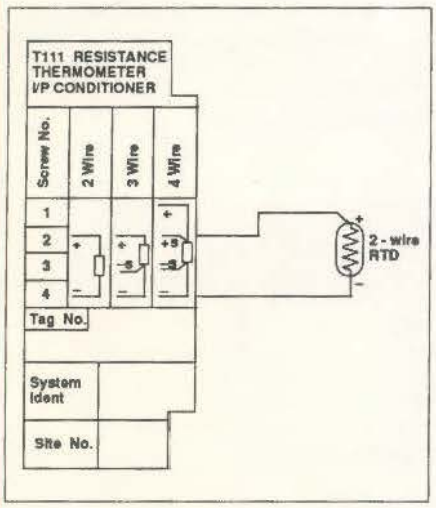


Figure 11 *2-Wire RTD Connections*

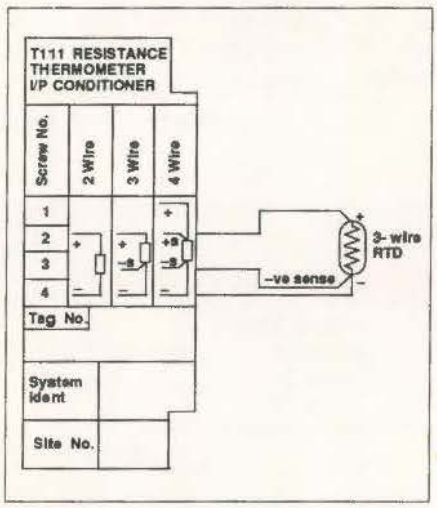


Figure 12 *3-Wire RTD Connections*

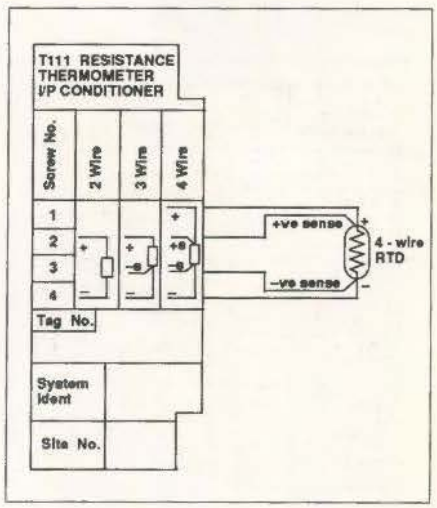


Figure 13 *4-Wire RTD Connections*

T112 Module — 8 Channel Thermocouple/mV Input

SPECIFICATION

Input Type: Multiplexed thermocouple or millivolt (any combination)

A-to-D Converter: Integrating type. (integration period = 20ms(50Hz) or 16.66ms (60Hz)

A-to-D Resolution: >15 bit

Channel-to-Channel Isolation:
Isolation technique: Multiplexed solid state switches.
Voltage rating: 110V AC rms, ±150V DC

Internal Ranges: 4 different mV ranges 12 Thermocouple types

Converter Scan Rate: 1.2 secs per channel (2.6 seconds worst case)*

Integration Period: selectable for 50 or 60Hz rejection

Calibration Values: Stored in T112 EEROM

Break protection: Up or Down scale (software selectable for each channel)

Break Protection Current: 2.5µA pulsed for 80ms at scan rate (after measurement)

Break Protection Time: 3.3mV/sec.

Common Mode Rejection: 120dB (50Hz to 5kHz)

Series Mode Rejection: 60dB @ 50Hz

Thermocouple Input CJC Rejection: 30:1 typically

* The scan rate extends for every new range selected due to additional internal measurements required.

Order Code. T112/TAG - - - - - - - -
(if the TAG is not specified it will be supplied blank)

DESCRIPTION

The T112 eight channel thermocouple input module provides an isolated interface to eight thermocouple or bipolar millivolt inputs. Thermocouple type, ranging and cold junction compensation (CJC) is provided individually on each channel.

Serviceability is enhanced by using two special temperature sensing 8-way plug and socket connectors housed in a double height box. All T112 modules are completely interchangeable since calibration data is module-dependent and stored in EEROM. The high accuracy of the CJC is maintained by using a direct temperature measurement underneath each termination pair on the connector.

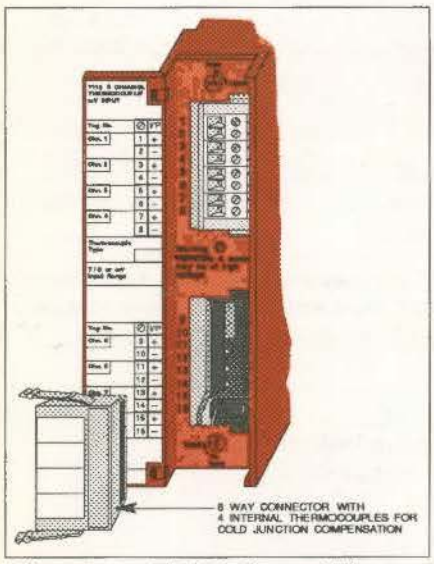


Figure 14 *T112 8-Channel Thermocouple Input Module*

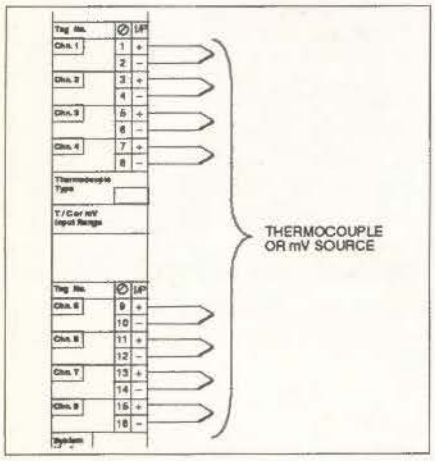


Figure 15 *T112 Input Connections*

Thermocouple Type T/C	Range (°C)	Range Specifications (50Hz[1]) Resolution (°C)	Accuracy[2] (±°C)	Temperature Stability Gain (PPM/°C)	Offset (°C/°C)
J	–210 to 1200	0.05	0.4	45	0.043
K	–270 to 1372	0.05	0.4	50	0.075
T	–270 to 400	0.035	0.3	68	0.075
S	–50 to 1767	0.078	0.7	68	0.225
R	–50 to 1767	0.07	0.6	68	0.2
E	–270 to 1000	0.04	0.4	45	0.033
B	0 to 1820	0.055	0.5	100	0.3
N	0 to 1300	0.05	0.4	50	0.075
W	1000 to 2300	0.11	1.0	50	0.15
W_3	0 to 2490	0.11	1.0	50	0.15
W_5	0 to 2320	0.11	1.0	50	0.15
MoRe	0 to 1990	0.075	0.6	68	0.213

Table 6 *T112 Standard Thermocouple Inputs*

Input Range (mV)	Range Specifications (50 Hz[1]) Resolution (µV)	Accuracy[2] (±µV)	Temp. Stability Gain (PPM/°C)	Offset (µV/°C)
–100 to 100	4.6	100	45	2.3
–65 to 65	3	65	50	2.3
–30 to 30	1.4	30	68	2.3
–15 to 15	0.7	15	100	2.3

Table 7 *T112 Millivolt Inputs*

Note 1 For operation at 60Hz, multiply figures for Resolution and Accuracy by a factor of 1.2.

Note 2 These figures represent the worst case resolution averaged over full range.

T120 Module - High Level Analogue Input

SPECIFICATION

Inputs: voltage and current (mutually exclusive, software selected)
A-to-D Converter: integrating type
A-to-D Resolution: >15 bit
(with integration period = 20ms)
Internal Ranges: 4
Converter Scan Rate: 9 per second
Integration Period: selectable for 50 or 60 Hz rejection
Calibration Values: in T120 E²PROM
Common Mode Rejection: 120dB (50Hz to 5kHz)
Series Mode Rejection: 60dB @ 50Hz
Max. Break Protection Time: 1V/sec.

Transmitter Power Supply

Output Voltage: 25V ±4%
Current Limit: 21.5mA min to 30mA max (limiting reported to processor)

Voltage Input

Break Protection: up- or down-scale (user-selectable)
Input Levels: +12.5V, –11.5V max. sustained

Resolution Accuracy:

Range, ±V	1	2.2	5	10
Resolution, mV	0.05	0.11	0.25	0.5
Accuracy	(0.1% all ranges)			

Temperature Stability: <0.009% of input per °C

Current Input

Burden Resistor: 50Ω
Break Protection: down-scale
Input Levels: ±50mA max.
Resolution Accuracy:

Range, ±mA	20	44	50
Resolution, µA	1.2	2.6	6
Accuracy	(0.1% all ranges)		

Temperature Stability: <0.011% of input per °C

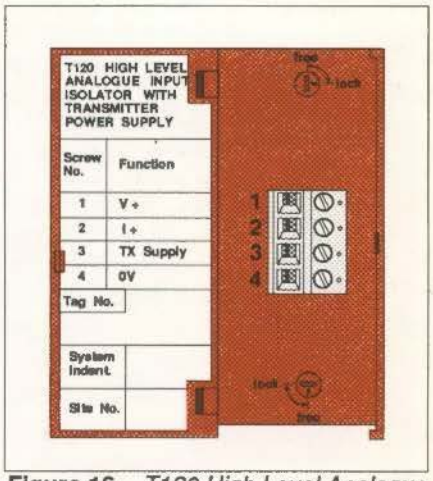


Figure 16 *T120 High Level Analogue Input Module*

DESCRIPTION

The internal transmitter power supply is a 25V supply with a 21.5mA current limit. Figure 16 illustrates a T120 module with the door open, showing the connector and the two locks holding it into the backplane.

The label on the inside of the module door shows where to connect the external plant lines. Figures 17, 18 and 19 give examples of the three different modes of operation of the T120.

Transmitter Power Supply

To use the internal 25V power supply, the field transmitter should be connected across pins 2 and 3, as shown in Figure 19. Current input is selected when the T120 is configured.

Voltage/Current Inputs

Voltage/current input is selected when the T120 is configured. For a voltage input, pins 1 and 4 are used (Figure 17); for a current input, pins 2 and 4 are used (Figure 18).

Ranges

The T120 supports the hardware ranges listed above. T100 allows software selection of the ranges listed in Table 8.

Volts	0 to 10	1 to 5	–10 to +10	0 to 1
mA	0 to 20	4 to 20	–10 to +10	0 to 10

Table 8 *Analogue Input Ranges Selectable*

The appropriate hardware range is automatically selected. The resolution for that hardware range then applies to the input.

Order Code. T120/TAG-------- (if the TAG is not specified it will be supplied blank).

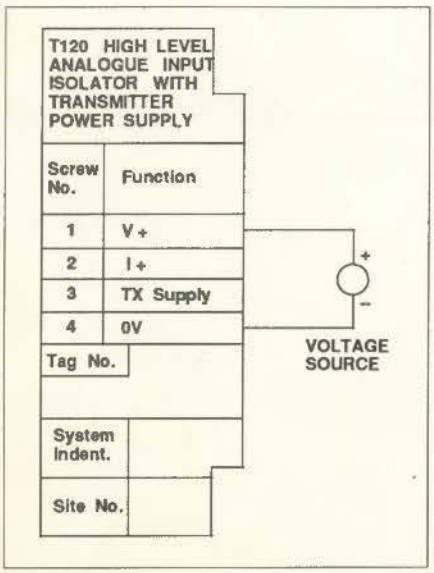


Figure 17 *Voltage Input Signal*

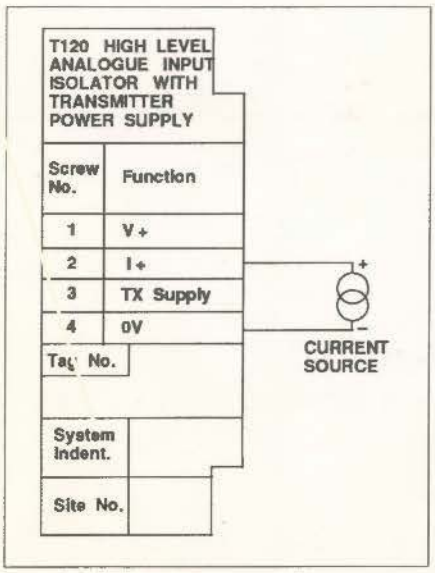


Figure 18 *Current Input Signal*

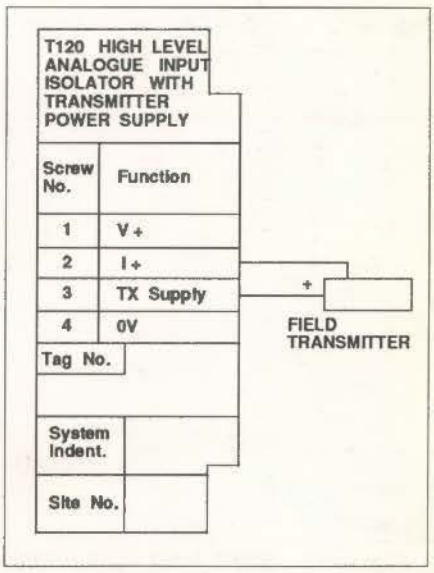


Figure 19 *Transmitter Power Supply*

T121 Module - Dual Channel Analogue Input

SPECIFICATION

Inputs: dual voltage channels
A-to-D Converter: integrating type
A-to-D Resolution: >15 bit
(with integration period = 20ms)
Internal Ranges: 4
Converter Scan Rate: 8 per second (4 per channel)
Integration Period: selectable for 50 or 60Hz rejection
Calibration Values: in T121 E²PROM
Common Mode Rejection: 120dB (50Hz to 5kHz)
Series Mode Rejection: 60dB @ 50Hz

Voltage Input

Break Protection: up or down scale (user-selectable — common to both inputs)
Input Levels: +12.5V, –11.5V, max. sustained
Max. Break Protection Time: 1V/sec.

Resolution Accuracy:

Range, ±V	1	2.2	5	10
Resolution, mV	0.05	0.11	0.25	0.5
Accuracy:	(0.1% all ranges)			

Temperature Stability:
<0.009% of input per °C

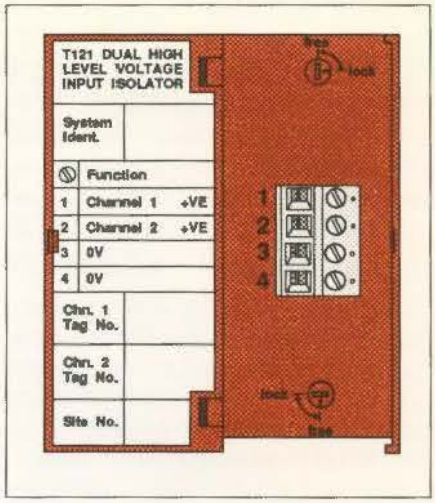


Figure 20 *Dual Channel Analogue Input Module*

DESCRIPTION

Figure 20 shows the inside of the T121 module with the connections and door label.

The T121 takes two voltage-only inputs. To convert it to a current input device, use an external burden resistor across the input.
Pin connections for the dual voltage input are shown in Figure 21. There is no isolation between the two input channels.

Table 9 shows the software ranges which are selectable. The appropriate hardware range is automatically selected by the T100; the resolution for that range then applies to the input.

Order Code. T121/TAG--------
(if the TAG is not specified it will be supplied blank).

Range
0 to 10V
1 to 5V
–10 to +10V
0 to 1V

Table 9 *Dual Voltage Input Ranges (RS422 Software Selectable)*

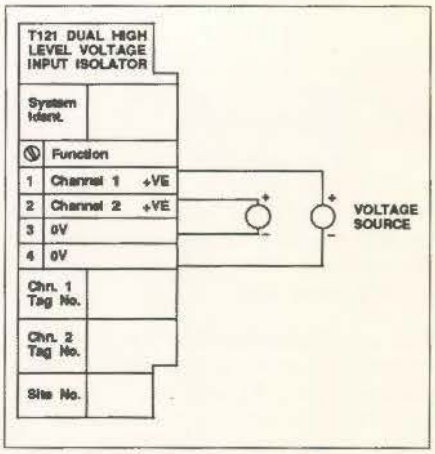


Figure 21 *Dual Voltage Input Connections*

T122 Module — Eight -Channel High Level Analogue Input

SPECIFICATION

Inputs: eight voltage channels
A-to-D Converter: integrating type
A-to-D Resolution: >15 bit
(with integration period = 20ms)
Internal Ranges: 0 to 10V only
Converter Scan Rate: each channel once per second
Integration Period: selectable for 50 or 60Hz rejection
Calibration Values: in T122 E²PROM
Break Protection: up or down scale (same for all channels)
Max. Break Protection Time: 2V/sec.
Input Level: +12.5V (max sustained)
Resolution: 0.3mV
Accuracy: 0.1%
Common Mode Rejection: 120dB (50Hz to 5kHz)
Series Mode Rejection: 60dB @ 50Hz
Temperature Stability: 0.009% of input per °C

DESCRIPTION

The T122 takes up to eight voltage only high-level analogue inputs. The hardware range is 0 to 10V. Positive ranges of 0 to 10V, 1 to 5V, and 0 to 1V are software selectable.

Figure 22 illustrates the inside of the T122, and Figure 23 shows the input connections. To convert it to a current input device, use an external burden resistor across the input.

Order Code. T122/TAG--------
(if the TAG is not specified it will be supplied blank).

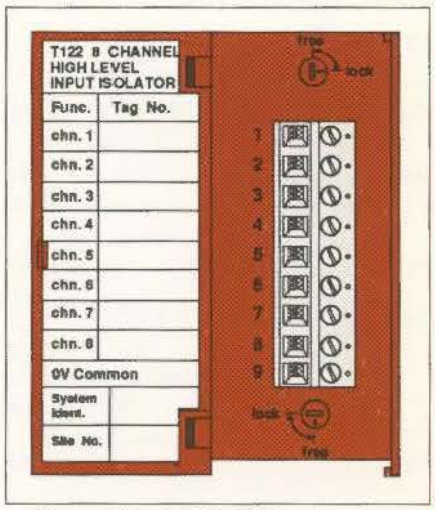


Figure 22 *T122 8-Way Analogue Input Isolator*

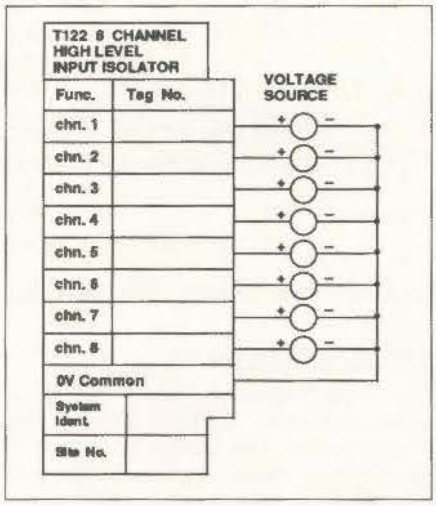


Figure 23 *8-Way Analogue Input Connections*

T130 Module — Frequency Input

SPECIFICATION

Frequency Measurements

Frequency Range: 0.01Hz to 30kHz

Magnetic Inputs: 10Hz to 30kHz
Overrange: 60kHz

Minimum Pulse Length: 8µs

Hardware Response Time:
Above 15Hz: 125ms max
Below 15Hz: waveform period + 125ms max

Resolution: better than 0.006%

Time Base Accuracy: set by base unit (0.05% over 5 years)

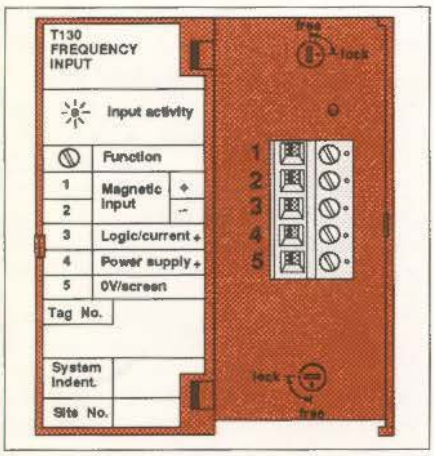


Figure 24 *T130 Frequency Input*

T130 Features

— Ranged PV
— Filter
— Characterisation (Implemented using CHAR block)
— Low Cutoff/Default PV
— Debounce

— Alarms:
- Absolute
- Over/Under range
- Open Circuit Detection
(*Not with voltage or magnetic inputs*)
- Module Hardware Error

Transducer Interface

Magnetic Pick-up:

Input Type: bipolar

Input Impedance: >30kΩ

Signal Voltage Range: 10mV to 30V (1mV/Hz) rising with frequency

Threshold: at cross-over of inputs

Logic Input

Transmitter Type	Logic	Pre-amplifier	Proximity (DIN 19 234)	Contact
Burden Resistor	>100kΩ	50Ω	1kΩ	5kΩ
Typical Supply Volts		24V	8V	24V
Thresholds	0.4, 1.6, 3.5, 10V	9mA	1.6, 3.5mA	0.7, 2mA
Open Circuit Detect	0.1V	2mA	0.1mA	0.02mA

Table 10 *Logic Input Selection*

Open Circuit Input Detection Time: 1 scan time (no filter or delay) (Burden Resistor inputs only)

Proximity Input: DIN 19 234 (NAMUR)/PNP types

Maximum Input Voltage: 50V (absolute)

DESCRIPTION

The T130 Frequency Input module provides an isolated interface to frequency input signals. The module has a programmable power supply and software selectable burden resistors, and therefore can be used with a wide range of current pre-amplifiers, proximity detectors and volt free contact input as well as magnetic input transducers. An LED located above the connectors indicates the operating status of the input signal. The module has no build options and requires no hardware configuration or calibration.

Order Code. T130/TAG – – – – – – – –
(if the TAG is not specified it will be supplied blank)

Transmitter Power Supply

Voltage Settings: 8, 12, 24V

Tolerance: ±10% (max 26 volts)

Current Limit: 21 to 30mA (temperature dependent)

Minimum High/Low Pulse: 8µs (10:1 mark to space ratio)

Debounce (Contact): selectable 25ms (max 20 pulses/sec)

Closed Contact Current: 5.2mA ± 1mA (24V/5kΩ burden)

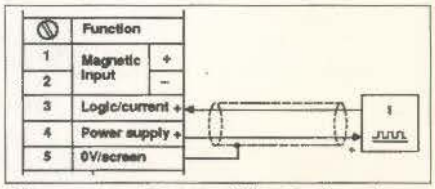


Figure 25 *T130 2-Wire Current Input*

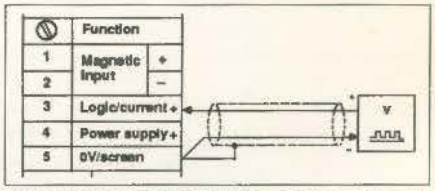


Figure 26 *T130 2-Wire Voltage Input*

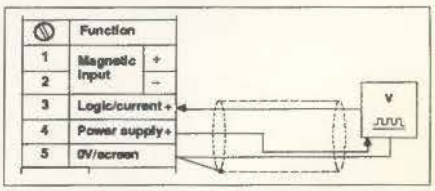


Figure 27 *T130 3-Wire Proximity Input*

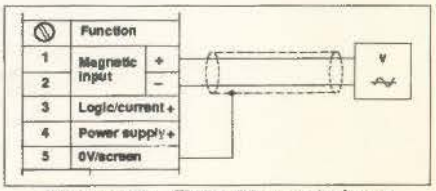


Figure 28 *T130 Magnetic Input*

T140 Module - Eight-Way Digital Input

SPECIFICATION

Inputs:	8 identical digital, Logic or Contact sensing (software selectable)
Input Filter:	1ms
Hardware Response Time:	0.1 sec/ channel

Logic Inputs

Input Logic 1 Level:	50V max.
Input Impedance:	>100kΩ
Hysteresis:	±0.25V
Threshold (software selectable):	1 to 10V

Contact Inputs

Input Current:	2.5mA max, per channel
Input Voltage:	30V max.
Input Impedance:	12kΩ
Hysteresis:	±0.1mA
Threshold:	1.1mA

Transmitter Power Supply

Output Voltage:	24V ±12%
Current Limit: (limiting reported to processor)	>18mA
Zero Volts Connection:	shared with inputs. Software detects overdrive.

DESCRIPTION

Figure 29 shows the inside of the T140 module, with connections corresponding to the labels.

The T140 can handle up to eight digital inputs. All eight channel inputs are either logic or contact sense, as selected in the software. The input threshold for a logic input may be set between 1.0 and 10.0 volts; the threshold for a contact sense input is set at 1.1mA. Debounce time is also configurable.

Logic Inputs

The logic input, or high impedance, connections are shown in Figure 30. The T140 reads the input signals in channels 1 to 8.

Contact Sense Inputs

Relays, switches and other volt-free contacts are read by the T140 when it is configured for contact sense inputs, using either the internal contact wetting current supply, or an external supply. Figure 31 shows the connections for using the 24 volts internal supply.

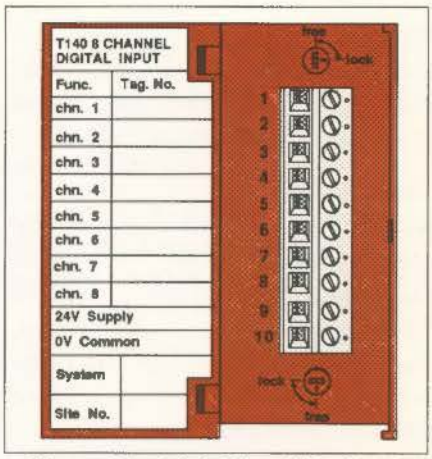


Figure 29 *Eight Way Digital Input Module*

Figure 32 shows the connections for using an external power supply. The customer power supply must not exceed 30 volts.

Order Code. T140/TAG- - - - - - - -
(if the TAG is not specified it will be supplied blank).

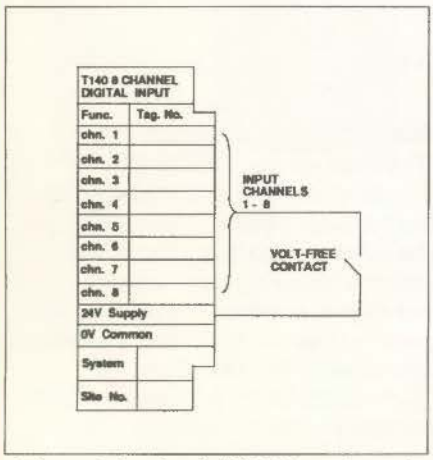


Figure 30 *Logic (High Impedance) Input*

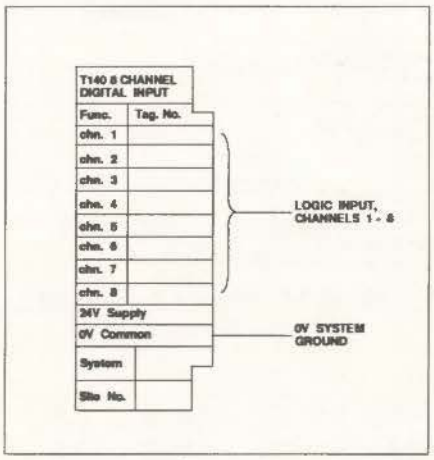


Figure 31 *Contact Sense Inputs Using Internal Power Supply*

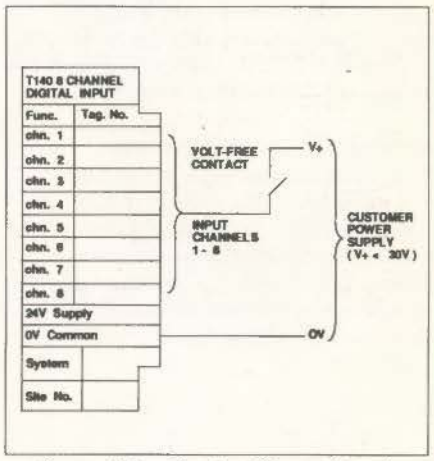


Figure 32 *Contact Sense Inputs Using External Power Supply*

T150 Module - High Level Analogue Output

SPECIFICATION

Outputs:	voltage or current
D to A Resolution:	>15 bit
Calibration Values:	in T150 E²PROM
Hardware Response time:	0.1 sec.

Voltage Output

Nominal Range:	0 to 10V
Minimum output:	–1V
Maximum output:	11V
Drive Capability:	–0.3 to 20mA
Resolution:	0.18mV
Accuracy, entire range:	±5mV
Temperature Stability:	offset drift ±160µV/°C, gain drift ±0.01%/°C of output
Short-circuit Output:	read by processor

Current Output

Nominal Range:	0 to 20mA
Minimum output:	0mA
Maximum output:	22mA
Drive Capability:	<750Ω
Resolution:	0.37µA
Accuracy, entire range:	±10µA
Temperature Stability :	offset drift ±0.05µA/°C, gain drift ±0.01%/°C of output
Open Circuit Output:	read by processor

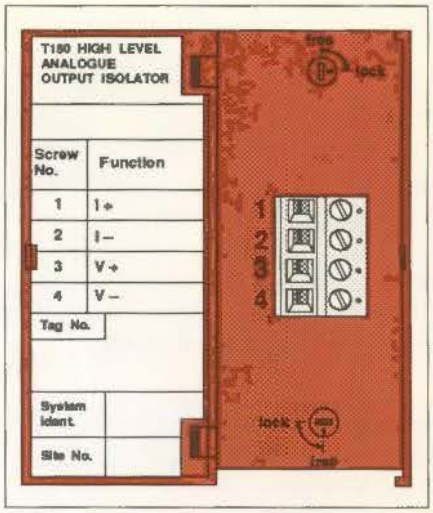


Figure 33 *High Level Analogue Input Module*

DESCRIPTION

Figure 33 shows the inside of the T150 module, with connections corresponding to the door label.

The T150 has a single analogue output channel. It can drive voltage or current signals and the hardware supports outputs anywhere within the range 0 to 10V or 0 to 20 mA. Table 11 shows the output ranges that are selectable.

Voltage/Current Outputs

The T150 may be used for either a current output or a voltage output, as selected in the software configurator. A current output should be connected across pins 1 and 2; a voltage output should be connected across pins 3 and 4. Figure 34 shows the connections for the T150.

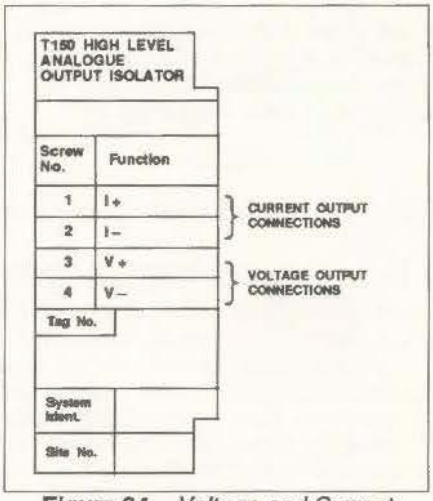


Figure 34 *Voltage and Current Output Connections*

Volts	0 to 10	1 to 5	0 to 1
mA	0 to 20	4 to 20	0 to 10

Table 11 *Analogue Output Ranges Selectable*

Order Code. T150/TAG--------
(if the TAG is not specified it will be supplied blank).

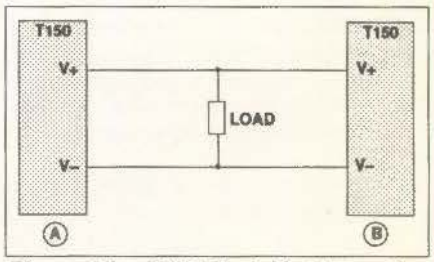


Figure 35 *T150 Back-Up Connections — Voltage Output*

Back-Up Connections

The T150 may be backed up by a T150 in a different T100 Base Unit, so that the back-up module takes over when the power supply fails. The module with the higher signal is selected as the net output, and the other module reports to its processor that it is being overdriven. Figures 35 and 36 illustrate the back-up connections for voltage and current outputs.

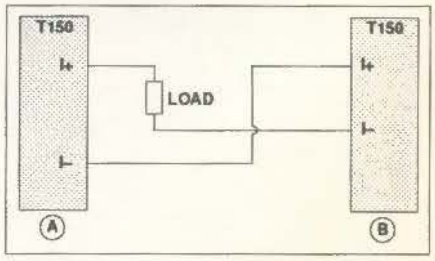


Figure 36 *T150 Back-Up Connections - Current Output*

T180 Module - Eight-Way Digital Output

SPECIFICATION

Outputs: 8 identical digital, open drain with s/w selectable pull-up voltage

Processor Read-back:	all outputs
Read-back Threshold:	≈2.5V
Read-back Input Filter:	20µs
Hardware Response Time:	0.1 sec./ channel

Logic 0, Output Low

Current Sink Capability:	120mA max
'ON' Resistance:	4Ω max

Logic 1, Output High

Open Drain Voltage:	60V max

Pull-up Voltages (s/ware selectable): none (open drain), 5V, 15V, 24V

Internal Pull-up Resistor	10Ω

DESCRIPTION

Figure 37 shows the inside of the T180 module, with connections corresponding to the door label.

The T180 eight-channel digital output module may be configured for either open-drain or logic output signals. This is set in the software, and all eight channels are configured for the same type of output. The connections for the open-drain output (with no pull-up voltage) are shown in Figure 38. Pins 9 and 10, the 0V ground, are interchangeable for both types of output.

Logic Output

The logic output connections, with a pull-up voltage of 5V, 15V or 24V, are shown in Figure 39. The pull-up voltage level is selected via the software configurator.

Order Code. T180/TAG- - - - - - - - (if the TAG is not specified it will be supplied blank).

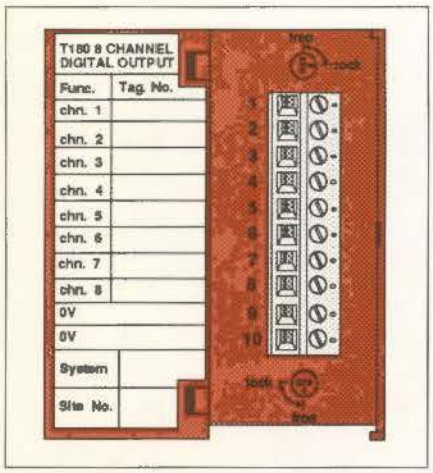


Figure 37 *Eight Way Digital Output Module*

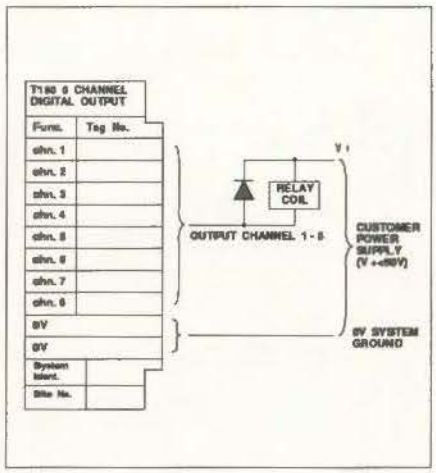


Figure 38 *Open-Drain Output (No Pull-Up Voltage)*

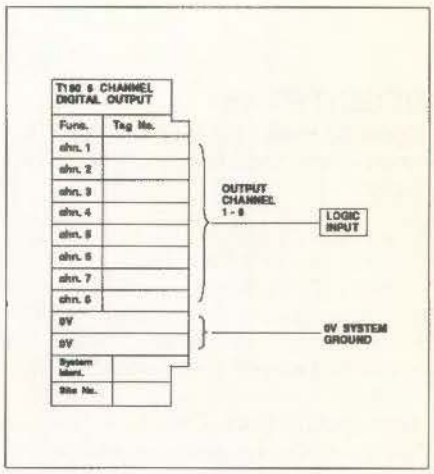


Figure 39 *Logic Output (Pull Up Voltage)*

ORDERING INFORMATION

BASE UNIT

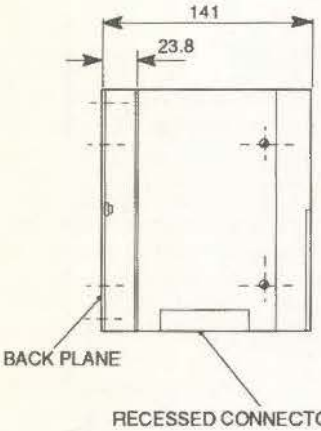
DESCRIPTION		ORDER CODE
T100 Intelligent I/O System:	— base unit	T100
Power Supply: 20-50V	— DC with backup inputs	DC
Communications:	— RS422	RS422
Tag:	— Unit I/D (4 characters)	TAG:____
Mounting:	— Bulkhead — 19-inch Rack Mounting	(no code) 19"RM
Factory Configuration:	—I/O modules fitted & sites pre-configured	F

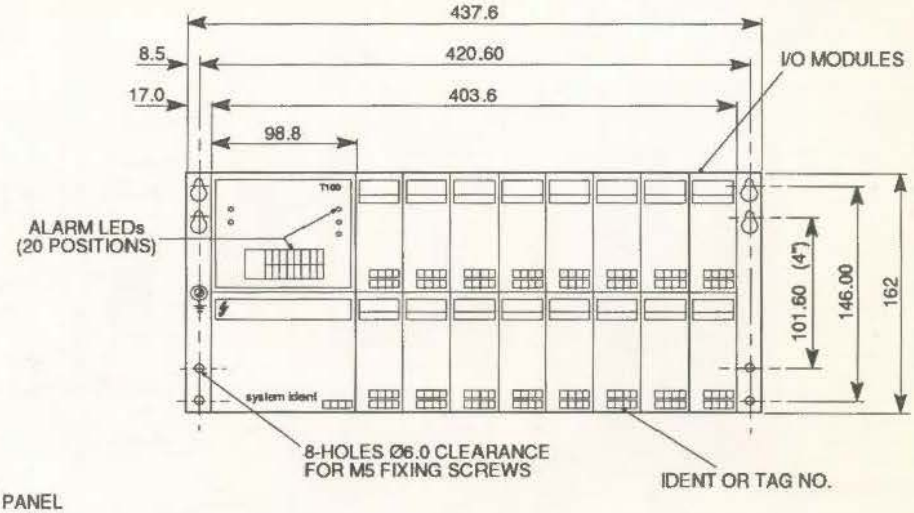
E.g. T100/DC/RS422/TAG:FURN/19"RM/F

I/O MODULES

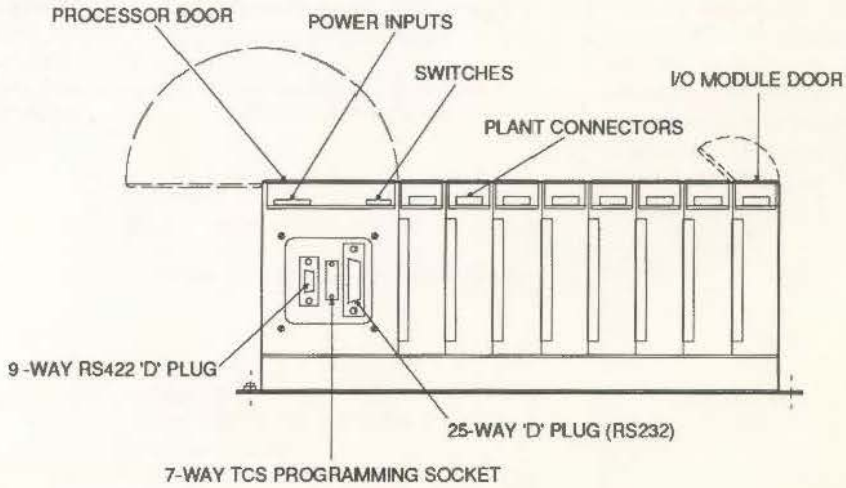
DESCRIPTION	CODE
1- Channel Thermocouple Conditioner	T110
1- Channel PRT Input Conditioner	T111
8 - Channel Low Level Input Conditioner	T112
High Level Analogue Input	T120
Dual High Level Analogue Input	T121
8-Channel High Level An. Input	T122
1-Channel Frequency Input	T130
8-Channel Digital Input	T140
High Level Analogue Output	T150
8-Channel Digital Output	T180

DIMENSIONS



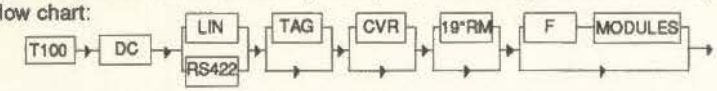


NOTE: T100 IS INSTALLED ORIENTATED AS ABOVE ONLY



T100 INTELLIGENT I/O SYSTEM — Order Form

1 Fill in the T100 **Base Unit Order Code** you require, on the diagram below. The options are shown in this flow chart:



DC = PSU. **LIN/RS422** = Comms. **TAG** = Base Unit I/D markers. **CVR*** = PSU/processor protective cover. **19"RM** = rack mounting. **F** = factory-configured I/O modules and sites. **MODULES** = Quantity of I/O Modules fitted to Base Unit (1 to16) (Specify only with F option)
(*Not yet available*)
Examples: **T100**/DC/RS422/TAG/19"RM/10; **T100**/DC/RS422/CVR/F/16

2 If you specified the **TAG** option, fill in the 4-character (maximum) **Base Unit Tag** you want on the T100 fascia.

3 If you specified the **F** option, fill in the **I/O Module Type** you want configured (with default parameters) in each of the 16 sites, including any 'blank boxes' (T1BB). *Unspecified sites will be fitted with blanking plugs*. Also fill in the **I/O Module Tag** you want to appear on each module.

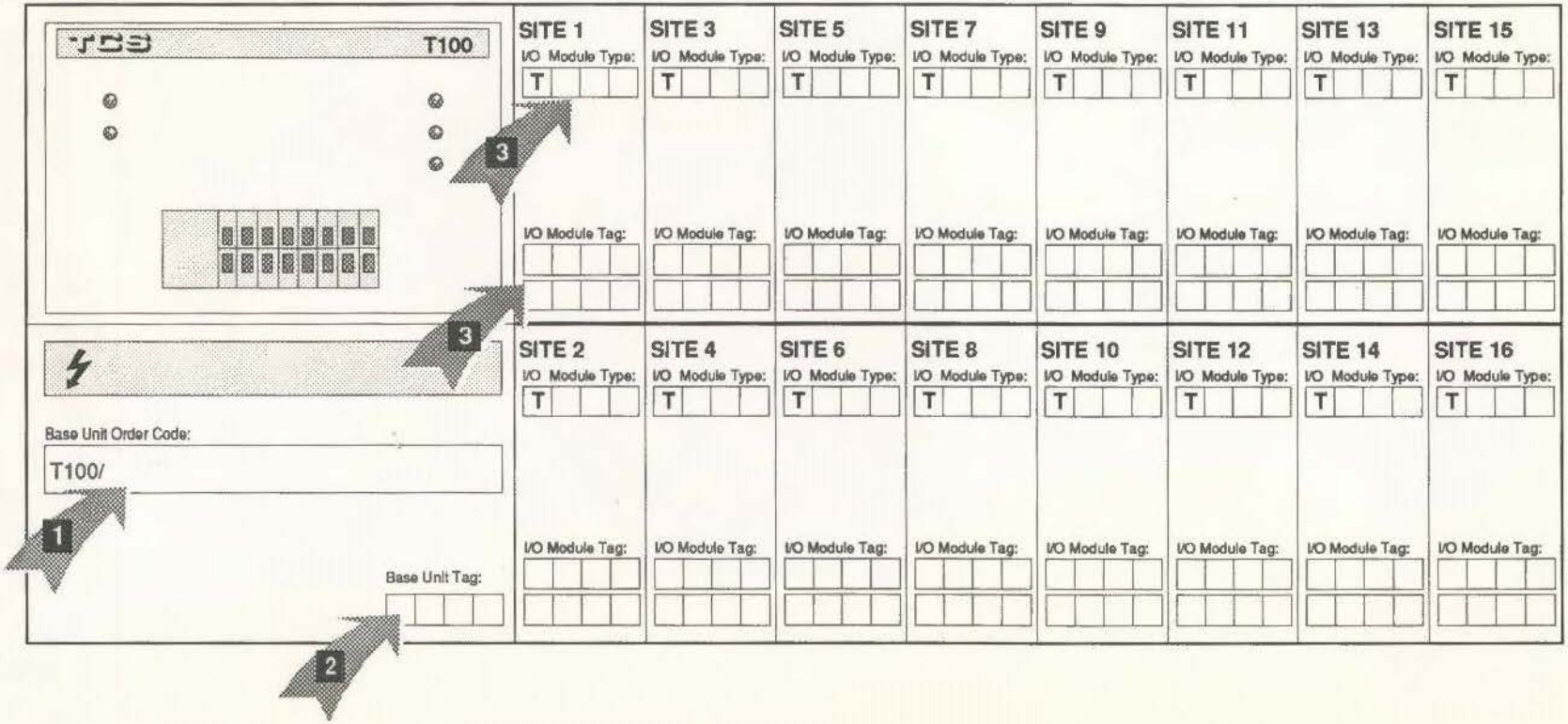
4 If you want to order *loose* I/O Modules simply advise us of the order codes for each module.
Examples: T120/TAG:TIC01014; T150 (*tags left blank*)

Customer .....

Order Number .....

Date .....

Sheet ..... **of** .....



Turnbull Control Systems Limited
Broadwater Trading Estate
Worthing Sussex BN14 8NW
Tel: Worthing (0903) 205277 Telex: 87437 Fax. 0903 33902

HA 081140 U001
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TCS continuously strives to improve and develop its products. The specifications in this document may therefore be changed without notice.