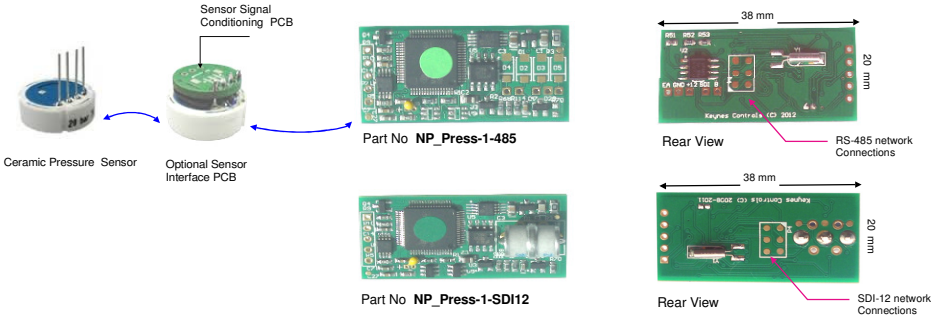
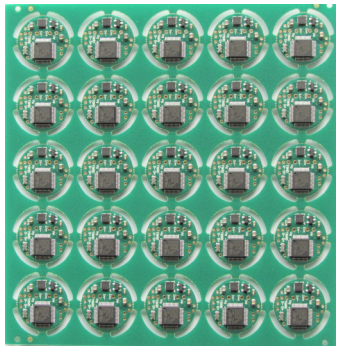
Pressure Sensor Interfaces - SDI12/485 Networks

Introduction

Keynes Controls manufacture a range of intelligent pressure sensor interface units that can be used with many different manufactures sensor elements.

The NP_PR-1-3820 range of devices has been developed for use with SDI-12 and RS-485 digital networks as standard and supports most manufactures ceramic sensor elements. The NP_PR-1-3820 devices can supply measurements in raw signal, or engineering SI units and makes an easy interface into 3rd party products. The PCBs can be customised to fit 3rd party housings. Only a sample of the many different designs are shown here.





Customised PCB

The image above shows customised versions of the standard pressure sensor PCBs finished in blocks of 25 units, as supplied direct to a client for installation into 3rd party products.

Technical Data:	
Common Measuring range	0 .. 10 m, 0 .. 20 m, 0 .. 50 m, 0 .. 100 m H^20 (most common) 0 .. 33 ft 0 .. 66 ft 0 .. 164 ft 0 .. 328 ft Others on demand - standard Ceramic sensors
Pressure resolution	0.005% FS - deviations of 1 mm can be measured at 10 m range
Long term stability	± 0.05 % FS max per year
Linearity hysteresis	<0.05% FS
Temperature compensation range	2 - 30 Deg C under software control -5 to 45 Deg C internal electronic self correction
Temperature resolution	0.1 ºC / 0.1 ºF
Temperature accuracy	± 0.2 ºC / 0.2 ºF SDI-12 & RS-485
Units	M, ft, inch, bar, psi, ºC, ºF
Calibration	6 point calibration
Electrical Data	
Voltage supply	**SDI-12** 10.5 to 16V DC **RS-485** 10.5 to 16V DC
Current compensation	Typical values are
Idle mode Active / measurement	**SDI-12** 0.65 mA **RS-485** 1.15 mA **SDI-12** 2.1 mA **RS-485** 2.6 mA These values may change slightly between sensors. Use figures as an approximation only.
Measuring time warm up response	200 ms - defined sample period 500 ms
Length of data lines SDI-12 RS-485	 100 m (Extended to 1000 m with NP_Isolator module) 1000 m (Extended with NP_Isolator unit)
SDI-12/RS-485 Address mode	Supports enhanced addressing 0 .. 9 A .. Z

Firmware Upgrade Facility

All of the NP_PR-1-3820X family of pressure sensor interfaces are supplied with a firmware upgrade facility. This enables Keynes Controls to E-mail new software upgrades or add new features for User installation.

General Data:	
Pressure sensor	Ceramic pressure sensor Temperature compensated
Dimensions	102 x 22 mm diameter - length includes noise cone
Temperature range	-25 ºC .. +70 ºC (non freezing)
CE Conformity	CE conformity according to EN 61000-6
Lifetime	> 1x 10^7 cycles
Weight	102 g
RS-485 Network Settings	9600 Baud, 8 data bit, 1 stop bit, even parity
SDI-12 Digital Port	SDI-12, 1200 Baud, 7 bit, N stop bit, Even Parity - other speeds on request. Ver 1.03

Part Numbers

USB-SDI12-pro USB to SDI12 isolated media converter
USB-485-Pro USB to RS485 isolated media converter

NP_PR-1-3820-485 38 x 20 mm 1 channel Ceramic Pressure sensor interface with RS-485 communications
NP_PR-1-3820-SD 38 x 20 mm 1 channel Ceramic Pressure sensor interface with SDI-12 communications

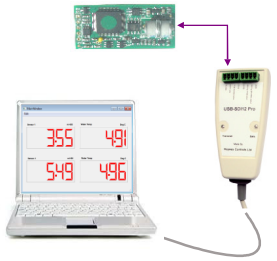
Systems Integration & Testing

All of the NP_PR-1-3820 range of cards are fully supported in the free Q-LOG data acquisition and display software. This application package can be used to test measurement parameters while integrating the NP_PR-1-3820 PCB into third party systems.

Up to 10 individual cards can be directly connected to the Keynes Controls USB-SDI12/485-Pro media converters. Extended SDI-12 and RS-485 addressing is supported where larger number of devices are to be used simultaneously.

The image below demonstrates a complete data acquisition system using the USB-SDI12-Pro media converter.

Any measurement made by the NP_PR-1-3820 card or instruction sent to the device cause the status LED indicators



For RS-485 operations simply use theUSB-485-Pro Interface

Download Q-LOG

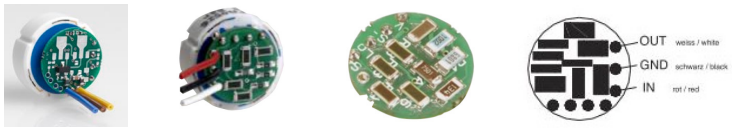
Download a copy of Q-LOG at

http://www.aquabat.net/QLOGFree/qlogv2.html

Signal Conditioning PCB

Depending upon which manufactures sensor is to be used a signal conditioning device may be required. Some sensor manufactures supply a standard PCB with the sensor element.

Keynes Controls can manufacture sensor signal conditioning to suit any sensor combination.



Example of signal conditioning PCB needed with ceramic pressure sensors.

Supported Commands

The NP_PR-1-3820 board sets currently support the following SDI–12 / RS-485 command sets. Additional commands can be added upon request.

Standard commands

Command		Response	Description
aM!	%aM!	a0tt2	2 values in time tt given by stats
aD0!	%aD0!	a+0.123+25.5	Pressure and temperature values
aD1!	%aD1!	a+0.1299+0.1201+25.9+25.0	Statistical values max P, min P, max T, Min T
aI!	%aI!	a13KEYNESCOPRESR001	Identification string
aV!	%aV!	Verification (no action taken at present)	

Selecting temperature units

The NP_PR-1-3820 devices support a range of temperature SI unit options.

Command	Response	Comment
aXUT0!	**a0<CR><LF>**	Sets the temperature units to °C
aXUT1!	**a1<CR><LF>**	Sets the temperature units to °F
aXUT!	**a1,a0<CR><LF>**	Queries the temperature units

Selecting pressure units

The NP_PR-1-3820 devices support a range of SI Engineering unit options.

Command	Response	Comment
aXUP0!	**a0<CR><LF>**	Sets the pressure units to mH^20
aXUP1!	**a1<CR><LF>**	Sets the pressure units to ftH^20
aXUP2!	**a2<CR><LF>**	Sets the pressure units to inH^20
aXUP3!	**a3<CR><LF>**	Sets the pressure units to bar
aXUP4!	**a4<CR><LF>**	Sets the pressure units to psi
aXUP!	**a(1..4)<CR><LF>**	Queries the pressure unit with setting a value.

Entering the local gravity

Command	Response	Comment
aXE9.81!	a9.81<CR><LF>	Sets the local gravity to 9.81 m/s^2

Automatic Calculation of the maximum and minimum measurements

The PIEZO-RM sensors support the following data analysis functions.

aM1!= Maximum level / Pressure
aM2!= Minimum level / Pressure
aM3!= Maximum temperature
aM4!= Minimum temperature

The NP_PR-1-3820 devices support basic statistical processing using the built in functions. Refer to user manual for full details.

Additional commands can be added on request.

Command	Response	Comment
aXMM1!	a1<CR><LF>	Resets the maximum pressure level to the current value.
aXMM2!	a2<CR><LF>	Resets the minimum pressure level to the current value.
aXMM3!	a3<CR><LF>	Resets the maximum temperature level to the current value
aXMM4!	a4<CR><LF>	Resets the minimum temperature level to the current value

Setting up a custom unit

Unit conversion can be carried out differently from the pre-defined values and is in the form y = bx + c.

Value of n	Variable stored
0	**Pressure units Slope =, b**
1	**Pressure units Offset = c**
2	**Temperature units Slope = b**
3	**Temperature units Offset = c**

The value of b should be calculated as follows:

For Pressure

$$b = \frac{\text{(Full Scale in User Units - Zero scale in User Units)}}{\text{(Full scale in } mH_20 \text{ at 4 °C - Zero Scale at } mH_20 \text{ at 4 °C)}}$$

For Temperature

$$b = \frac{\text{(Full Scale in User Units - Zero scale in User Units)}}{\text{(Full scale in °C - Zero Scale in °C)}}$$

Setting pressure units to mbar

Customised Command sets

All of the control software for these devices is written and maintained by Keynes Controls Ltd.

Keynes Controls can add User specified commands at the time of manufacture.

Customised Communications

Keynes Controls can manufacture versions of the NP_PR-1-3820 device that contain multiple digital networks.

For example, the RS-485 version card can have a high speed communications port added to enable third party programming and configurations to be undertaken.

This is used for QA testing once a device is fitted inside a third party casing.

Case Parts & Machining

Keynes Control can machine all sensor body parts and these can be supplied in a range of materials, and in kit form.

The case design is based upon the standard keynes Control sensors, and this makes sure that the seals are correct and the device will operate to the desired range.

Keynes Controls manufacture the bulkhead seals that are used in this product.