



## Hydrogen Mobility pressure sensor

M71H2 –Standard Version  
M91H2 –Enhanced Version

### Overview

The M71H2 & M91H2 series is now available for hydrogen pressure sensing applications. Tested to a variety of hydrogen and automotive standards, the HYDROGEN series combines the best mechanical design for hydrogen measurement with high performance digital compensation.

### Benefits

- More compact and simplified design
- Uses Microfused sensing technology
- Lighter Weight
- Designed for higher volume applications
- Includes sensor level diagnostics
- EC-79 Certification

### Applications

- PEM Fuel Cells
- Hydrogen Storage
- Hydrogen Filling Stations
- Test Stands
- Back Up Power

## Product Data

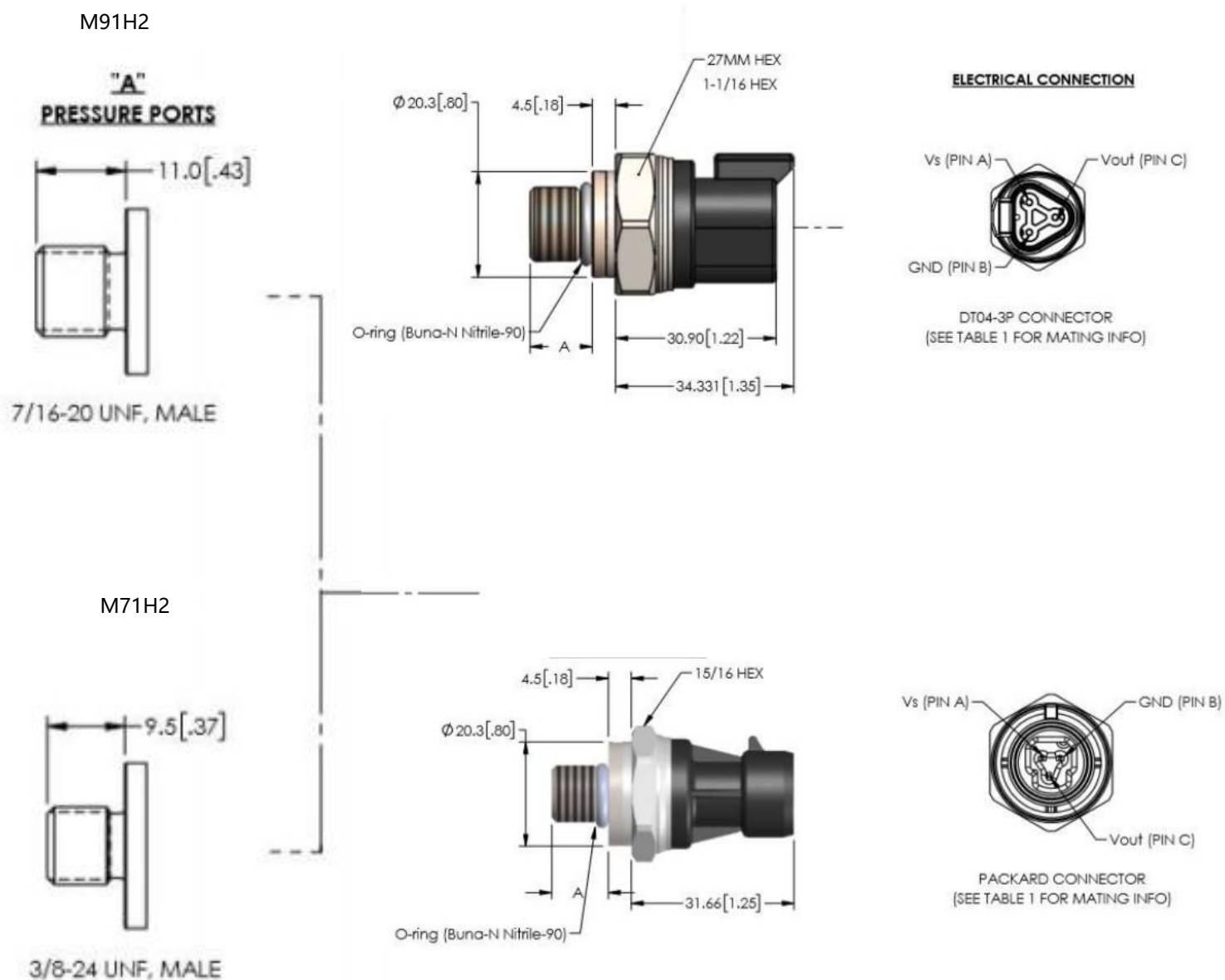
|                           |                                                                                                     |
|---------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Status:</b>            | New Product Release (B Samples available / SOP Q4 2021)                                             |
| <b>Application:</b>       | Hydrogen Storage and Motive line pressure                                                           |
| <b>Location:</b>          | Storage and Distribution System                                                                     |
| <b>Type of pressure:</b>  | Gage                                                                                                |
| <b>Power supply:</b>      | 5 +/- 0.25 VDC                                                                                      |
| <b>Output signal:</b>     | Analog Ratiometric (0.5 to 4.5V)                                                                    |
| <b>Electr. Connector:</b> | Delphi Packard / Deutsch                                                                            |
| <b>Pressure range:</b>    | 20,448, 900 Bar                                                                                     |
| <b>Storage Temp:</b>      | -40 to 140°C                                                                                        |
| <b>Compensated Temp:</b>  | -40C to 85C                                                                                         |
| <b>Accuracy</b>           | ± 0.25% Span                                                                                        |
| <b>Total Error Band:</b>  | ±1% -20C to 85C / ± 2% -40C to -20C (448/900 bar)<br>±1.5% -20C to 85C / ± 3% -40C to -20C (20 bar) |
| <b>Special feature:</b>   | -316L Wetted Materials<br>-EC-79 Certified<br>-Microfused Strain Gage Technology                    |

## Certification Information

### EC-79 Certification

|                       |                                                   |
|-----------------------|---------------------------------------------------|
| H2 Compatibility:     | Wetted Material must be compliant to ISO11114-1   |
| Ageing Test:          | Compliant to D572. Exposed to O2@85C + 2MPa.      |
| Corrosion Resistance: | Compliant to ISO9227 Salt Spray 144 Hrs           |
| Endurance Test:       | 72K Pressure Cycle at Amb, 1.5K Cycles -40C, 85C. |
| Hydraulic Test:       | Hydraulic 115K Pressure Cycles at Ambient         |
| External Leakage:     | Over Temperature, at Nominal Work Pressure.       |

## Dimensions & Electrical Connection



## M71H2

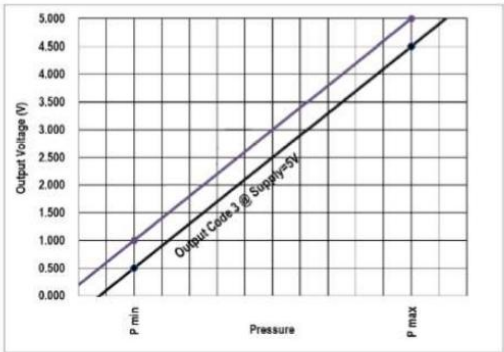
| PERFORMANCE                                                 |                                                                                                                       |             |     |       |            |       |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------|-----|-------|------------|-------|
| PARAMETERS                                                  |                                                                                                                       | MIN         | TYF | MAX   | UNITS      | NOTES |
| SUPPLY VOLTAGE                                              |                                                                                                                       | SEE TABLE 2 |     |       | V          |       |
| SUPPLY CURRENT                                              |                                                                                                                       | SEE TABLE 2 |     |       | mA         |       |
| OUTPUT VOLTAGE                                              |                                                                                                                       | SEE TABLE 2 |     |       | V          | 1     |
| LOAD RESISTANCE                                             |                                                                                                                       | 10          |     |       | KOHM       |       |
| ACCURACY (COMBINED LINEARITY<br>HYSTERESIS & REPEATABILITY) |                                                                                                                       | -0.25       |     | +0.25 | %SPAN      | 2     |
| TOTAL ERROR<br>BAND<br>448B & 900B                          | 0 TO 100°C                                                                                                            | -1.0        |     | +1.0  | %SPAN      | 3     |
|                                                             | -40 TO 0°C                                                                                                            |             |     |       |            |       |
|                                                             | 100 TO 125°C                                                                                                          | -2.0        |     | +2.0  |            |       |
| TOTAL ERROR<br>BAND 20B                                     | 0 TO 100°C                                                                                                            | -1.5        |     | +1.5  |            |       |
|                                                             | -40 TO 0°C                                                                                                            | -3.0        |     | +3.0  |            |       |
|                                                             | 100 TO 125°C                                                                                                          |             |     |       |            |       |
| OPERATING TEMPERATURE                                       |                                                                                                                       | -40         |     | + 120 | °C         | 9     |
| STORAGE TEMPERATURE                                         |                                                                                                                       | -50         |     | +140  | °C         |       |
| INSULATION RESISTANCE (500VDC)                              |                                                                                                                       | 10M         |     |       | OHM        | 4     |
| REVERSE VOLTAGE                                             |                                                                                                                       | SEE TABLE 2 |     |       | V          |       |
| OVERVOLTAGE PROTECTION                                      |                                                                                                                       | SEE TABLE 2 |     |       | V          |       |
| SHORT CIRCUIT PROTECTED                                     |                                                                                                                       | YES         |     |       |            |       |
| OUTPUT NOISE@ 1KHZ                                          |                                                                                                                       | -           | 10  | -     | mV         |       |
| LONG TERM STABILITY                                         |                                                                                                                       | -0.25       |     | 0.25  | %SPAN/YEAR |       |
| FREQUENCY RESPONSE@ 0-3dB                                   |                                                                                                                       |             | 1   | -     | KHz        |       |
| ENVIRONMENTAL                                               |                                                                                                                       |             |     |       |            |       |
| PARAMETERS                                                  | MIN                                                                                                                   | TYP         | MAX | UNITS | NOTES      |       |
| PRESSURE OVERLOAD                                           | -                                                                                                                     | -           | 2X  | RATED | 5          |       |
| PRESSURE BURST                                              | -                                                                                                                     | -           | 5X  | RATED | 6          |       |
| EC79 PRESSURE TEST<br>PARAMETERS                            | 50K CYCLES AT NOM. WORKING PRESSURE<br>150K CYCLES AT 1.25X NOM. WORKING PRESSURE<br>1 CYCLE 1X NOM. WORKING PRESSURE |             |     |       |            |       |
| MEDIA. PRESSURE<br>PORT                                     | FLUIDS COMPATIBLE WITH 316L ST STL                                                                                    |             |     |       |            |       |
| MECHANICAL<br>VIBRATION                                     | 20G. 10-2000HZ MIL-STD-810C, METHOD 514.2, CURVEL                                                                     |             |     |       |            |       |
| MECHANICAL SHOCK                                            | HALF-SINE. PEAK: 50g. 11 ms MIL-STD-202G, METHOD 213B. CONDITION A                                                    |             |     |       |            |       |
| PACKAGE<br>PROTECTION                                       | IP 67, PLUGGED MATING CONNECTOR - IEC60529                                                                            |             |     |       |            |       |

## M91H2

| PERFORMANCE                                                 |                                                                                                                       |             |     |       |            |       |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-------------|-----|-------|------------|-------|
| PARAMETERS                                                  |                                                                                                                       | MIN         | TYP | MAX   | UNITS      | NOTES |
| SUPPLY VOLTAGE                                              |                                                                                                                       | SEE TABLE 2 |     |       | V          |       |
| SUPPLY CURRENT                                              |                                                                                                                       | SEE TABLE 2 |     |       | mA         |       |
| OUTPUT VOLTAGE                                              |                                                                                                                       | SEE TABLE 2 |     |       | V          | 1     |
| LOAD RESISTANCE                                             |                                                                                                                       | 4           |     |       | KOHM       |       |
| ACCURACY (COMBINED LINEARITY<br>HYSTERESIS & REPEATABILITY) |                                                                                                                       | -0.25       |     | +0.25 | %SPAN      | 2     |
| TOTAL ERROR<br>BAND<br>448B & 900B                          | 0 TO 100°C                                                                                                            | -1.0        |     | +1.0  | %SPAN      | 3     |
|                                                             | -40 TO 0°C                                                                                                            |             |     |       |            |       |
|                                                             | 100 TO 125°C                                                                                                          | -2.0        |     | +2.0  |            |       |
| TOTAL ERROR<br>BAND 20B                                     | 0 TO 100°C                                                                                                            | -1.5        |     | +1.5  |            |       |
|                                                             | -40 TO 0°C                                                                                                            | -3.0        |     | +3.0  |            |       |
|                                                             | 100 TO 125°C                                                                                                          |             |     |       |            |       |
| OPERATING TEMPERATURE                                       |                                                                                                                       | -40         |     | + 120 | °C         | 9     |
| STORAGE TEMPERATURE                                         |                                                                                                                       | -50         |     | +140  | °C         |       |
| INSULATION RESISTANCE (500VDC)                              |                                                                                                                       | 10M         |     |       | OHM        | 4     |
| REVERSE VOLTAGE                                             |                                                                                                                       | SEE TABLE 2 |     |       | V          |       |
| OVERVOLTAGE PROTECTION                                      |                                                                                                                       | SEE TABLE 2 |     |       | V          |       |
| SHORT CIRCUIT PROTECTED                                     |                                                                                                                       | YES         |     |       |            |       |
| OUTPUT NOISE@ 1KHZ                                          |                                                                                                                       | -           | 10  | -     | mV         |       |
| LONG TERM STABILITY                                         |                                                                                                                       | -0.25       |     | 0.25  | %SPAN/YEAR |       |
| FREQUENCY RESPONSE@ 0-3dB                                   |                                                                                                                       |             | 1   | -     | KHz        |       |
| ENVIRONMENTAL                                               |                                                                                                                       |             |     |       |            |       |
| PARAMETERS                                                  | MIN                                                                                                                   | TYP         | MAX | UNITS | NOTES      |       |
| PRESSURE OVERLOAD                                           | -                                                                                                                     | -           | 2X  | RATED | 5          |       |
| PRESSURE BURST                                              | -                                                                                                                     | -           | 5X  | RATED | 6          |       |
| EC79 PRESSURE TEST<br>PARAMETERS                            | 50K CYCLES AT NOM. WORKING PRESSURE<br>150K CYCLES AT 1.25X NOM. WORKING PRESSURE<br>1 CYCLE 1X NOM. WORKING PRESSURE |             |     |       |            |       |
| MEDIA. PRESSURE PORT                                        | FLUIDS COMPATIBLE WITH 316L ST STL                                                                                    |             |     |       |            |       |
| MECHANFICAL LOADS                                           | ISO 16750-3: 2013 (CODE LETTER J)                                                                                     |             |     |       |            |       |
| ELECTRICAL LOADS                                            | ISO 16750-2: 2010                                                                                                     |             |     |       |            |       |
| CLIMATIC LOADS                                              | ISO 16750-4:2010 (CODE LETTER Q AND D)                                                                                |             |     |       |            |       |
| CHEMICAL LOADS                                              | ISO 16750-5: 2010 (CODE LETTER D)                                                                                     |             |     |       |            |       |
| PACKAGE PROTECTION                                          | IP69/IP6K9K (ISO 20653)                                                                                               |             |     |       |            |       |

M71H2+M91H2

CHART A: PRESSURE TRANSFER FUNCTIONS



Output Code 3:  
$$\text{Output Voltage} = \left[ \frac{0.8}{(P_{\text{max}} - P_{\text{min}})} \times (\text{Pressure applied} - P_{\text{min}}) + 0.1 \right] \times \text{Supply Voltage}$$

TABLE 2: OUTPUT TYPE VS. SUPPLY

|                                           |                        |
|-------------------------------------------|------------------------|
| OUTPUT TYPE [CODE)                        | 3                      |
| SUPPLY VOLTAGE                            | 4.75 ~ 5.25 V*         |
| SUPPLY CURRENT                            | 4.0 ~ 10.0 mA          |
| OUTPUT VOLTAGE                            | 0.5 ~ 4.5 V            |
| REVERSE VOLTAGE                           | 16 V                   |
| OVERVOLTAGE PROTECTION<br>(@ LEASE 1 MIN) | 28 V(M91) 16V<br>(M71) |
| • OUTPUT RATIO METRIC TO SUPPLY VOLTAGE   |                        |

TABLE 1: CONNECTOR MATING INFORMATION

|                                                                                                                                                          |                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------|
| DT04-3P                                                                                                                                                  | PACKARD METRI-PACK 150 SERIES                   |
| CONNECTOR. PIN PLATING                                                                                                                                   |                                                 |
| PIN PLATING. 0.4um min. AU PLATING<br>OVER 1.3-3um Ni PLATING.                                                                                           | 0.003mm Sn OVER 0 0005 - 0.001 mm Cu            |
| CONNECTOR, MATING                                                                                                                                        |                                                 |
| DT06-3S AND W3S-1939-P012                                                                                                                                | HOUSING P/N: 12065287<br>TERMINAL P/N: 12103881 |
| NOTES (CONTINUED): CONNECTOR                                                                                                                             |                                                 |
| 9.DO NOT APPLY TORQUE TO THE CONNECTOR HOUSING OF TRANSDUCER.                                                                                            |                                                 |
| 10.TO ENSURE PROPER ENVIRONMENTAL SEALING AND ELECTRICAL CONNECTIONS WHEN USING A<br>MATING CONNECTOR, FOLLOW THE MANUFACTURERS INSTALLATION GUIDELINES. |                                                 |

## M91 STANDARD PART MATRIX ORDERING INFO

MX1H2x x-xxxx x-x x 0000

| SENSOR |      |
|--------|------|
| CODE   | TYPE |
| 7      | M71  |
| 9      | M91  |

| OUTPUT TYPE<br>SEE TABLE 2 AND CHART A |           |
|----------------------------------------|-----------|
| CODE                                   | OUTPUT    |
| 3                                      | 0.5-4.5 V |

| CONNECTORS                         |                    |
|------------------------------------|--------------------|
| CODE                               | TYPE               |
| A*                                 | DT04-3P (M91 ONLY) |
| 9*                                 | PACKARD (M71 ONLY) |
| CONNECTOR AND MATING<br>SEE TABLE1 |                    |

| PRESSURE RANGE<br>(NOT EQUIVALENT)                    |          |
|-------------------------------------------------------|----------|
| BAR                                                   | PSI      |
| 020B                                                  | 300      |
| 448B                                                  | 7.500P   |
| 900B*                                                 | 13,000P* |
| •ONLY AVAILABLE IN 7/16-20.<br>SEE PRESSURE PORT CODE |          |

| PRESSURE TYPE |      |
|---------------|------|
| CODE          | TYPE |
| G             | GAGE |

| PORT MATERIAL |         |
|---------------|---------|
| CODE          | TYPE    |
| 1             | 316L SS |

| PRESSURE PORT |                                                  |           |                                              |
|---------------|--------------------------------------------------|-----------|----------------------------------------------|
| CODE          | PORT                                             | DIM" A"   | TIGHTENING<br>TORQUE<br>SEE NOTES<br>9,10,11 |
| D             | 7/16-20 UNF. SAE<br>J1926-2 MALE.<br>w/O- Ring   | 11.0[.43] | 10                                           |
| Y             | 3/8 - 24 UNF. SAE<br>J1926-2. MALE.<br>w/O- Ring | 9.5 [.37] | 10                                           |

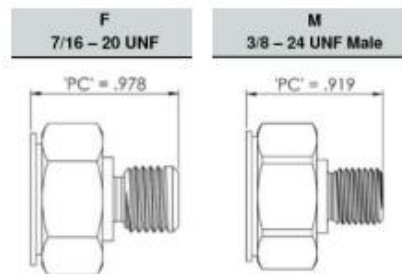
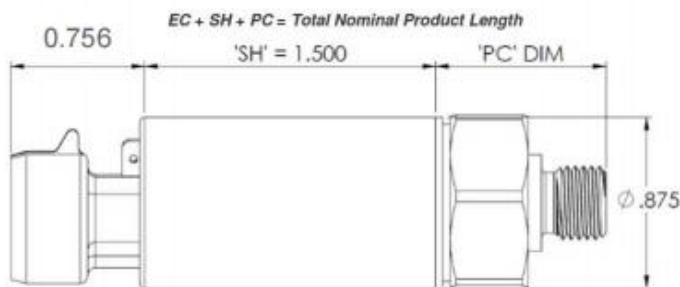
### NOTES (CONTINUED): INSTALLATION

11. TRANSDUCERS CAN BE INSTALLED BY EITHER SPANNER OR DEEP SOCKET. TORQUE VALUES PROVIDED ARE FOR REFERENCE: ACTUAL TORQUE DEPENDS UPON MATING PORT MATERIAL. SURFACE FINISH. LUBRICATION AND SEALING MECHANISM. TRANSDUCER CALIBRATION AND/OR ZERO MAY SHIFT IF PART IS OVER-TORQUED DURING INSTALLATION. CHECK FOR A ZERO SHIFT AFTER INSTALLING.

12.SAE J1926/2 ONLY APPROVED UP TO 63 MPa

SAE O-rings are not provided

## AST2000 H2 (Reference)



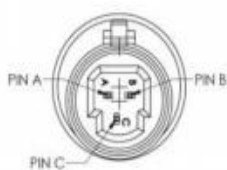
Ambient Temperature: 25°C (77°F) (Unless otherwise specified)

| Parameters              | AST2000              | AST2000 High Accuracy  |
|-------------------------|----------------------|------------------------|
| Accuracy                | ±0.25%               | ±0.25%                 |
| Zero Error              | ±1                   | ±1                     |
| Span Error              | ±1                   | ±1                     |
| Thermal Error, Zero     | -1.0                 | -                      |
| Thermal Error, Span     | -1.0                 | -                      |
| Total Error Band        | -                    | 1.0%                   |
| Stability (1 year)      | ±0.25 TYP            | ±0.25 TYP              |
| Proof Pressure          | 2X Rated Pressure    | 2X Rated Pressure      |
| Burst Pressure          | 5X Rated Pressure    | 5X Rated Pressure      |
| Pressure Cycles         | 10 Million           | 10 Million             |
| Compensated Temp. Range | 0 - 55° (32 to 132°) | -20 - 60° (-4 to 140°) |

### Electrical Data

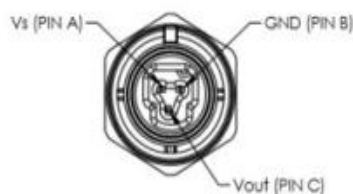
| Model                       |                      |
|-----------------------------|----------------------|
| Output                      | 0.5-4.5V Ratiometric |
| Excitation                  | 5.0 ± 0.5VDC         |
| Output Impedance            | < 100 Ω              |
| Current Consumption         | < 10mA               |
| Output Noise                | < 2mV RMS            |
| Output Load                 | 10k Ω Min.           |
| Reverse Polarity Protection | Yes                  |
| Bandwidth                   | DC-1kHz              |

### AST



| Pin | 3 Wire Voltage | 4-20mA |
|-----|----------------|--------|
| A   | GND            | -V     |
| B   | +V             | +V     |
| C   | S              | N/C    |

### M71



PACKARD CONNECTOR  
(SEE TABLE 1 FOR MATING INFO)

Pin-outs are not directly interchangeable

| Feature    | M71         | M91         | AST      |
|------------|-------------|-------------|----------|
| Hex        | 24          | 27          | 22       |
| Height     | 47          | 50          | 82       |
| Comp Range | -40 to 125C | -40 to 125C | 0 to 55C |
| Proof      | 2X          | 2X          | 2X       |
| Burst      | 5X          | 5X          | 5X       |
| RI         | 100 V/m     |             | 10 V/M   |
| Ingress    | IP67        | IP6K9K      | IP67     |