

## Appendix 10. Using the EX Interface

### Connecting the Cable

The connector for the EX interface is mounted in the meter only and has no counterparts in the power supply. It should only be connected to a suitable sensor made by any vendor for measuring other variables, like paper roll hardness, web temperature, relative humidity etc. We use regularly a LEMO 0K connector with five pins to carry the signals. See the Figure L10-1 below. If any other connector type is installed for some reason, the pin order/numbering is kept the same. Female LEMO 0K connector is used in the meter side and the cable needs to have a LEMO 0K male plug. The connector is keyed and can be mounted only in one position marked with a colour code. Avoid using excessive force while using. The meter is always delivered with a suitable connector, usually without any cable. The sensor is recommended to have its own power supply or battery but temporary use drawing not more than 20 mA from the moisture meter is allowed. Higher current consumption will reduce the working period of the meter significantly.

The analog voltage is lead to an 8-bit analog-to digital converter. The digital data is converted to a ratiometric reading describing a variable measured by the external sensor. The scaling can be changed by user to match exactly the sensor signal scaling, see the next page. The data is displayed on the meter's LCD top right corner instead of the Th (head temperature). The quality may be "C" but ignore this. If the EX option is selected either in the topmost measuring state menu (press "2") or in the 9=EX menu branching from the main menu, **the data can be saved to the current memory bank instead of the moisture data.** Statistics can be calculated as if this data were from the moisture meter itself and the series can be downloaded to PC as well.

When connecting new devices to this interface, there should not be any possibility of exceeding the input voltage limits (max +5V). Else damage may occur to CPUK12 parts and servicing becomes

Fig. L10-1 The connector pins for the EX interface

IRMA-7 side, the EX connector	LEMO 0K connector pin number	External equipment side
operating voltage +5.50V +/- 10% 0.020A max	1	operating voltage +5.50V +/- 10% 20mA max
EX data 0..+5.0 Volts max	2	EX data 0..+5.0 Volts max
0V ground	3	0V ground
EX_DO	4	EX digital output TTL
EX_DI	5	EX digital input TTL

necessary. **Avoid any possibility of making shorts from the +5.5V power line to any other wire or circuit part. Shorting may cause damage to all components involved.** The IRMA-7-A has an overcurrent protection in this line but shorting will reset the meter at least. The digital input and output lines are for TTL lines only. They are implemented with HCMOS logic and the input is without a Schmitt-trigger but has a 10K pullup resistor to 5.5V. Their use is undefined at this time but can be separately controlled in the menu. Observe carefully the pin ordering (refer to Fig. L10-2) to avoid mistakes. It is the user's responsibility to make correct connections to his sensor.

When you go to the EX menu (press "9") the following appears:

```
1=EX:Y
2=wA 3=wB
4=1A 5=1B 6=1C 7=1D
8=Out:1 In:1
```

With "1" you can toggle the EX device to be in active use or not. The variable to be converted from the analog signal is manipulated in the following way:

$$\text{Variable (units)} = 4.0 * \text{NADC} * \text{wA} + \text{wB}$$

**NADC** is the 8 bit reading (possible values within 0...255) of the signal whose input voltage range is 0...+5.0V. **wA** is used for converting the binary reading to any sensible units familiar to the user. **wB** is for making an offset in the final units. For example, if one has a sensor whose actual reading is pressure in units of 0...100kPa and the output voltage is 0...+5V, the **wA** coefficient is calculated as follows assuming the **wB** is zero:

$$100\text{kPa} = 4 * 256 * \text{wA}$$

or

$$\text{wA} = 100 \text{ kPa} / 1024 = 0.0977 \text{ kPa}$$

This value is edited in "2" and the in "3" is checked to be zero. Then you will get kPa readings to the display and to the chosen memory bank. If the sensor's voltage range differs, you need to adjust the coefficient correspondingly. You can also calibrate the reading exactly by using a coefficient **wA** of 1.0 or 0.1 and making a few accurate points measured at far ends. Then you can calculate the coefficient from that data.

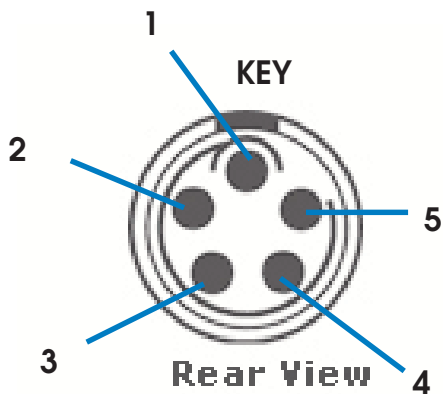
The rest of the coefficients (**IA**, **IB**, **IC** and **ID**) are for linearizing the sensor if it needs any. It is based on the following formula (**Varlin** is the result and **Varnonlin** is the nonlinear variable):

$$\text{Varlin (units)} = \text{IA} * \text{Varnonlin}^3 + \text{IB} * \text{Varnonlin}^2 + \text{IC} * \text{Varnonlin} + \text{ID}$$

Thus this enables a third order polynomial to be used covering a lot of practical applications. You need to be more familiar with these methods before applying this formula. The **IC** coefficient should be set to 1.00 when the linearization is not used and the other coefficients **IA**, **IB** and **ID** should be zero.

Pressing "8" will toggle the output and the input is read every time you do anything in this menu. These lines can be used for some exotic sensor perhaps requiring a simple handshake or for controlling some device in the sensor, like a relay. Here "0" means logic LOW and "1" means logic HIGH.

**LEMO 0K panel receptacle, rear view**



**LEMO 0K cable plug connector, rear view**

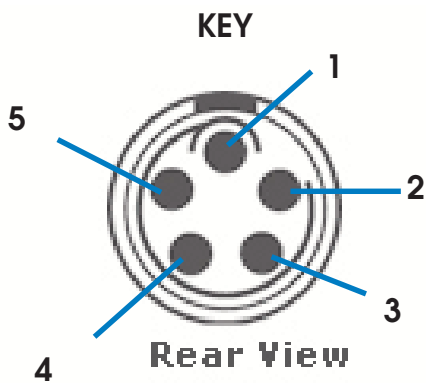


Fig. L10-2 The connector pin ordering for the EX interface's LEMO 0K connector pair