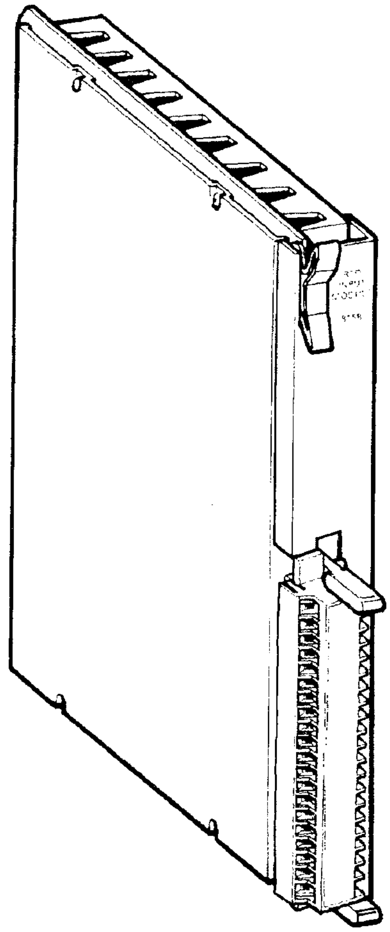
CEGELEC
INDUSTRIAL CONTROLS

8158 RTD Input Module



GEM 80 USER INFORMATION

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1. INTRODUCTION

The 8158 Resistance Thermometry Device (RTD) Input module provides signal conditioning and linearisation for resistive temperature measurement devices. It is one of a range of modules that are used in conjunction with GEM 80 controllers that have Verification I/O capability.

Eight input channels are available, each one being user programable to output the measured RTD value as resistance or as one of three temperature scales.

The module is self calibrating and has auto ranging.

2. SPECIFICATION

POWER REQUIREMENTS

From GEM 80	:	+15V @ 40mA
	:	+5V @ 290mA
From Plantside Supply	:	+/- 15V @ 210mA

Note

Modules later than Issue C do not have the facility to take a supply from the backplane

INPUTS

2-, 3- and 4-wire RTDs	:	8 differential floating inputs.
RTD Temperature Range (PT100 type RTD)	:	-200°C to 850°C
	:	-328°F to 1562°F
Resistance Range	:	0 to 500 ohm.
Step Response Time	:	10ms 10% to 90%
	:	10ms 90% to 10%
Resolution	:	Relative to units being measured____°F, °C, K or Ohms

0 - 4095	1 step
4096 - 8190	2 steps
8192 - 12288	3 steps
12288 and above	4 steps

Accuracy	:	0.1% of full scale reading
Stability	:	Self calibrating.
Linearity	:	0.024% of full scale.
Input Impedance	:	2 Gohm
Input Isolation	:	1500V between analogue signals and GEM 80.
Input Protection	:	70V a.c./d.c. differential and common mode.

MECHANICAL

Temperature	:	0°C to 60°C operating.
	:	-25°C to 70°C storage.
Humidity	:	10% to 90% non-condensing
Fire Resistance	:	UL94 Class VO
Standards	:	IEC 751
	:	BS 1904
	:	DIN 43760
Weight	:	0.5kg approx.

Dimensions	:	Standard single width module
Mechanical Interlocks	:	10, 18 and 31

3. HARDWARE LAYOUT

Figure 3.1 shows the relative position of the module within a system.

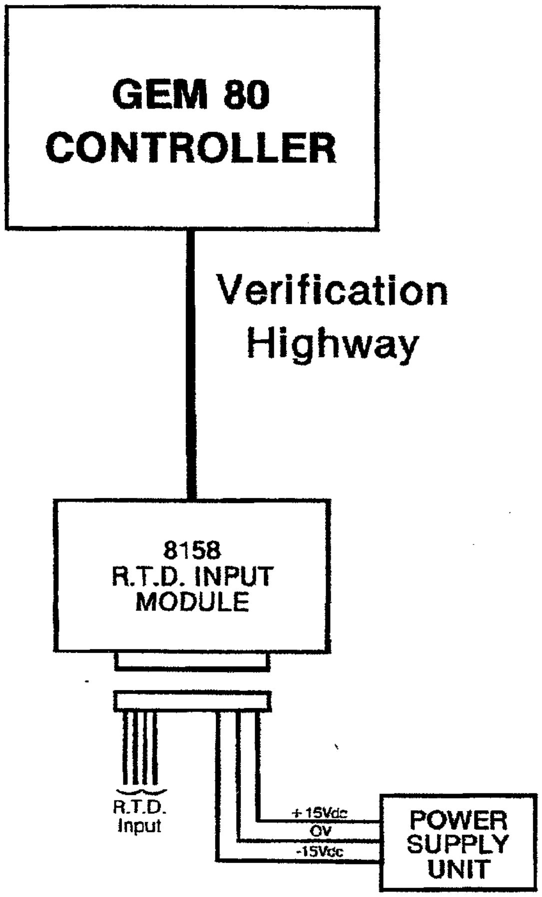

Figure 3.1 Relative Position of Module Within System

4. OPERATION

4.1 Introduction

The 8158 module produces a source current for a resistive device. This generates a voltage drop that is amplified, processed and presented to the GEM 80 controller as a sixteen bit word. The user can select whether this word represents resistance in ohms or temperature in °C, °F, or K.

A separate -15V/0V/+15V power supply unit is required to power the unit. Full connection details are given in Section 7 Connections.

4.2 Inputs

Each of the eight input channels accepts inputs within the range 0 to 500 ohms and can be individually connected for 2-, 3-, or 4-wire RTD operation, allowing the module to receive inputs from a variety of RTDs at the same time.

Full configuration details for the 8158 RTD module are contained in Section 4.4 Programming.

4.3 Addressing

The RTD input module occupies eight Verification I/O addresses. The maximum number of Verification I/O addresses is 4096 (0 to 4095) which is 2^{12} Therefore, to allow the module to be allocated any required address within the range of 0 to 4095, subject to the capacity of the host controller, twelve address switches are required.

The twelve switches are located at the bottom rear corner of the module and are accessible without removing the modules protective sidecover. The twelve switches are in a group of eight, bits 0-7, and a group of four, bits 8-11. When a switch is in the "ON" position, that bit is a logical "1". Figure 4.1 shows the layout of the address switches.

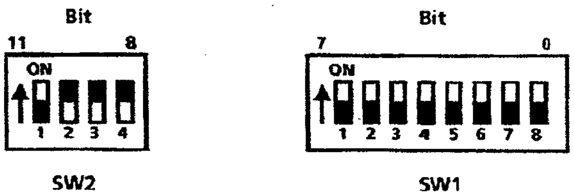

Figure 4.1 Address Switch Arrangement

In Figure 4.1 the address switches for bits 8 (256), 9 (512), and 10 (1024) are set to the logical "1" position giving a module base address of 1792 (256+512 +1024).

The module address corresponds to the address of the first channel. The subsequent seven addresses are then assigned automatically to the remaining seven channels of the module. Any available address may be used by the module but care must be taken to ensure that when the seven addresses are automatically assigned, they do not overlap any other previously allocated address as this will cause errors on the Verification highway.

It must be remembered that the base address of the module must be at least eight addresses less than the maximum I/O address of the host controller. If this rule is not observed it will result in the loss of one or more of the top channels of the module. For example, if the maximum I/O address of the host controller is 256 and the module is given an address of 251 only six addresses are available. This results in a loss of channels 7 and 8 of the module.

Any channels that are unused on the module will still occupy one word of I/O and parameter data.

4.4 Programming

The module is configured by means of eight P-Tables. Each channel can be individually configured to give the data in ohms, °C, °F, or K. In addition, each channel has a bit in its P-Table that specifies whether the channel is used or unused.

The bit allocation within the P-Table is as follows:

```
Bit   15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
                                    X   0 0 Resistance
                                    X   0 1 °C
                                    X   1 0 °F
                                    X   1 1 K
```

"X" shows that bit 3 is set to either a "1" or a "0" to indicate whether a channel is used or unused.

Bit 7 should always be set to a "1" in the first P-table location for each module to indicate that the module occupies eight address locations.

A typical system could have the following requirements.

Requirement : 2 off 2-wire RTDs indicating °C and °F

2 off 3-wire RTD indicating °F

4 off 4-wire RTDs indicating °C and resistance

The user might decide to allocate the channels as follows:

Channel	No. of wires	Format
1	2	°C
2	4	°C
3	4	°C
4	2	°F
5	4	Resistance
6	4	Resistance
7	3	°F
8	3	°F

In this example, the configuration data has been written into locations P300 to P307 inclusive. The value 300 has been written into location P53 which tells the GEM 80 controller that the start of the parameter tables can be found in location P300.

P300	0000	0000	1000	1001
P301	0000	0000	0000	1001
P302	0000	0000	0000	1001
P303	0000	0000	0000	1010
P304	0000	0000	0000	1000
P305	0000	0000	0000	1000
P306	0000	0000	0000	1010
P307	0000	0000	0000	1010

4.5 Fault Tables

Two bits are available in the F-Tables, a warning bit and a fault bit.

The warning bit is set when the module has been set up incorrectly, the RTD is open or short circuit, or the resistance input is overrange.

The fault bit is set when the module has failed or there has been a verification highway error.

The location of the two bits within the F-Tables will depend on the address allocated to the particular module. However, they will always be in a block of sixteen bits, the fault bits being the odd numbered bits and the warning bits being the even numbered bits. Depending on the addresses allocated to the module, the block of sixteen bits may be split between two F-Table locations.

Table 4.1 Fault Locations

Fault Table	Address	Fault Table	Address	Fault Table	Address	Fault Table	Address
F45	0-7	F53	64-71	F61	128-135	F69	192-199
F46	8-15	F54	72-79	F62	136-143	F70	200-207
F47	16-23	F55	80-87	F63	144-151	F71	208-215
F48	24-31	F56	88-95	F64	152-159	F72	216-223
F49	32-39	F57	96-103	F65	160-167	F73	224-231
F50	40-47	F58	104-111	F66	168-175	F74	232-239
F51	48-55	F59	112-119	F67	176-183	F75	240-247
F52	56-63	F60	120-127	F68	184-191	F76	248-255

Any fault table with its associated block of 8 I/O addresses can be calculated from the formula :

Fn = (n : 8) + 45

where n is the I/O address

e.g. To find the fault table associated with A231

F231 = (231 : 8) + 45
= 28 + 45
= F73

The remainder from the integer division is used to identify the low order bit of the pair associated with the I/O address in the fault table.

231 : 8 = 28 rem 7

The low order bit is obtained by multiplying the 7 by 2

7 x 2 = 14

Hence F73 bits 14 and 15 correspond to A231.

5. APPLICATION NOTES

Figure 5.1 shows an example of ladder diagram. In it, the rungs take four readings from inputs A0 to A3 (in the same units) and outputs the lowest temperature to B8. The sensor giving the lowest reading is identified in G1.

```
|                                                                          |
|            GT                                                            |
+-<AND>---SPEC.----------------------------------------------------(OUT)+
|  A0       T3                                                     G0.0|
|         +-<   >                                                       |
|         |                                                              |
+-<AND>--+                                                              |
|  A1                                                                   |
|                                                                       |
|            GT                                                          |
+-<AND>---SPEC.----------------------------------------------------(OUT)+
|  A0       T3                                                     G0.1|
|         +-<   >                                                       |
|         |                                                              |
+-<AND>--+                                                              |
|  A2                                                                   |
|                                                                       |
|            GT                                                          |
+-<AND>---SPEC.----------------------------------------------------(OUT)+
|  A0       T3                                                     G0.2|
|         +-<   >                                                       |
|         |                                                              |
+-<AND>--+                                                              |
|  A3                                                                   |
|                                                                       |
|            GT                                                          |
+-<AND>---SPEC.----------------------------------------------------(OUT)+
|  A1       T3                                                     G0.3|
|         +-<   >                                                       |
|         |                                                              |
+-<AND>--+                                                              |
|  A2                                                                   |
|                                                                       |
|            GT                                                          |
+-<AND>---SPEC.----------------------------------------------------(OUT)+
|  A1       T3                                                     G0.4|
|         +-<   >                                                       |
|         |                                                              |
+-<AND>--+                                                              |
|  A3                                                                   |
|                                                                       |
|            GT                                                          |
+-<AND>---SPEC.----------------------------------------------------(OUT)+
|  A2       T3                                                     G0.5|
|         +-<   >                                                       |
|         |                                                              |
+-<AND>--+                                                              |
|  A3                                                                   |
|                                                                       |
+-<AND>-----]/[----]/[----]/[--+-----------------------------------(OUT)+
|   0        G0.0   G0.1   G0.2 |                                  G1   |
|                               |                                        |
+-<AND>-----] [----]/[----]/[--+                                        |
|   1        G0.0   G0.3   G0.4 |                                       |
|                               |                                        |
+-<AND>-----] [----] [----]/[--+                                        |
|   2        G0.1   G0.3   G0.5 |                                       |
|                               |                                        |
+-<AND>-----] [----] [----] [--+                                        |
|   3        G0.2   G0.4   G0.5                                         |
|          LOCATE                MOVE                                    |
+-<AND>---<SPEC>---<VALUE>---<SPEC>---<VALUE>---------------(OUT)+
|  G1       S20       A0        T20        1                 F200 |
|                             +-<     >                            |
|          LOCATE             |
+-<AND>---<SPEC>---<VALUE>--+
|  0        S20       B8
|
```

Figure 5.1 Ladder Diagram Example

6. INSTALLATION

Each subrack backplane edge connector is fitted with plastic coding keys (called Mechanical Interlocks) in positions 10, 12, 18 and 31. The key fitted in position 31 is used as a guide to accurately locate the module's edge connector and must not be removed.

This module is constructed to accept the coding keys in slots 10, 18, and 31 only, therefore the coding key in position 12 must be removed. This identifies the slot as being allocated to a Verification input module

For the greatest accuracy with two wire RTDs, the leads joining the RTD to the module should be as short as possible as their resistance is included in that measured as the RTD.

On three or four wire RTDs, the compensating lead(s) should be the same length and gauge as those from the RTD.

If the leads need extending, they should all be extended by the same length and gauge of the same material. The type of material used for the lead extension is not critical. It is more important to ensure that the overall length of all leads remain equal.

Care must be taken in wiring up the four wire inputs due to the different configurations possible. Each configuration will only work when wired up as shown in Figure 7.3.

7. CONNECTIONS

The cabling from the plant mounted RTDs is terminated in two flying sockets (supplied with the module) that connect to two panel mounted sockets on the front of the module. The sockets have screw terminals and will accommodate cores of up to 2.5 mm^2.

A separate -15V/0V/+15V power supply, sized to take into account the number of RTD Input Modules fitted, is required and is connected via the plant-side connector on the front of the module.

Socket terminal connections are shown in Table 7.1

Table 7.1 Plant Wiring Terminations to Module

Terminal	Function	Terminal	Function
1	RTD 1	19	RTD 5
2	1	20	5
3	1	21	RTD 6
4	1	22	6
5	RTD 2	23	6
6	2	24	6
7	2	25	RTD 7
8	2	26	7
9	RTD 3	27	7
10	3	28	7
11	3	29	RTD 8
12	3	30	8
13	RTD 4	31	8
14	4	32	8
15	4	33	Earth
16	4	34	0V
17	RTD 5	35	-15V
18	5	36	+15V

Figures 7.1, 7.2, and 7.3 show the connections for a 2-, 3-, and 4-wire RTD respectively. For ease of understanding, the figures all use RTD channels 1 and 2 for the examples.

Figure 7.4 shows the connections for a typical system. It is based on the one discussed in 4.4.

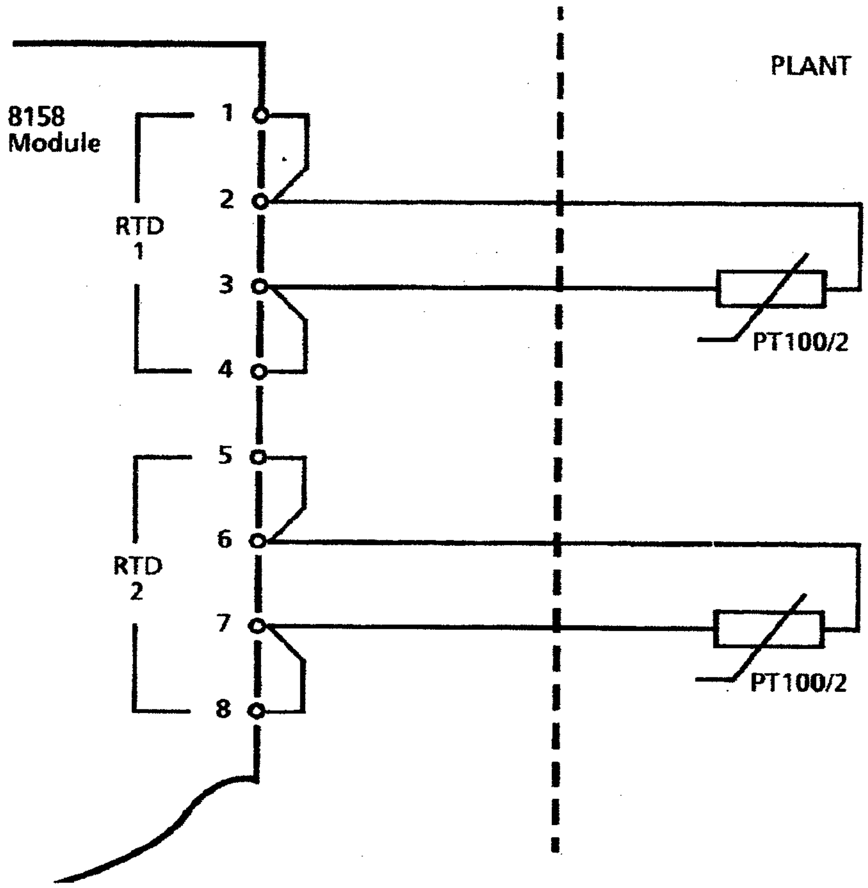

Figure 7.1 2-wire RTD Terminations

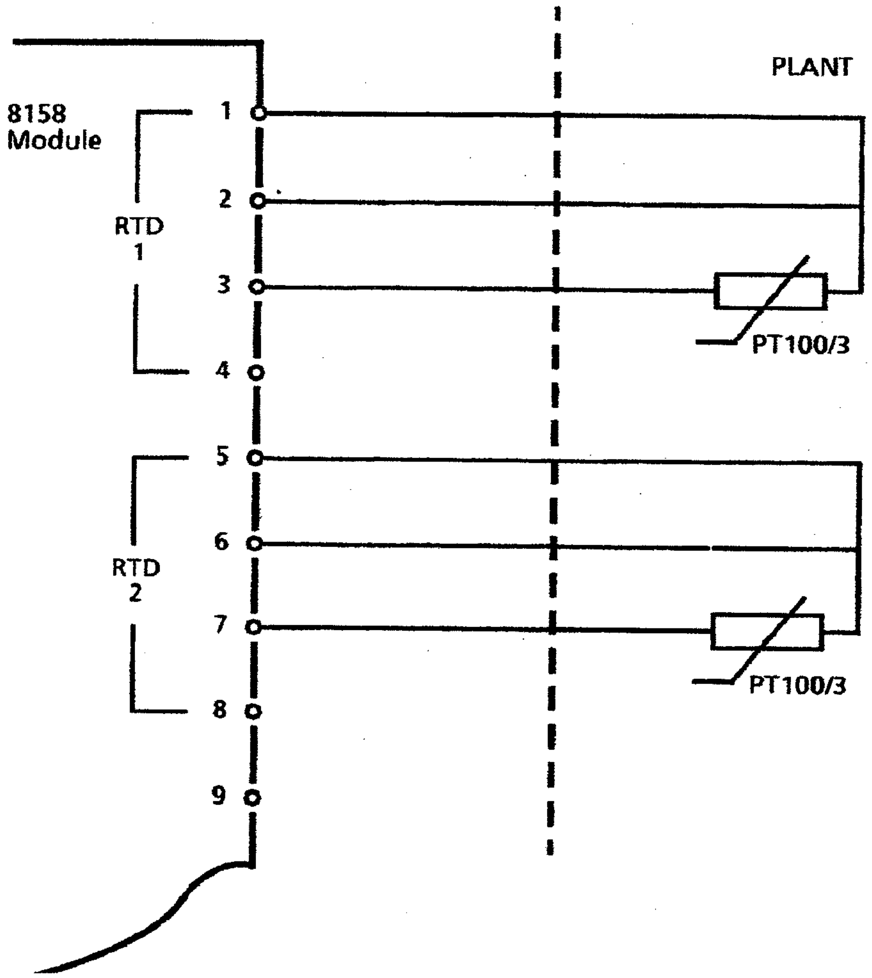

Figure 7.2 3-wire RTD Terminations

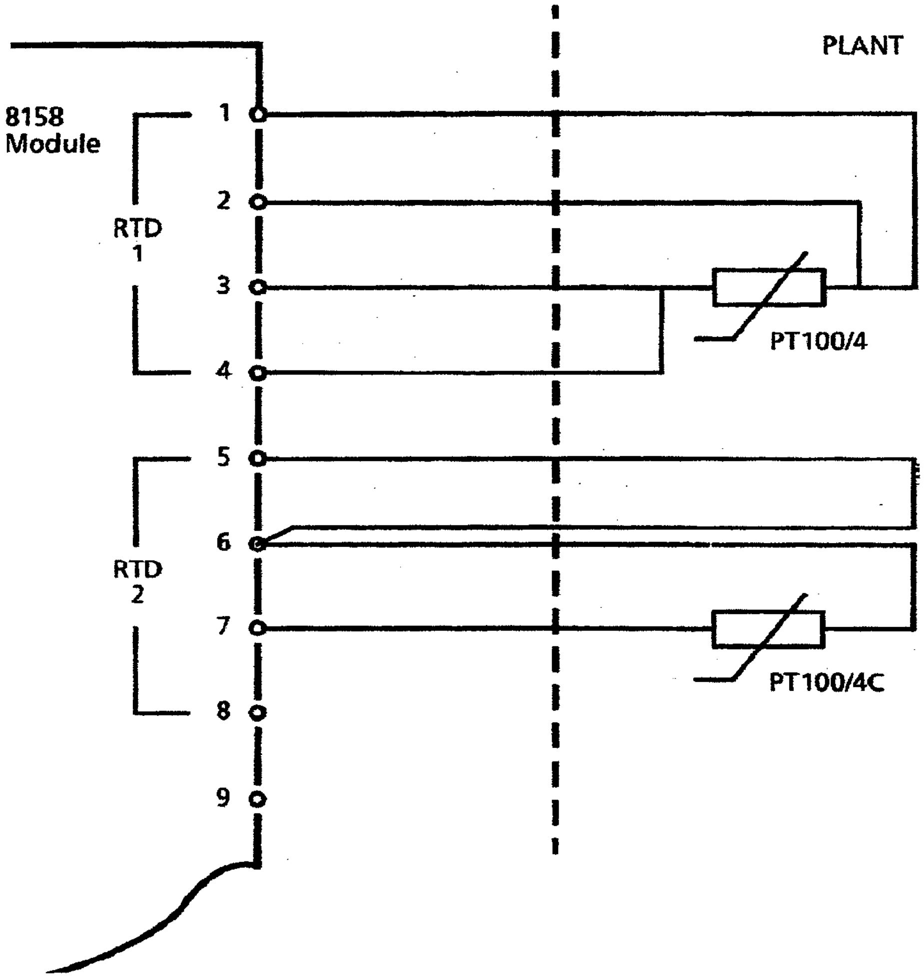

Figure 7.3 4-wire RTD Terminations

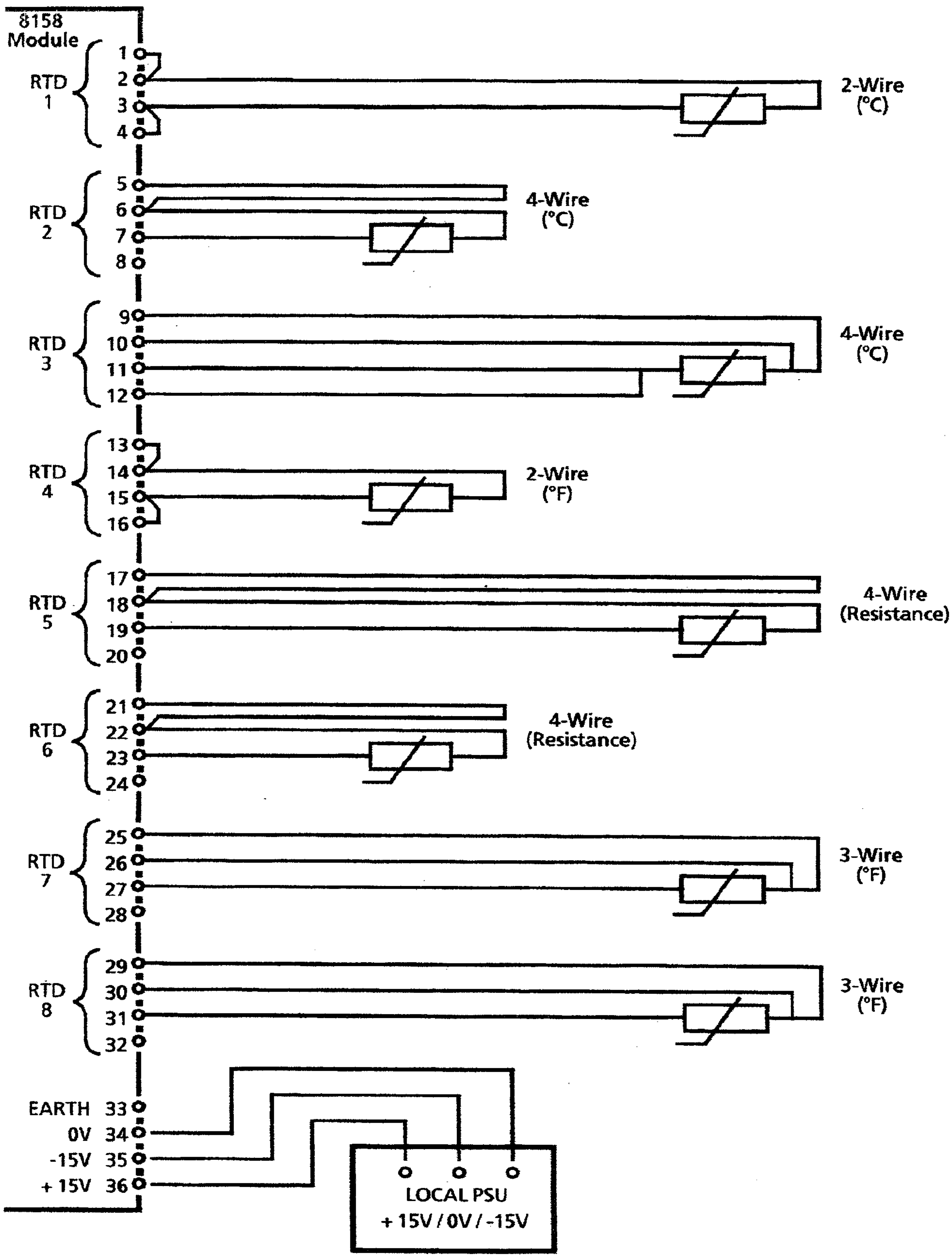

Figure 7.4 Connections - Typical System

8. ORDERING CODES

RTD Input Module with EPROM	8158-4004

9. ADDITIONAL INFORMATION

If you require any further information, or wish to discuss an application in detail, do not hesitate to contact the GEM 80 Customer Support Unit at;

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T476 Issue 3 07.90