



**UMI
OPERATING MANUAL
MAN-00066 R1**

EPROM version 6.1.x

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SAFETY INFORMATION

The following safety instructions must be observed whenever the UMI instrument is operated. Failure to comply with any of these instructions or with any precaution or warning contained in the UMI Operating Manual is in direct violation of the standards of design, manufacture and intended use of the UMI conditioner. FISO Technologies inc assumes no liability for the customer failure to comply with this safety requirements. This product is not designed with components of level of reliability suitable for use in life support or critical applications.

IN NO CASE WILL FISO TECHNOLOGIES INC BE LIABLE TO THE BUYER, OR TO ANY THIRD PARTIES, FOR ANY CONSEQUENTIAL DAMAGE OR INDIRECT DAMAGE WHICH IS CAUSED BY PRODUCT FAILURE, MALFUNCTION, OR ANY OTHER PROBLEM

IMPORTANT SAFETY INSTRUCTIONS



When using any electrical appliance, basic safety precautions should be followed, including the following:

- Use only the wall plug-in (or table top) power supply delivered with your UMI instrument and verify that the voltage specifications indicated on the wall plug-in power supply are compatible with the AC voltage and frequency delivered at the power outlet
- Do not operate in wet/damp conditions
- Do not operate in an explosive atmosphere
- Keep product surfaces clean and dry

DISCLAIMER

Information published in this manual is believed to be accurate and reliable. However, FISO Technologies assumes no responsibility for the use of such information. FISO Technologies reserves the right to make revisions or changes to any parts of this manual or to the software described herein at any time without obligation to notify of these changes



WARRANTY INFORMATION

FISO Technologies warrants the UMI conditioner sold has been made in good workmanlike and proper manner; that it will perform according to the specifications if used in compliance with the guidelines provided; that when shipped, it will be in proper working order, free from any defects in either workmanship or material; and that, for a period of one year from the date of delivery, we will repair or replace without cost any part that may prove to be defective. This warranty does not apply to the transducers sold for use with the UMI.



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1.0 GETTING STARTED

1.1 PRODUCT AND FEATURE DESCRIPTION

The UMI conditioner is a universal multi-channel fiber-optic signal conditioner. It is used with FISO Technologies' fiber-optic transducers to perform Strain, Temperature, Force & Load, Displacement, Refractive index and Pressure measurements in hostile locations that were formerly inaccessible with other measuring instruments. The UMI conditioner has a 14-bit resolution (without averaging) with a relative dynamic range of 15 000:1. The resolution and the full-scale output depend on the type and sensitivity of the transducers used with the UMI. Data averaging, data logging, direct and delayed acquisition, etc, are different features that come with the UMI. The UMI conditioner can be remotely controlled via a PC computer using the FISO *Commander*[™] software. More details can be found in the following sections with instructions about installing and using your UMI conditioner. Depending on the options you purchased with your UMI, you may not have access to all the functions and commands described next.

1.2 INSTALLATION

1.2.1 Installing the UMI

- 1) Connect the wall plug-in (or tabletop) power supply to a power outlet. Connect the power cable to the UMI power connector (figure 2).



VERIFY THAT THE VOLTAGE SPECIFICATIONS INDICATED ON THE WALL PLUG-IN POWER SUPPLY COMPLY WITH THE AC VOLTAGE AND FREQUENCY DELIVERED AT THE POWER OUTLET.

1.2.2 Installing the transducers

- 1) Connect the transducer connectors to the input connectors of the UMI (Figure 1)

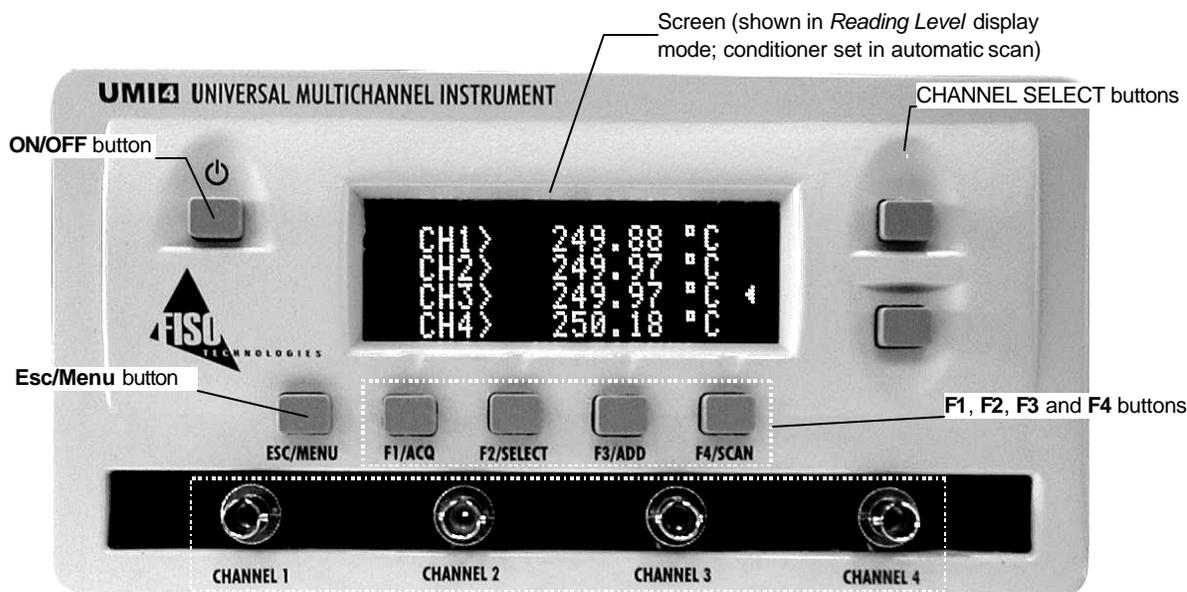


READ THE HANDLING PRECAUTIONS IN SECTION 1.6.1 BEFORE INSTALLING AND USING THE TRANSDUCERS FOR THE FIRST TIME



1.3 CONTROL PANEL

The front panel of the UMI conditioner has 4 X 20 characters alphanumeric screen with eight push-button control keys and four (UMI-4) or eight (UMI-8) fiber-optic input connectors.



Measuring channels no 1, 2, 3 and 4 and their input connectors

Figure 1: Front panel of UMI (Model UMI-4)

The **ON/OFF** button is used to turn the UMI conditioner on and off. The **CHANNEL SELECT** buttons are used to select the channel to be displayed when the conditioner is set to manual scan; or to select the channel for which a specific command of the menu functions has to be performed (ex. assign a *Gauge Factor* to channel no 3). The **ESC (MENU)** button is used to: 1) access the *Menu Level* mode of the display, 2) go one-step back in the menus or, 3) access the *Reading Level* mode of the display.

In *Menu Level* display mode, menu functions are displayed on the bottom line of the screen and selected with **F1**, **F2**, **F3** or **F4** buttons. In *Reading Level* display mode, these buttons have different uses: **F1** (ACQ) starts an *Acquisition Session*; **F2** (SELECT) brings the user to the *Gauge Factor* Assignment menu, **F3** (ADD) brings the user directly to the Add *Gauge Factor* menu; **F4** (SCAN) toggles between automatic and manual scan. See sections 2.0 and 3.0 for more information.

1.3.1 Quick Start with the control panel

Follow the instructions given below to get ready for measurements with your UMI conditioner:

1. **Save the *Gauge Factors* in the memory of the UMI**

The *Gauge Factor* is a 7-digit number located near-by the fiber-optic connector of the transducer. This number provides the UMI conditioner with the information related to the



transducer (type, sensitivity, etc). Before using a transducer, its *Gauge Factor* must first be saved into the non-volatile RAM memory of the conditioner. See section 3.1 for more details.

- From the *Reading Level* display mode, press the **F3** button to go directly to the **Add Gauge Factor** menu (see also the diagram of section) Use the arrow-equivalent buttons **F1** (↑↑↑) or **F2** (↓↓↓) to select a digit at the insertion point and **F3** (→→→) to move the insertion point. Press **F4** (ENTR) to confirm your *Gauge Factor* entry.
- Next, the conditioner prompts the user to enter a *Gauge Name*, which will be associated to the *Gauge Factor*. The *Gauge Name* is a 5-character word for mnemonic purpose only. This step is optional; pressing **F4** will skip this step and will immediately save the *Gauge Factor* (Note: the UMI will automatically set a default name). Otherwise uses **F1** or **F2** to select an alphanumeric character at the insertion point and **F4** to save the *Gauge Factor* and its associated *Gauge Name*.
- Repeat the preceding steps for all the transducer that will be used with your UMI conditioner in order to create the so-called *Gauge List*. This list can contain up to 50 different *Gauge Factors*. When finished, press **ESC** to return to the *Reading Level* display mode.

2. **Connect the transducers to the UMI**

- If not already done, connect each transducer to one of the channel input connectors of the UMI conditioner.

3. **Assign the Gauge Factors to the measuring channels**

To use a transducer with the UMI, you must first assign its *Gauge Factor* to the corresponding channel, that is the one in which the transducer is connected.

- From the *Reading Level* display mode, press **F2** to display the **Gauge Factor Assignment** menu. Select one of the measuring channels with the aid of the **CHANNEL SELECT** buttons.
- Press the **F2** or **F3** buttons (press as many time as necessary) to scroll through the *Gauge List* and select a *Gauge Factor*. Your selection must correspond to the *Gauge Factor* of the transducer actually connected to the measuring channel.
- Repeat the preceding steps for all the measuring channels that will be used. Select the "OFF" option of the *Gauge List* to deactivate the unused channels. When finished, press **ESC** to return to the *Reading Level* display mode.

4. **Select the automatic or manual scan mode**

In automatic scan mode, the UMI conditioner performs measurements by sequentially switching through all the activated channels. It is strongly recommended to deactivate all unused channels (**OFF** option of the *Gauge List*) in order to minimize the time required for a complete scan of the measuring channels. In manual scan mode, the UMI conditioner performs measurements on one selected channel only. See sections 3.2.2 and 3.2.3 for more information.

- From the *Reading Level* display mode, press **F4** to toggle between automatic and manual scan mode. In manual scan mode, use the **CHANNEL SELECT** buttons to select the desired measuring channel.



5. Zero adjustment of the transducers

- ✓ Go directly to the next point if you are using temperature transducers only.

The zero adjustment, done with the aid of the **NULL** function, force the reading of the transducer to be equal to zero immediately after it is activated. The zero adjustment of the transducer is necessary when using for the first time a strain gauge, force & load, refractive index and/or, a pressure transducer. See section 3.1.3 for more details. The **NULL** function is available from the **Calibrate Gauge** sub-menu as described in the diagram of section 2.2.2B

- Press the **ESC** (MENU) button to switch to the *Menu Level* display mode. Then press **F2** (GAUGE), followed by **F3** (CAL).
- Select the desired measuring channel using the **CHANNEL SELECT** buttons and then press the **F3** (NULL) button to make a zero adjustment of the transducer connected to that channel. Note that the value of the *Gauge Zero* (section 3.1.3) will be associated to (and saved with) the corresponding *Gauge Factor* assigned to that channel.

- ✓ The zero adjustment function (NULL) is automatically disabled in case of a temperature transducer.

6. Data measurement and various parameters

From this point, your UMI conditioner is ready to display the data measurements taken with the fiber-optic transducers. For this purpose, the screen of the UMI must be set to the *Reading Level* display mode. (Press the **ESC** button as many times as necessary to go back to this display mode)

Different features of the UMI conditioner allow the user to set the parameters related to the data measurement. Among others, the *Averaging Time* parameter can be set to display an average value of the samples or data reading values collected by the transducers. See the menu diagram of section 2.2.1 as well as sections 3.2 and 4.1.2.

The data measurements are available as well through the analog outputs, the USB ports and the RS-232 serial output. For more details on these outputs, consult the diagram in section 2.2.3A as well as sections 3.0 and 4.0.

Other functions are available, for example, to set the time and date of the conditioner or to select the system of units displayed by the conditioner. Consult the menu diagram of section 2.2.3B as well as section 3.3.

1.4 BACK PANEL

The back panel of the UMI conditioner comes with different connectors as described in this section.



figure 2 : Back panel of UMI (model UMI-8)

1.4.1 Power Supply

The UMI conditioner comes with a wall plug-in or tabletop power supply. It is used to power the conditioner and recharge the internal battery. The latter provide the necessary power to maintain the contents of the memory. Its capacity is enough to maintain the memory during one year. However, it is recommended to keep the power supply always connected to your conditioner to insure a fully charged internal battery.

1.4.2 Analog Outputs

The UMI conditioner has, for each of the measuring channels, a corresponding analog output. The analog outputs provide a voltage within a range of ± 5 Volts. The ratio between the voltage variation measured at the output and the corresponding variation of the physical parameters measured by the transducer is given by the *Analog Scale Factor*. This factor, expressed in Volts per physical unit (ex: 10 mV/°C), is displayed when entering into the **Analog Output Setup** sub-menu (See the menu diagram of section 2.2.3A).

The linear relationship between the analog voltage output and the measured value of the transducer depends on the type of the transducer and its own measuring range. Both the *Analog Offset* (given by the *ZERO* parameter) and the *Analog Scale Factor* (given by the *SCALE* parameter) of the analog output



can be adjusted by the user or set to their defaults value. The *SCALE* and *ZERO* parameters allow the user to adjust the analog output so its ± 5 V range fits with the full scale of the transducer measurements. These setting parameters are adjusted with the aid of the **Analog Output Setup** sub-menu functions. For more detail, consult the menu diagram of section 2.2.3A as well as section 3.3.1.

1.4.3 RS-232 Link

The UMI conditioner can be remotely controlled via a PC computer (or other devices) with the aid of a RS-232 serial link. A set of *Remote Control Commands* emulates all the functions (and more) available from the front panel of the conditioner. For more detail about the remote control of the UMI, consult the REMOTE CONTROL COMMANDS MANUAL.

- ✓ **FISO Technologies suggests using its specially designed remote control software for the UMI conditioner. This software, called the FISOCommander™, provides an effective and simple tool for remotely controlling your UMI as well as for downloading and viewing in real-time the data measurements directly from your PC computer. Consult the FISOCommander™ user manual for more information.**

1.4.4 USB communication port

The UMI supports the standard USB 1.1 protocol. This new feature is only available when used in conjunction with FISOCommander 2.0™. You can cascade several UMI systems using a USB HUB from a single USB port. More details are provided in the FISOCommander 2.0™ operating manual.

- ✓ **Important notice: You must install the software from the FISO software CD before you connect the UMI. Further instructions are provided in the user manual of FISOCommander 2.0™.**
- ✓ **In order to use the USB communication port efficiently, DO NOT use the RS-232 port while using the USB port. This procedure will prevent any risk of unpredictable performance from the UMI system.**
- ✓ **ONLY use with PC computers equipped with Windows® 2000 or XP version. Any version below that, such as Windows® 98 SE or NT 4.0, is NOT supported.**

1.4.5 Hardware Reset Button

This button is used to reset the UMI conditioner to its original configuration as set at the factory.

- ✓ **For a full hardware reset, the power supply must be connected to both a power outlet and your UMI conditioner. Note that all the Gauge Factors of the Gauge List and their associated Gauge Zero will be erased from memory.**

1.5 MEMORY

The UMI conditioner is equipped with a non-volatile RAM type memory where all the settings of the conditioner (*Gauge Factors*, analog output settings, etc.) are stored. Each time the UMI conditioner is turned on; it is reset with the same settings in use just before the last time it was turned off. If for whatever reasons, the RAM memory contents has been damaged or lost, the message MEMORY LOST! will be displayed for few seconds and the conditioner will be reinitialized to its default factory settings. When this message appears, all the *Gauge Factor* and their associated *Gauge Zero* are lost. The user can reset the UMI to its factory settings by using the **RST** function of the More sub-menu. (See the menu diagram of section 2.2.2A as well as section 3.3). The Hardware Reset Push Button located on the rear panel can be used as well for this purpose.



The UMI conditioner has also a non-volatile memory buffer, which can store close to 50000 data measurements. These stored data can be downloaded to a computer via the RS-232 serial link. See section 4.1.2 for more information.

1.6 USING THE TRANSDUCERS

1.6.1 Handling of the transducers



READ THE FOLLOWING PRECAUTIONS BEFORE INSTALLING AND USING THE TRANSDUCERS:

- Avoid sharp radius turns in the fiber-optic cable (radius less than 10 mm)
- Temperature transducer: do not bend the rigid region at the end of the cable. The sensitive part of the transducer is located inside the rigid region, close to the tip.
- Strain Gauge transducer: do not touch the sensitive part of the transducer. This part must be kept clean until it is bonded.
- Avoid tension or twisting of the fiber-optic cable
- Avoid pinch points and “Scissors” when setting in place the transducers
- Do not pull on fiber-optic cable to clear tangles; carefully unwind instead
- Avoid allowing fiber-optic connectors to drop or scrape on hard surfaces
- Keep the surface of the fiber-optic connector clean
- Replace protector caps on the fiber-optic connectors when transducers are disconnected from the signal conditioner.

1.6.2 Cleaning the transducer connectors

For proper use of the fiber-optic transducers, the fiber-optic connectors must be kept clean and free of dust at all times. Any dust may obstruct the light transmitted from one connector to the other, and reduce the signal-to-noise ratio to an unusable level. **IT IS A GOOD PRACTICE TO ALWAYS CLEAN THE TRANSDUCER CONNECTOR BEFORE MATING IT TO THE CONDITIONER.** Wiping the end with low lint tissue such as Kimwipes® or lens cleaning tissues is a simple and easy way to clean transducer connectors. By keeping your transducer connectors clean you will also prevent the contamination of the UMI input connectors. However, we recommend cleaning the UMI input connectors occasionally. Use the specially designed 2.5-mm Mini Foam Swab provided with our cleaning kit (Part n° FTI-M) for cleaning the input connector of UMI.

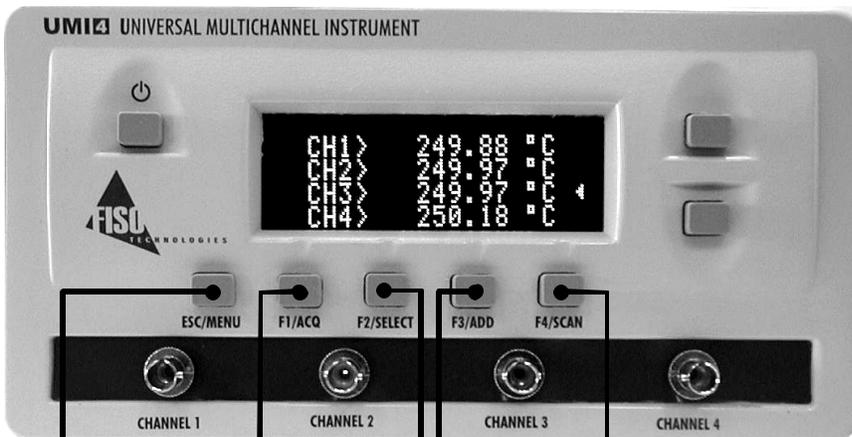
1.6.3 Transducer Technical Notes

Additional information is available on specific fiber-optic transducers. Ask your local representative for FISO Technologies' specific Fiber-Optic Transducer Technical Note and Installation Guide such as our *Fiber-Optic Strain Gauge Installation Guide*.



2.0 CONTROL PANEL FUNCTIONS

2.1 READING LEVEL DISPLAY MODE



F4/SCAN: To toggle between automatic and manual channel scan mode

- Press on **F4** button to toggle between the two scanning modes. When in automatic scan mode, the UMI conditioner performs measurements by sequentially switching through all the activated channels. In manual scan mode, the UMI conditioner performs measurements on one selected channel only. See sections 3.2.2 and 3.2.3 for more information.

F3/ADD: To add a Gauge Factor to the Gauge List

- Press on **F3** button to go directly to the **Add Gauge Factor** menu. See the diagram of section 2.2.2A as well as the section 3.1 for more details

F2/SELECT: To assign the Gauge Factors to the measuring channels

- Press on **F2** button to assign each of the *Gauge Factors* to the measuring channels in which the corresponding transducers are connected. See section 3.1.2.2 for more details

F1/ACQ: To start or stop a delayed Acquisition Session.

- Press once on **F1** button to start a *Acquisition Session*. Press twice on **F1** button to start the *Acquisition Programs*. Press **F1** again to stop the acquisition. See section 4.1.2 for more details.

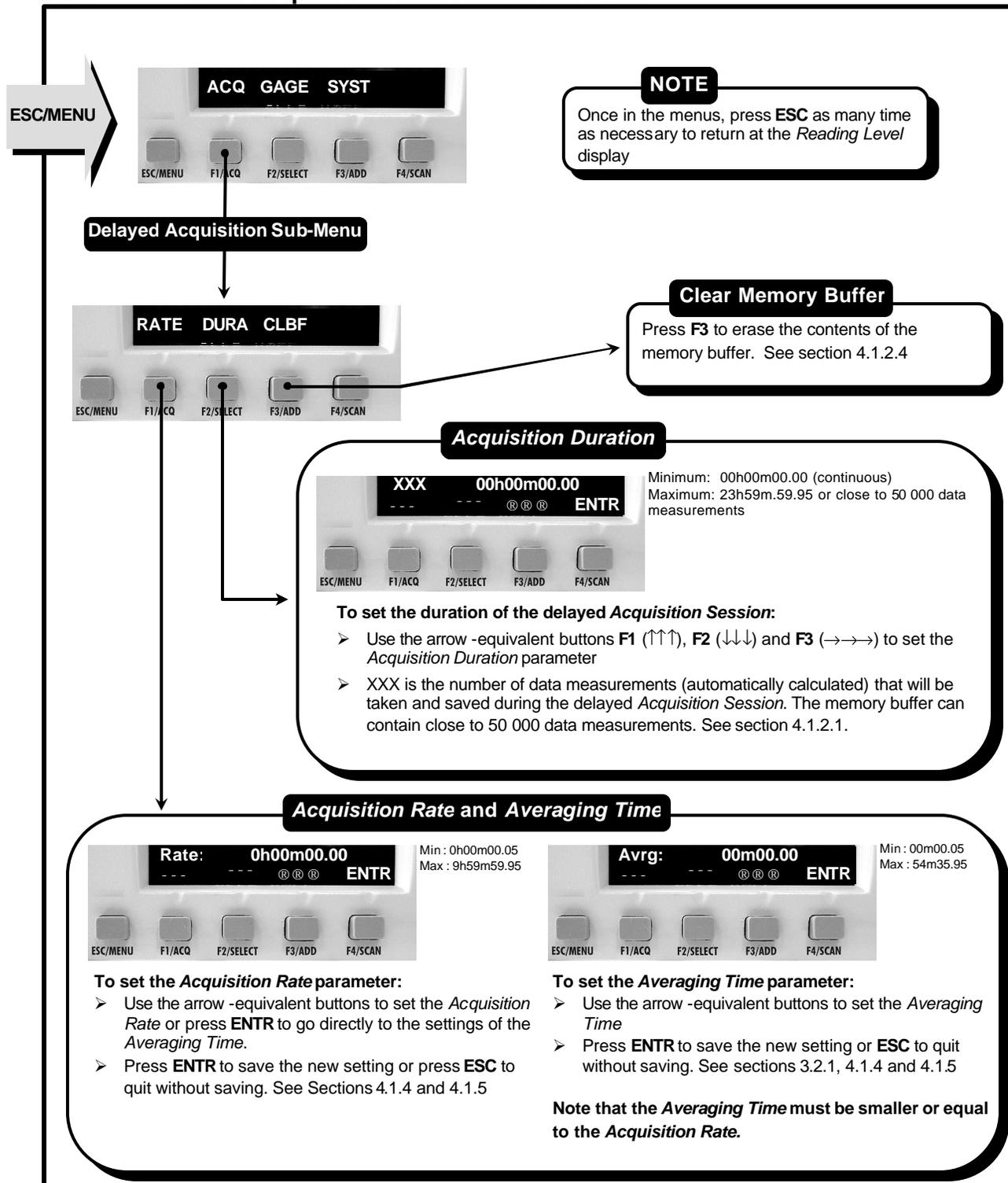
ESC/MENU: To go to the Menu Level display mode (when in the Reading Level) or to return to Reading Level display mode (when in the menus)

- When the display is at the *Reading Level*, press the **ESC** button to access to the menu functions. See next section for more information.
- When the display is at the *Menu Level*, press the **ESC** button to return one step back in the menus or to return to the *Reading Level* display mode. See next section for more information.

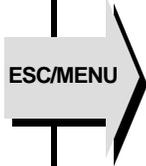
TO THE
MENUS

2.2 MENU LEVEL DISPLAY MODE

2.2.1 Data Acquisition associated functions



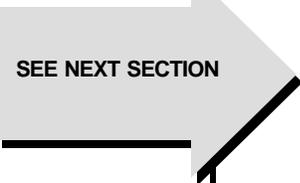
2.2.2A Transducer associated functions



Transducer Sub-Menu



Calibration Sub-Menu



NOTE
Consult section 3.1 for more information about the functions related to the transducers

Erase a Gauge Factor



To remove a Gauge Factor from the Gauge List:

- Use the arrow -equivalent buttons F1 (↑↑↑) or F2 (↓↓↓) to scroll through the Gauge List and to select a Gauge Factor
- Press ENTR to confirm your selection or ESC to cancel and return to the Transducer Sub-Menu.

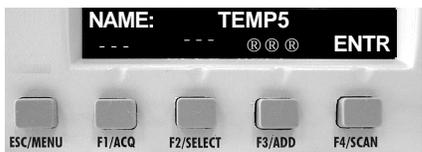
Add a Gauge Factor and Gauge Name



To add a new Gauge Factor and Gauge Name to the Gauge List:

1. To enter the Gauge Factor:

- Use the arrow -equivalent buttons F1 (↑↑↑), F2 (↓↓↓) and F3 (→→→) to enter a new Gauge Factor.
- Press ENTR to go to the next step or press ESC to cancel and return to the Transducer Sub-Menu.



2. To enter the Gauge Name and save the Gauge Factor:

- Use the arrow -equivalent buttons F1 (↑↑↑), F2 (↓↓↓) and F3 (→→→) to enter a Gauge Name or press ENTR to save the Gauge Factor with a default Gauge Name automatically given by the conditioner.
- If you have entered a Gauge Name, press ENTR to save your entries or ESC to cancel and return to the Transducer sub-menu. Attention: in the later case the Gauge Factor will not be saved.

2.2.2B Transducers associated functions (calibration)

Channel?

OFFS NULL

ESC/MENU F1/ACQ F2/SELECT F3/ADD F4/SCAN

Offset Sub-Menu

INTR PHY

ESC/MENU F1/ACQ F2/SELECT F3/ADD F4/SCAN

You must first select a measuring channel before activating the calibration functions. Use the **CHANNEL SELECT** buttons to select one of the measuring channels.

Zero adjustment

To make a zero adjustment of the transducer:

- After you have selected a measuring channel, press **F3** to zero adjust the transducer that is connected to that channel.
- Once the zero adjustment is completed, the conditioner displays during a few seconds the new value of the *Gauge Zero* (L_{zero}) and then returns to the *Reading Level* display. (See section 3.1.3.1)

Offset in Physical Units

To offset the readings of the transducer with a value given in physical (engineering) units:

- After you have selected a measuring channel, use the arrow-equivalent buttons **F1** (↑↑↑), **F2** (↓↓↓) and **F3** (→→→) to enter the offset value.
- Press **ENTR** to save your entry or **ESC** to cancel and return one step back in the menus. Once the offset is completed, the conditioner displays during a few seconds the new value of the *Gauge Zero* (L_{zero}) and then returns to the *Reading Level* display. (See section 3.1.3.2)

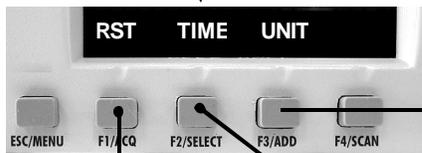
Offset in Internal Unit

To offset the readings of a transducer with a value given in Internal Unit

- After you have selected a measuring channel, use the arrow-equivalent buttons **F1** (↑↑↑), **F2** (↓↓↓) and **F3** (→→→) to enter the offset value.
- Press **ENTR** to save your entry or **ESC** to cancel and return one step back in the menus. (See section 3.1.3.2)

Note that the offset value entered in *Internal Unit* corresponds to the *Gauge Zero*. The value displayed when entering this menu is the current value of the *Gauge Zero*. (See section 3.1.3.2)

2.2.3B System associated functions (utility)



System of Units

To select the International or Imperial System of Units:
 ➤ Press **F3** to toggle between the two System of Units

Reset

To reset the conditioner and restore the default (factory) settings:

- Press **F1** to reset and **F4** to confirm



Resetting the conditioner will erase the content of the memory buffer and the RAM memory. The *Gauge Factors*, *Gauge Names* and associated *Gauge Zeros* as well as the data acquisitions will be lost.

Time and Date



1. To set the time of the conditioner real time clock:

- Use the arrow -equivalent buttons **F1** (↑↑↑), **F2** (↓↓↓) and **F3** (→→→) to set the time.
- Press **ENTR** to save your entry and to go to next step or press **ESC** to cancel and return one step back in the menus.



2. To set the date of the conditioner real time clock:

- Use the arrow -equivalent buttons **F1** (↑↑↑), **F2** (↓↓↓) and **F3** (→→→) to set the date (yyyy-MM-dd).
- Press **ENTR** to save your entry or press **ESC** to cancel and return one step back in the menus.



3.0 CONDITIONER \hat{U} TRANSDUCERS OPERATION

3.1 TRANSDUCERS

3.1.1 Principle of operation

All the fiber-optic transducers made by FISO Technologies are of interferometric type. More specifically, the sensing element of the transducers is a miniature Fabry-Pérot interferometer. This sensing element is designed such that a stimulus (i.e. the physical parameter being measured: temperature, pressure, displacement, etc....) produces a change in the cavity length (L_{cavity}) of the Fabry-Pérot interferometer. Therefore, the cavity length can be seen as the output signal¹ of the fiber-optic transducer. The output-stimulus relationship, which establishes the dependence between the output of the transducer, designated by L_{cavity} , and the stimulus, designated by M , is characterized by the following linear equation:

$$L_{cavity} = S \cdot M + L_{zero} \quad (1)$$

Where: S is the sensitivity of the transducer (in nanometers per physical unit),
and L_{zero} (*Gauge Zero*) is the output of the transducer when $M = 0$ (in nanometers).

The accurate factory-calibration of the sensitivity S and of the *Gauge Zero* (L_{zero}) provides all the necessary information to calculate, from the measurement of L_{cavity} , the true value of the stimulus M . The measure of L_{cavity} is the basic principle used in all the FISO Technologies' conditioners. The unit used to measure L_{cavity} is the nanometer — this is the *internal unit* of the conditioner used to represent the output signal of the transducer, as opposed to the physical units (°C, Bar, etc...) used to represent the value of the stimulus.

- ✓ **It should be emphasized that the full scale (or the span) of the transducer output L_{cavity} does not begin at zero. In other words, FISO Technologies' fiber-optic transducers are made and delivered with an initial cavity length L_{cavity} not equal to zero.**

3.1.2 The Gauge Factor

Before using a transducer with the UMI conditioner, its calibration factor, called the *Gauge Factor*, must be stored in memory and then assigned to one of the measuring channels of the conditioner. Up to fifty *Gauge Factors* can be stored in the non-volatile memory of the conditioner, which represent the so-called *Gauge List*. The *Gauge Factor* allows the conditioner to:

1. Identify the type of transducers connected
2. Know the sensitivity S of the transducer as determined by the factory calibration
3. Know the *Gauge Zero* (L_{zero}) of the transducer (temperature transducers only) as determined by the factory calibration.

The *Gauge List* contains a default *Gauge Factor* that is the number 0001000 (or 1000). The *Gauge Name* associated to this factor is FISO. This factor is permanently saved into the conditioner memory and cannot be erased.

¹ The physical signal measured from the fiber-optic transducer is a light signal. This light signal carries the information about the cavity length of the Fabry-Pérot interferometer.



The *Gauge Factor* is printed on a label close to the fiber-optic connector of the transducer. It is a 7-digit number where the first digit indicates the type of transducer, 0 being the default number value and is not associated with a specific type of transducer. The different numbers used to identify the transducer are listed next:

- 1: is used for non-compensated strain gauge transducers
- 2: is used for pressure transducers of type 1
- 3: is used for force & load transducers of type 1
- 4: is used for temperature transducers of type 1
- 5: is used for compensated strain gauge transducers
- 6: is used for pressure transducers of type 2
- 7: is used for force & load transducers of type 2
- 8: is used for linear displacement transducers
- 9: is used for temperature transducers of type 2
- 08: is used for refractive index transducers

In the case of force & load and pressure transducers, the second digit of the *Gauge Factor* is used to differentiate, within a transducer lot, the ones with same type and sensitivity. The third digit corresponds to a multiplying factor while the last four digits correspond to the sensitivity S of the transducer divided by the multiplying factor. It is the same for the strain gauge and the linear displacement transducer except that the last five digits correspond to the sensitivity S . In the case of the temperature transducers, the last six digits correspond to the sensitivity S and the *Gauge Zero* L_{zero} . See section 3.1.3 for more information.

3.1.2.1 To add (or remove) a *Gauge Factor* to the *Gauge List*

To add or remove a transducer *Gauge Factor*, simply follow the instructions given in the menu diagram of section 2.2.2A. Once you have entered a new *Gauge Factor*, the conditioner prompts you to enter a *Gauge Name* so to facilitate the identification of the corresponding transducer. You may enter a name with up to five alphanumeric characters: {0-9} {A-Z} { : ; }. If you do not want to assign yourself a *Gauge Name* just press **ENTR** button. The conditioner will then assign a default *Gauge Name*.

- ✓ **Attention: if you exit the *Gauge Name* menu with the Esc button, your new *Gauge Factor* will not be added to the *Gauge List*.**

3.1.2.2 To assign the *Gauge Factors* to the measuring channels

To use a transducer with the UMI, you must first assign its *Gauge Factor* to the corresponding channel, that is the one to which the transducer is connected.

From the *Reading Level* display mode, press **F2** to display the *Gauge Factor* Assignment menu. Select one of the measuring channels with the aid of the **CHANNEL SELECT** buttons. Press the **F2** or **F3** buttons (press as many time as necessary) to scroll through the *Gauge List* and select a *Gauge Factor*. Your selection must correspond to the *Gauge Factor* of the transducer actually connected to the measuring channel. Repeat the preceding steps for all the measuring channels that will be used. Select the "OFF" option of the *Gauge List* to deactivate the unused channels. When finished, press **ESC** to return to the *Reading Level* display mode.

- ✓ **It is strongly recommended to deactivate all unused channels (select the "OFF" option when scrolling through the *Gauge List*), otherwise the conditioner automatically assign the default *Gauge Factor* "1000" and its corresponding *Gauge Name* "FISO".**



- ✓ **Note that when the *Gauge Factor 1000* (or *0001000*) is assigned, the conditioner displays the actual value of the output signal of the transducer that is the value of its cavity length L_{cavity} . This value is displayed in *Internal Units*, i.e. in nm. (See section 3.1.1)**

3.1.3 Calibration

As explained in section 3.1.1, FISO Technologies' fiber optic transducers are characterized by a linear relationship between the stimulus M , and the output signal produced by the transducer, that is the cavity length (L_{cavity}) of the Fabry-Pérot interferometer. The factory-calibration of the transducer is made by measuring, for a set of accurately-known values of M , the corresponding values of L_{cavity} . These measurements establish the calibration curve of the transducer by providing the value of the sensitivity S and the value of the *Gauge Zero* (L_{zero}). Once these two parameters are known, it is easy to assign to each measured value of L_{cavity} the corresponding value of the stimulus M . The conditioner uses the following equation to calculate and display the values of M as a function of the output values L_{cavity} of the transducer:

$$M (L_{cavity}) = \frac{ (L_{cavity} - L_{zero})}{S} \quad (2)$$

The factory-calibration varies depending of the type of the transducers as explained next.

Temperature Transducer: the *Gauge Factor* of the temperature transducer provides both the sensitivity S and the *Gauge Zero* (L_{zero}). Therefore, the temperature transducer is fully calibrated and ready to use.

Strain Gauge Transducer: the *Gauge Factor* of this transducer provides only the sensitivity S . The *Gauge Zero* is not included in the *Gauge Factor* because it would have no physical meaning at this point. Clearly, the *Gauge Zero* of the strain gauge transducer has, in general, a real signification only when it is installed, that is when it is bonded to the structure to be studied. At first, the UMI conditioner fixes the default value of the *Gauge Zero* to zero ($L_{zero} = 0$ nm). However, the zero adjustment and offset functions of the conditioner allow the user to automatically define at any time a new value of the *Gauge Zero* — for example, after bonding the transducer (See sections 3.1.3.1 and 3.1.3.2).

Pressure Transducer: the *Gauge Factor* of this transducer provides only the sensitivity S . The *Gauge Zero* is not included in the *Gauge Factor* because in general these transducers are of gauge type (i.e. pressure measured relative to the ambient or atmospheric pressure). At first, the UMI conditioner fixes the default value of the *Gauge Zero* to zero ($L_{zero} = 0$ nm). However, the zero adjustment and offset functions of the conditioner allow the user to automatically define at any time a new value of the *Gauge Zero* (See sections 3.1.3.1 and 3.1.3.2). Note that in the case of absolute pressure type of transducer, FISO Technologies provides, separately, a calibrated value of L_{zero} . The offset function in *Internal Unit* allows the user to enter this value and assign it to the *Gauge Factor* of that transducer. (See section 3.1.3.2).

Force & Load Transducer: the *Gauge Factor* of this transducer provides only the sensitivity S . At first, the UMI conditioner fixes the default value of the *Gauge Zero* to zero ($L_{zero} = 0$ nm). However, the zero adjustment and offset functions of the conditioner allow the user to automatically define at any time a new value of the *Gauge Zero* (See sections 3.1.3.1 and 3.1.3.2).

Displacement Transducer: the *Gauge Factor* of this transducer provides only the sensitivity S . At first, the UMI conditioner fixes the default value of the *Gauge Zero* such as to obtain 0 mm (or 0 inch) at the center position of the transducer. However, the zero adjustment and offset functions of the conditioner



allow the user to automatically define at any time a new value of the *Gauge Zero* (See sections 3.1.3.1 and 3.1.3.2).

Refractive index gauge: The *Gauge Factor* of this transducer only provides the optical cavity length. After a simple zeroing, which corresponds to the physical cavity length, the gage is then ready to use (see Appendix A).

3.1.3.1 Zero adjustment of the transducer

The zero adjustment, done with the aid of the **NULL** function (see the menu diagram of section 2.2.2B), forces the data measurements of a given transducer to be equal to zero immediately after it is activated. The operating principle of this function is described next:

1. Immediately after pressing the button of the **NULL** function, the conditioner performs a measurement of L_{cavity} of the transducer.
2. Thereafter, the conditioner assigns this value of L_{cavity} to L_{zero} ; that is $L_{cavity} \rightarrow L_{zero}$.
3. Next, the conditioner displays during a few seconds the new value of L_{zero} (in nm) and subsequently returns to the normal display of the data measurements. At this point, one can see that the displayed values of the data measurement are equal or close to zero. Indeed, if the value of the stimulus has not changed (or very little) since the zero adjustment, its calculated value M from equation 2 must be equal or close to zero knowing that $L_{cavity} \cong L_{zero}$.

The zero adjustment function allows the user to specify or select the physical conditions at which the calculated value of the stimuli M must equal zero. It should be emphasized at this point that: 1) FISO Technologies' transducers are made and delivered with an initial cavity length L_{cavity} not equal to zero, 2) Except for temperature and displacement transducers, the default value of the *Gauge Zero* of the transducers is set to zero ($L_{zero} = 0$ nm). Consequently, when using for the first time the strain gauge, force & load, or pressure transducer, the conditioner will display a non-zero value of M even though there is no physical or real stimulus applied on the transducer (see equation 2). This situation will remain until the user redefines a new value of L_{zero} .

In the case of the strain gauge transducer, the zero adjustment is usually done after bonding the transducer to the structure. For pressure transducer of gauge type, the zero adjustment is done at atmospheric pressure or in vacuum (See next section for absolute pressure). The technical notes published by FISO Technologies for pressure and strain gauge transducers provide more information on this subject.

The principal characteristics of the zero adjustment that should be reminded are:

- ✓ **The measurement of the cavity length L_{cavity} , performed during the zero adjustment function, is done the same way as the data measurements (see section 3.2). Thus, parameters such as the *Averaging Time* will affect the results. Obviously, the value of the stimulus must be as stable as possible during the measurement of L_{cavity} in order to make an accurate zero adjustment.**
- ✓ **A new value of L_{zero} is redefined each time the zero adjustment function is activated. The new value replaces the preceding one and becomes the current value of L_{zero} . To look for the current value of L_{zero} , use the offset adjustment (OFFS) function with *Internal Unit* (see section 3.1.3.2).**
- ✓ **Despite the fact that the zero adjustment is active only on the selected measuring channel, this function is transducer-specific: that is the resulting value of L_{zero} will be associated to the**



Gauge Factor, not to the selected channel. In other words, the **Gauge Zero** is always linked to the **Gauge Factor** even though the later is re-assigned to another channel. Note that removing a **Gauge Factor** from the **Gauge List** will erase its **Gauge Zero** as well

- ✓ The zero adjustment function is automatically disabled in the case of a temperature transducer.
- ✓ The zero adjustment should be performed when the strain gauge, force & load, refractive index or gauge pressure transducers are being used for the first time (for absolute pressure, see section 3.1.3.2).
- ✓ It is recommended to take note of the current value L_{zero} when doing a zero adjustment. Knowing that it is possible to re-enter an arbitrary value of L_{zero} , it could be useful in the case where the conditioner is reset or its memory content is lost.

3.1.3.2 Offset adjustment of the transducer

The offset adjustment of the transducer, done with the aid of the **OFFS** function (see the menu diagram of section 2.2.2B), forces the data measurements of a given transducer to be equal to an arbitrary value immediately after it is activated. The operating principle of this function differs according to the selected unit.

Offset with physical units

With this option selected, the offset value is entered in the units that correspond to the transducer actually connected to the selected channel (For example, the value is entered in psi or Bar in the case of a pressure transducer). The offset adjustment function in physical units is the same as the zero adjustment except that the entered value can be different from zero. The entered value will thus correspond to the data measurements displayed right after the function is activated.

1. First, one must select the **PHY** option in the **Offset** sub-menu and then enter the offset value. (See the menu diagram of section 2.2.2B) Note that the conditioner displays the current physical units as given by the **Gauge Factor** that is assigned to the selected channel. Immediately after pressing the **ENTR** button, the conditioner performs a measurement of L_{cavity} of the transducer.
2. Thereafter, the conditioner recalculates a new value of L_{zero} from the measured value of L_{cavity} and the offset value just entered, the later being assigned to M in equation 2. In other words, the conditioner calculates a L_{zero} value that gives a value of M equal to the offset value:
$$L_{zero} = L_{cavity} - (S \times \text{offset value})$$
3. Next, the conditioner displays during a few seconds the new value of L_{zero} (in nm) and subsequently returns to the normal display of the data measurements. At this point, one can see that the displayed values of the data measurement are equal or close to the offset value. Indeed, if the value of the stimulus has not changed (or very little) since the offset, its calculated value M from equation 2 must be equal or close to the offset value knowing that
$$L_{cavity} \cong L_{zero} + (S \times \text{offset value})$$



Offset with *Internal Unit*

With this option selected, the offset value is entered in *Internal Unit* that is in nanometers. As opposed to the zero and physical units offset adjustment functions, there is no measurement of L_{cavity} since the entered value is directly assigned to L_{zero} without any other calculation.

1. First, one must select the **INTR** option in the **Offset** sub-menu (See the menu diagram of section 2.2.2B). When entering this function, the conditioner displays the current value of L_{zero} . It is recommended at this point to take note of this value. Thereafter the user can enter a new value and press **ENTR** to assign the entry to L_{zero} or press **Esc** to cancel. In the later case, the current value of L_{zero} will not be modified.
2. Next, the conditioner returns to the *Reading Level* display mode. The modification of the current value of L_{zero} will affect the displayed value of the data measurements according to equation 2.

The offset adjustment with *Internal Unit* is generally used to re-enter a given value of L_{zero} , for example, when the current value of L_{zero} is accidentally erased from the conditioner memory or when the transducer is to be used with another conditioner. This function can also be used to enter a calibrated value of L_{zero} , as for absolute pressure transducers.

The principal characteristics of the offset adjustment that should be reminded are:

- ✓ **The measurement of the cavity length L_{cavity} , performed during the offset adjustment in physical units, is done the same way as the data measurements (see section 3.2). Thus, parameters such as the *Averaging Time* will affect the results. Obviously, the value of the stimulus must be as stable as possible during the measurement of L_{cavity} in order to make an accurate offset adjustment.**
- ✓ **A new value of L_{zero} is redefined each time the offset adjustment function is activated. The new value replaces the preceding one and becomes the current value of L_{zero} . To look for the current value of L_{zero} , use the *Internal Unit* option.**
- ✓ **Despite the fact that offset adjustment is active only on the selected measuring channel, this function is transducer-specific, that is the resulting value of L_{zero} will be associated to the *Gauge Factor*, not to the selected channel. In other words, the *Gauge Zero* is always linked to the *Gauge Factor* even though the later is re-assigned to another channel. Note that removing a *Gauge Factor* from the *Gauge List* will erase its *Gauge Zero* as well.**
- ✓ **The offset adjustment function is automatically disabled in the case of a temperature transducer.**
- ✓ **The offset adjustment function with *Internal Unit* can be useful to enter a calibrated value of L_{zero} . This is particularly the case with absolute pressure transducers.**



3.2 DATA MEASUREMENT

3.2.1 Data sampling and averaging

The signal conditioning of FISO Technologies' fiber-optic transducers consists of the following steps.

1. The UMI conditioner samples the transducer signal, connected to one of the measuring channels, at a fix *Sampling Rate* of 20 Hz. Consequently, the conditioning process of the sampled signal from the transducer generates one data reading every 1/20 or 0.05 second.
2. The data readings generated at this 20 Hz *Sampling Rate* are averaged during an adjustable period of time as set by the user with the *Averaging Time* parameter.
3. The average value of the data readings is thereafter displayed by the conditioner – this is the **data measurement**.
4. Next and according to the selected scanning mode, the conditioner will switch (or not) to the next channel and will repeat the three preceding steps.

The *Averaging Time* is set from the **Acquisition** sub-menu of the control panel (See the menu diagram of section 2.2.1) The minimum value of the *Averaging Time* is 0.05 where in this case there is no averaging since the data measurement is obtained from one data reading. To calculate the number of data readings that is used to produce one data measurement, simply multiply the *Averaging Time* by 20 Hz.

✓ **The *Averaging Time* directly affects the rate at which the conditioner generates the data measurements to be displayed or directed toward the analog outputs. See the next sections for more information.**

3.2.2 Automatic Scan

The measuring channels of the UMI conditioner can be scanned in two ways: automatic and manual scan. From the *Reading Level* display mode, the **F4** button allows the user to pass from one mode to the other.

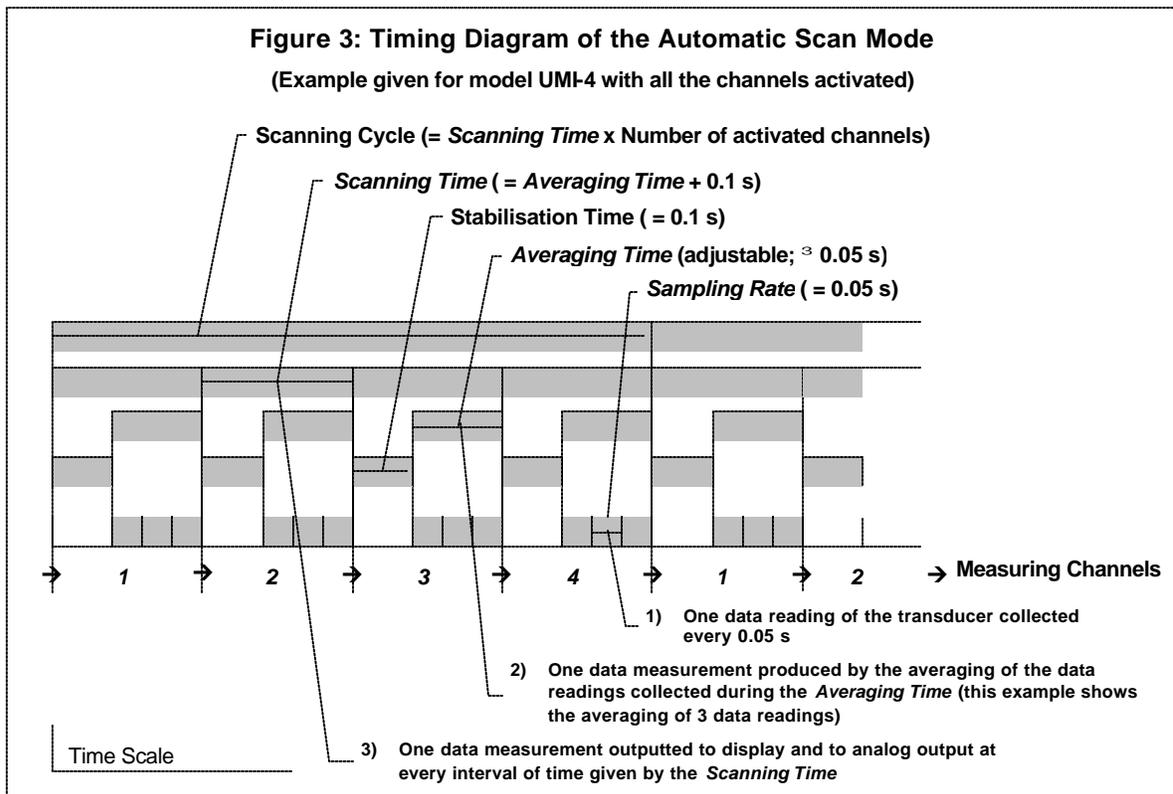
When set to automatic scan mode, the data measurements are sequentially taken on each of the activated UMI channels. The conditioner switches from one active channel to the next active one in ascending order (ex: channel no 1→2→3→4). This scanning cycle is continuously repeated: 1→2→3→4→1→2→....

The *Scanning Time* is defined as the time required for switching to a channel and get a data measurement. This time varies with the *Averaging Time* and with a stabilization time fixed at 0.1 second:

$$\text{Scanning Time} = \text{Averaging Time} + 0.1 \text{ second} \quad (\text{seconds/channel}) \quad (3)$$

The smallest value of the *Scanning Time* is 0.15 second/channel, that is when the *Averaging Time* is set to its minimum value of 0.05 second. It should be emphasized that the conditioner skips the deactivated channels. Consequently, it is recommended to set the non-used channels to OFF in the *Gauge Factor* Assignment menu (section 3.1.2.2) so to minimize the time required for a complete scan of the channels.

- ✓ In automatic scan mode, the interval of time between two successive data measurements is equal to the *Scanning Time*. However, the interval of time between two successive data measurements but from the same measuring channel is equal to the *Scanning Time* multiplied by the number of activated channels (i.e. the time required for a scanning cycle). The following diagram shows the process of the data measurement in automatic scan mode. It should be emphasized that the conditioner display and analog outputs are updated at the same rate given by the *Scanning Time*.



3.2.3 Manual Scan

When set to manual scan mode, the data measurements are taken with one measuring channel. This mode gives the fastest means of measurement that is up to 20 data measurements per second. From the *Reading Level* display mode, use the **F4** button to switch from Automatic to Manual Scan mode and select one of the four (UMI-4) or eight (UMI-8) measuring channels with the aid of the **CHANNEL SELECT** buttons.

- ✓ In manual scan, the amount of time between two consecutive data measurement is equal to the *Averaging Time* since there is no stabilization time. The corresponding analog output of the conditioner is updated at this rate. In manual scan, the screen of the conditioner cannot be refreshed faster than once every 0.5 s (2 Hz) whatever the setting of the *Averaging Time*. Clearly, the screen is refreshed at a rate given by the *Averaging Time* or once every 0.5 second, whichever is the slowest rate.



3.3 SYSTEM FUNCTIONS

3.3.1 Analog Outputs

The UMI conditioner has a voltage analog output for each of its measuring channels. These outputs have a full scale range of ± 5 Volts with a resolution of approximately 2.44 mV. The analog outputs are updated at the same rate of the data measurements (see section 3.2.2 and 3.2.3). For each of the outputs, the user has control of both the *Analog Scale Factor* (mV per Physical Unit) and the *Analog Offset* (the value of the data measurement M at which the analog output voltage is zero). The analog output voltage is proportional to the data measurement obtained from the transducer. It is given by the following equations:

$$V_{out} = SCALE \times (M - ZERO) \quad (\text{Volts}) \quad (4)$$

where:

$SCALE$ is the *Analog Scale Factor* in mV/Physical Units

M is the data measurement displayed by the conditioner

$ZERO$ is the *Analog Offset*

With the aid of the functions available in the **Analog Output Setup** sub-menu (see the menu diagram of section 2.2.3A) the user can adjust independently for each analog output, the values of the $SCALE$ (*Analog Scale Factor*) and $ZERO$ (*Analog Offset*) parameters so to cover the entire range of the instrument. However, for highest resolution, use the highest possible *Analog Scale Factor*. The voltage range of the output can be determined by using the above equation and substituting in the highest measured value of M , and lowest measured value of M . The analog output of the signal conditioner is adjusted at the factory with default setting values which depends of the type of the transducer. (The default value of the *Analog Offset* is always zero). The following table gives the analog output default setting values for different type of transducers along with the corresponding range and resolution.

DEFAULT SETTINGS OF THE ± 5 VOLTS ANALOG OUTPUT								
Transducer type	<i>Analog Scale Factor</i> (SCALE)		<i>Analog Offset</i> (ZERO)		Range		Resolution	
	SI	Imperial	SI	Imperial	SI	Imperial	SI	Imperial
Strain	2 mV/ $\mu\epsilon$	2 mV/ $\mu\epsilon$	0 $\mu\epsilon$	0 $\mu\epsilon$	$\pm 2500 \mu\epsilon$	$\pm 2500 \mu\epsilon$	1.22 $\mu\epsilon$	1.22 $\mu\epsilon$
Temperature	10 mV/ $^{\circ}\text{C}$	10 mV/ $^{\circ}\text{F}$	0 $^{\circ}\text{C}$	0 $^{\circ}\text{F}$	$\pm 500 \text{ }^{\circ}\text{C}$	$\pm 500 \text{ }^{\circ}\text{F}$	0.24 $^{\circ}\text{C}$	0.24 $^{\circ}\text{F}$
Pressure	75 mV/bar	5 mV/psi	0 bar	0 psi	$\pm 66.66 \text{ bar}$	$\pm 1000 \text{ psi}$	0.032bar	0.48 psi
Load	2 mV/kg	1 mV/lb	0 kg	0 lb	$\pm 2500 \text{ kg}$	$\pm 5000 \text{ lb}$	1.22 kg	2.44 lb
Displacement	500 mV/mm	10000 mV/in	0 mm	0 in	$\pm 10 \text{ mm}$	$\pm 0.5 \text{ in}$	4.88 μm	0.24 $\mu\text{-in}$
Refractive	10000 mV/RI	10000 mV/RI	1 RI	1 RI	0.5 RI	0.5 RI	0.00024 RI	0.00024 RI
Internal unit (nm)	1 mV/nm		0 nm		$\pm 5000 \text{ nm}$		2.44 nm	

- ✓ To restore the *Analog Scale Factor* and the *Analog Offset* to their default value, set the **SCALE** parameter to zero.
- ✓ Assigning another *Gauge Factor* from the *Gauge List* (i.e. selecting another transducer) will restore the *Analog Scale Factor* and the *Analog Offset* to their default values only if this transducer is a different type than the previously assigned one. In other words, selecting another transducer but of same type, will not change the analog output settings.



3.3.2 Diagnostic and error messages

With the aid of the diagnostic function (**DIAG**), available from the **System** sub-menu (see menu diagram in section 2.2.3A) the user can obtain useful information for evaluating the performances of both the conditioner and the transducer. The diagnostic information is: the light intensity (in Volts), the Signal (in Volts), and the memory in use (%). By comparing the diagnostic information with the following evaluation table, the user can make a diagnosis of its setup measurement.

DIAGNOSTIC:	Defective	Poor	Normal
Light	< 0.4 V	0.4 - 1.0 V	> 1.0 V
Signal	< 0.3 V	0.3 - 1.5 V	> 1.5 V
Memory	0 - 100 % of memory in use		

The UMI conditioner has an auto-diagnosis feature that informs the user in case of defective or noisy measurement conditions. Depending of the conditions, the UMI will display different messages:

MESSAGE	TYPE AND DESCRIPTION	POSSIBLE CAUSE & REMEDIES
« MEMORY LOST »	ERROR The content of the RAM memory has been erased.	✓ The RAM memory has been corrupted so the UMI conditioner is automatically reset with the factory default settings. Contact factory if that problem persists .
« NO SIGNAL »	ERROR The conditioner detects a low level signal or no signal.	<ul style="list-style-type: none"> ✓ No transducer connected to the UMI or improper connection. Verify connections or clean transducer, cable, and/or UMI input connector. ✓ Fiber optic extension cable is longer than the maximum length permitted. Use cable with shorter length. ✓ Cable or transducer is damaged. Replace damaged part. ✓ UMI conditioner is defective. Contact factory.
« SYSTEM FAULT »	ERROR The conditioner has detected a faulty condition	✓ The UMI conditioner has detected a faulty condition other than NO SIGNAL. Contact factory if that problem persists.
« SETTling »	INFORMATION OR ERROR The conditioner is settling its electronic.	✓ This is not a defective condition if the message disappears, normally after 2 or 3 seconds. This message is displayed just after the UMI conditioner is turned ON or just after a transducer is connected to the UMI.
« WAIT AVRg »	INFORMATION The conditioner is averaging the data readings of the transducer.	✓ This message appears when the conditioner displays the first data measurement and the <i>Averaging Time</i> is greater than 2 s. Wait until the <i>Averaging Time</i> elapsed.
« Next acquisition in XXhXXmXXs »	INFORMATION During an <i>Acquisition Session</i> , the conditioner goes in Low Power State between two successive data measurements.	✓ This message appears only during a delayed <i>Acquisition Session</i> . It is displayed between two successive data measurements and when the <i>Acquisition Rate</i> is larger than 2m30s + averaging time.
« Program start in XXhXXmXXs »	INFORMATION When the delayed <i>Acquisition Session</i> is activated, the conditioner goes in Low Power State until the activation of the <i>Acquisition Programs</i> at the preset date and time.	✓ This message appears only when a delayed <i>Acquisition Session</i> is activated.



4.0 THE DATA MEASUREMENT & ACQUISITION

4.1 DATA ACQUISITION

4.1.1 Acquisition Modes

The UMI conditioner offers different methods of making data acquisition through a selection of several *Acquisition Modes*. These modes are divided into two classes, that is the direct data acquisition and the delayed data acquisition, the later is subdivided into two other classes: data acquisition at set duration and programmable data acquisition. The direct data acquisition means that each data measurement is immediately sent to the RS-232 link of the conditioner without storage in the buffer memory. On the other hand, the data measurements taken during the delayed data acquisition (set duration or programmable) are stored into memory and must be downloaded with the **DATA DOWNLOAD [DD]** *Remote Control Command*. Each *Acquisition Modes* offers other options such as data acquisition in automatic or manual scan of the measuring channels. Note: the UMI switches immediately to manual or automatic scan according to the *Acquisition Modes* that is selected. The *Acquisition Modes* are selected with the **ACQUISITION MODE [TMX]** (X=0-9) *Remote Control Command*. See Table 1 and the next sections for additional explanation on each *Acquisition Modes*.

4.1.2 Delayed Data Acquisition

The UMI conditioner has an integrated data logger (memory buffer) for real time storage of the data measurements. The process of making a delayed data acquisition and data storage in memory is called an *Acquisition Session*. The term “delayed” means that the data measurements will be available as soon as the acquisition session has started logging.

4.1.2.1 Data Acquisition at set duration

Use the **ACQUISITION MODE [TMX]** command to select the appropriate *Acquisition Mode* among the ones that have a set duration (see Stop parameter in Table 1). The duration of the *Acquisition Session* is adjusted with the *Acquisition Duration* parameter. Use the **ACQUISITION DURATION [DA]** command to set the value of this parameter or go at the **Acquisition** sub-menu of the control panel (See the menu diagram of section 2.2.1).

To activate the *Acquisition Session*, send the **TRIGGER [TS1]** command or press the **F1/(Acq)** button from the *Reading Level* display mode (See the menu diagram of section 2.1). To stop the *Acquisition Session*, press **F1** again or send the **TRIGGER [TS0]** command, otherwise *Acquisition Session* terminates when the elapsed time since the beginning of the session becomes equal to the *Acquisition Duration*. Note that the memory buffer stores close to 50 000 data measurements — that may limit the maximum value of the *Acquisition Duration*. To use the full capacity of the memory, simply set the *Acquisition Duration* to 00h00m00.0. In that case, the *Acquisition Session* will terminate when the memory buffer is full.

The other time-based parameters of the *Acquisition Session* are the *Averaging Time (Avrg)* and the *Acquisition Rate (Rate)*. These acquisition-setting parameters can be manually adjusted in the **Acquisition** sub-menu of the control panel (See the menu diagram of section 2.2.1) or with their remote control equivalent commands **ACQUISITION AVERAGE [TC]** and **ACQUISITION RATE [SR]** respectively. The result of the acquisition is different depending of the scanning mode used.



UMI OPERATING MANUAL

EPROM version 6.1.x REV. 03/09/16

TABLE 1: ACQUISITION MODES (See ACQUISITION MODE command in REMOTE CONTROL COMMANDS MANUAL)							
NAME	COMMAND	SCAN MODE *	DATA STORAGE	ACTIVATION / DEACTIVATION	START PARAMETER	STOP PARAMETER	OTHER SPECIFIC PARAMETERS AND FEATURES
NORMAL (Default mode)	[TM0]	Manual	Yes	[TS1] / [TS0] commands or F1 button	None (Starts immediately after activation)	<i>Acquisition Duration</i> or deactivation	<i>Averaging Time</i> <i>Acquisition Rate</i>
SINGLE	[TM1]	Manual	Yes	[TS1] / [TS0] commands or F1 button	None (Starts immediately after activation)	None (single data measurement)	<i>Averaging Time</i>
RS-232	[TM2]	Manual	No (Direct acquisition)	[TS1] / [TS0] commands or F1 button	None (Starts immediately after activation)	<i>Acquisition Duration</i> or deactivation	<i>Averaging Time</i> <i>Acquisition Rate</i> "READY" string
PROGRAM/CONT	[TM3]	Automatic	Yes	[TS1] / [TS0] commands or F1 button	Starting Time (repeated every day)	Ending Time (repeated every day) or deactivation	See PROGRAM # commands in REMOTE CONTROL COMMANDS MANUAL
READY	[TM4]	Manual	Yes	[TS1] / [TS0] commands or F1 button	None (Starts immediately after activation)	<i>Acquisition Duration</i> or deactivation	<i>Averaging Time</i> <i>Acquisition Rate</i> "READY" string
	[TM5]	RESERVED FOR INTERNAL USE					
SCAN	[TM6]	Automatic	Yes	[TS1] / [TS0] commands or F1 button	None (Starts immediately after activation)	<i>Acquisition Duration</i> or deactivation	<i>Averaging Time</i> <i>Acquisition Rate</i>
	[TM7]	RESERVED FOR INTERNAL USE					
RS-232 / SCAN	[TM8]	Automatic	No (Direct acquisition)	[TS1] / [TS0] commands or F1 button	None (Starts immediately after activation)	None (continuous), deactivation only	<i>Averaging Time</i> <i>Acquisition Rate</i>
PROGRAM/DATE	[TM9]	Automatic	Yes	[TS1] / [TS0] commands or F1 button	Starting Date and Starting Time	Ending Date and Ending Time or deactivation	See PROGRAM # commands in REMOTE CONTROL COMMANDS MANUAL

* Note: the UMI switches immediately to manual or automatic scan according to the *Acquisition Mode* selected



4.1.2.2 Programmable Data Acquisition

Up to five different *Acquisition Sessions* can be programmed and each one of them can be activated at a specific date and time. These programmed *Acquisition Sessions* are called the *Acquisition Programs*. To create an *Acquisition Program*, the user must download into the conditioner memory (from a PC computer) the program parameters: starting and ending date & time, *Averaging Time*, etc. Each *Acquisition Program* is numbered from one to five. This programmed mode of acquisition can be activated by different ways: 1) by pressing twice on the **F1** button, 2) with the **[TS1]** *Remote Controls Command* or, 3) with FISO Technologies' *FISOC Commander* remote control software. When activated, the UMI conditioner will start the *Acquisition Programs* in chronological order as given by their respective Starting Date & Time.

The user create its own *Acquisition Programs* via the different **PROGRAM#** Remote Control Commands (see **PROGRAM#(command)**, etc. in Remote control commands Manual). An *Acquisition Program* consists of the following parameters:

- | | |
|--|---------------------------------------|
| 1. Starting Time (0 to 23h59m59.9) | See PROGRAM# STARTTIME command |
| 2. Starting Date (yyyyMMdd) | See PROGRAM# STARTDATE command |
| 3. <i>Acquisition Rate</i> (0.05 to 09h59m59.95) | See PROGRAM# RATE command |
| 4. <i>Averaging Time</i> (0.05 to 54m36.75) | See PROGRAM# AVERAGE command |
| 5. Ending time (0.05 to 23h59m59.95) | See PROGRAM# ENDTIME command |
| 6. Ending Date (yyyyMMdd) | See PROGRAM# ENDDATE command |

An *Acquisition Program* is said enabled when its *Acquisition Rate* value is different from zero. One can disabled a given *Acquisition Program* by setting its *Acquisition Rate* to zero. To activate a set of enabled *Acquisition Programs*, first use the **ACQUISITION MODE [TM3]** or **[TM9]** command to select the appropriate programmable *Acquisition Mode*. Then send the **TRIGGER [TS1]** command or press twice the **F1/(Acq)** button. The UMI will run the set of activated *Acquisition Programs* in chronological order as given by the Starting Time and Starting Date (TM9 mode only) of each program. In case of time and date overlap between different *Acquisition Programs*, the Starting time (or date) of a given *Acquisition Program* has priority over the Ending time (or date) of the preceding *Acquisition Program*. It means that the UMI may jump to the next *Acquisition Program* while the actual *Acquisition Program* is not terminated yet.

Note: in TM3 mode, the *Acquisition Programs* are run again every 24 hours (the date is ignored) until the next **TRIGGER** command is received by the UMI or until the user has pressed twice the **F1/(Acq)**.

The following example show a list of the Remote Control Commands to sent to the UMI for creating a TM9 *Acquisition Program*:

[SF [∨] ₂ [∨] 20001124]	Set the Starting Date of <i>Acquisition Program</i> # 2 to 2000-11-24
[SA [∨] ₂ [∨] 013000]	Set the Starting time of <i>Acquisition Program</i> # 2 to 01h30m00s
[SG [∨] ₂ [∨] 20001126]	Set the Ending Date of <i>Acquisition Program</i> # 2 to 2000-11-26
[SB [∨] ₂ [∨] 023000]	Set the Ending time of <i>Acquisition Program</i> #2 to 02h30m00s
[SC [∨] ₂ [∨] 000100.00]	Set the <i>Acquisition Rate</i> of <i>Acquisition Program</i> #2 to 1 minute
[SD [∨] ₂ [∨] 0010.00]	Set the <i>Averaging Time</i> of <i>Acquisition Program</i> #2 to 10 seconds

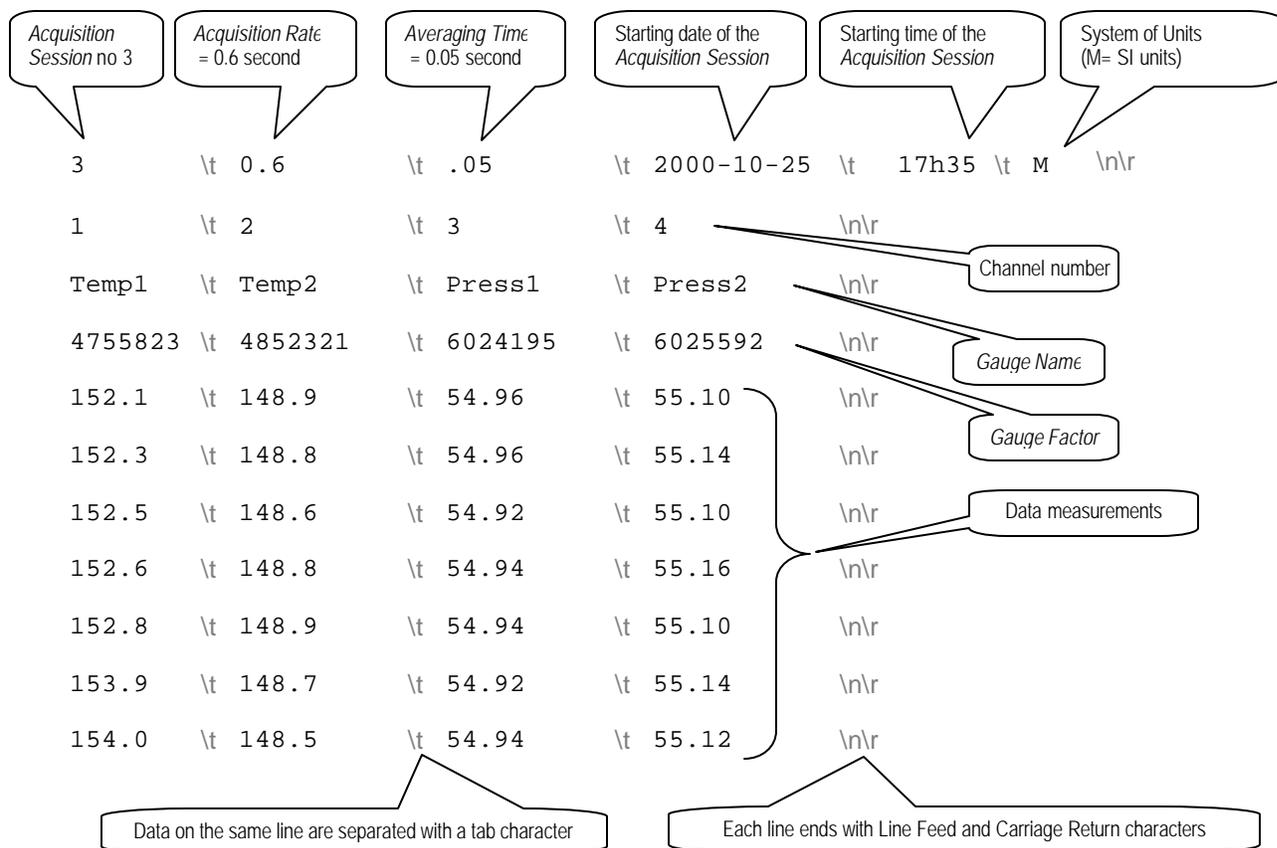
The listing of a given *Acquisition Program* # can be viewed with the **PROGRAM# SHOW** command. See REMOTE CONTROL COMMANDS MANUAL for more information.



4.1.2.3 Data Logging and Downloading

Each time an *Acquisition Session* is started, a new data files is created and opened in the memory of the UMI conditioner. The content of this file includes the data measurements and other useful information of the acquisition. The file (ASCII characters text file) is called the *Acquisition Series* and can be easily downloaded to a computer with the aid of the **DATA DOWNLOAD [DD]** command. The *Acquisition Series* file includes a four-line header and the data measurements taken during the duration of the *Acquisition Session*. First line of the header contains the *Acquisition Series* number, the value of the *Acquisition Rate*, the value of the *Averaging Time*, the date of the *Acquisition Session*, the time at which the *Acquisition Session* was started, and the system of Units. The *Acquisition Series* number indicates the chronological order of the *Acquisition Session*, i.e. 1 is the first *Acquisition Session*, 2 is the second *Acquisition Session*, etc. The second line of the header indicates the channel numbers from which the data measurements are taken. Each channel number defines a row under which is the *Gauge Name* (third line of the header) and the *Gauge Factor* (fourth line of the header.) and then followed by the data measurements, each line of data corresponding to a scanning cycle (if in automatic scan mode). Use the **LIST TAG [LT]** command to get a listing of all the *Acquisition Series* stored in the memory buffer without the data measurements. The following figure shows an example of the content of an *Acquisition Series* file.

Figure 4: CONTENT OF THE ACQUISITION SERIES FILE
(Example given for model UMI-4 with all the channels activated)



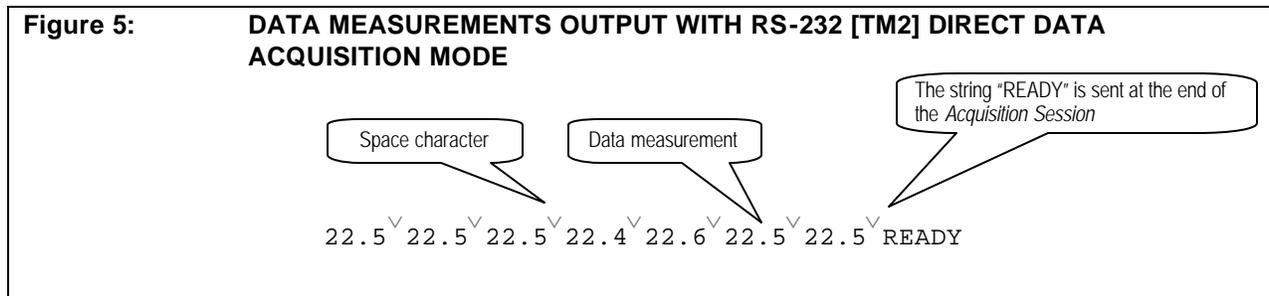


4.1.2.4 Deleting the Memory Buffer

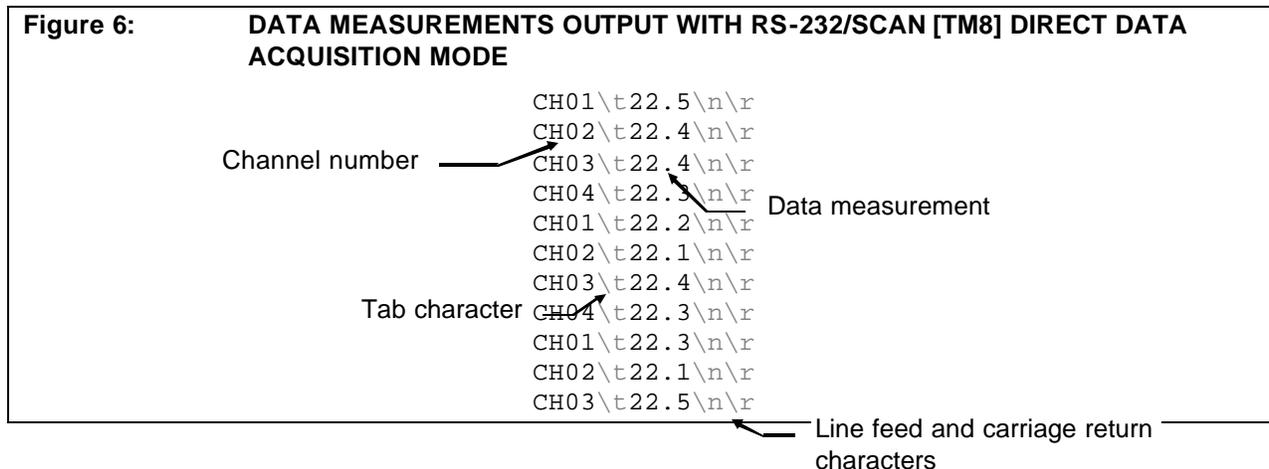
We recommend clearing the contents of the memory buffer once the data measurements have been downloaded. This ensures that the full capacity of the memory buffer is available for the next *Acquisition Sessions*. To delete the contents of the memory buffer, use the **CLBF** function of the **Acquisition** Sub-menu (see the menu diagram of section 2.2.1) or the equivalent remote command **CLEAR BUFFER [CB]**

4.1.3 Direct Data Acquisition

If a direct data acquisition mode is selected, each data measurement is immediately sent to the RS-232 link of the conditioner without storage in the memory. Use the **ACQUISITION MODE [TM2]** or **[TM8]** command to select the appropriate direct *Acquisition Mode* and then send the **TRIGGER [TS1]** command to activate the acquisition (or press the **F1/(Acq)** button). When the direct data acquisition is set in manual scan (RS-232 **[TM2]** mode), a space character separates each data measurement (taken on a single channel) sent to the RS-232 output. The string **READY** is sent at the end of the last data measurement. No information is given on the acquisition parameters, the *Gauge Factor*, the unit of the measure, etc. Figure 5 shows an example of the direct data measurement output when in manual scan mode.



When the direct data acquisition is set in automatic scan (RS-232/SCAN **[TM8]** mode), each data measurement collected on the different channels are placed on separate lines. The line begins with the channel number (ex.: CH01) followed by a tab character, then the data measurements and it terminates with a line feed (\n) and carriage return (\r) character. No information is given on the acquisition parameters, the *Gauge Factor*, the unit of the measure, etc. Figure 6 an example of the direct data measurement output when in automatic scan mode.





The duration of the direct data acquisition (set with the *Acquisition Duration* parameter) can be adjusted only in the RS-232 [TM2] mode. The RS-232/SCAN [TM8] mode is continuously running and stops with the TRIGGER [TS0] command or by pressing the F1/(Acq) button. The other time-based parameters of the direct data acquisition are the *Averaging Time (Avrg)* and the *Acquisition Rate (Rate)*. These acquisition-setting parameters can be manually adjusted in the **Acquisition** sub-menu of the control panel (See the menu diagram of section 2.2.1) or with their remote control equivalent commands **ACQUISITION AVERAGE [TC]** and **ACQUISITION RATE [SR]** respectively.

4.1.4 Data Acquisition in Manual Scan

As mentioned before, the result of the acquisition is different depending of the scanning mode used. When the conditioner is set to manual scan, the data acquisition consists of storing (or directly outputting to RS-232 link) one data measurement at every interval of time given by the *Acquisition Rate* parameter. See Figure 7 for the timing diagram of the data acquisition when in manual scan. It should be noted that the data measurements are taken according to the *Averaging Time* initially set by the user (section 3.2.1). That is the averaging process is done on a 20 Hz sampling rate basis which means the UMI conditioner calculates an average value of the data readings collected at every 1/20 s and during the period of time set with the *Averaging Time* parameter. The averaging process is always started at the beginning of the period as set with the *Acquisition Rate* parameters. For example, if the *Averaging Time* is set to 45 seconds and the *Acquisition Rate* is set to two minutes, the UMI conditioner will take and store (or output) the average value of the first 900 data readings (20 Hz X 45s) of the 2400 (20 Hz X 120s) available data readings (rounded to the closest integer). It should be noted that the *Acquisition Rate* parameter could not be smaller than the *Averaging Time*. If the user tries to set the *Averaging Time* larger than the *Acquisition Rate*, the later will be automatically reset (at the start of the *Acquisition Session*) to a value equal to the *Averaging Time*.

4.1.5 Data Acquisition in Automatic Scan

When the conditioner is set to automatic scan, the data acquisition is performed by storing (or by directly outputting to the RS-232 link), at every interval of time given by the *Acquisition Rate*, the data measurements taken during one scanning cycle. See Figure 8 for the timing diagram of the data acquisition when in automatic scan. It should be noted that the data measurements are taken according to the *Averaging Time* initially set by the user (section 3.2.1). That is the averaging process is done on a 20 Hz sampling rate basis which means the UMI conditioner calculates an average value of the data readings collected at every 1/20 s and during the period of time set with the *Averaging Time* parameter. The averaging process is always started at the beginning of the period as set with the *Acquisition Rate* parameters. For example, a UMI-4 with its four activated channels has an *Averaging Time* set to 1 second and an *Acquisition Rate* set to 10 seconds. The conditioner starts the *Acquisition Session* on channel no 1 by making the averaging of 20 data readings (20 Hz x 1 s). Thereafter, it switches to channel no 2 and remakes the same averaging process. These steps are repeated until the end of the scanning cycle that is at channel no 4. Once the cycle is completed (in 4.4 seconds), the conditioner stores (or output) the four data measurements taken. This process is repeated at every interval of time given by the *Acquisition Rate* that is 5.6 seconds after the last data measurement on channel no 4. The lowest possible value of the *Acquisition Rate* is equal to the *Scanning Time* multiply by the number of activated channels that is the time of a scanning cycle. If the user tries to enter a lower value, the *Acquisition Rate* will be automatically reset (at the start of the *Acquisition Session*) to this limiting value.



4.1.6 Low Power State

When it goes in *low power state*, the UMI signal conditioner keeps the minimum hardware ON for remote communication, and turns OFF all other non-necessary hardware (ex. Lamps). The user still has access to the *Remote Control Commands* such as, downloading data or programming the conditioner. This state means that one of the UMI *Acquisition Modes* is activated and still active (for example an *Acquisition Program* is to be started at a set date and time), but no data measurements is being taken nor is being planned for at least the next 2m30s. The lower power state will be set automatically by the system.

4.1.7 Refreshing rate of the screen and the analog output during acquisition

During an *Acquisition Session*, the screen is refreshed as following. In manual scan, the screen is refreshed at a rate given by the *Acquisition Rate* or once every 0.5 s, whichever is the slowest rate. In automatic scan, the screen is refreshed at a rate given by the *Acquisition Rate*.

The analog output is always refreshed at a rate given by the *Acquisition Rate*.



Figure 7: Timing Diagram of Data Acquisition in Manual Scan Mode
(Example given for model UMI-4, channel no 1 selected)

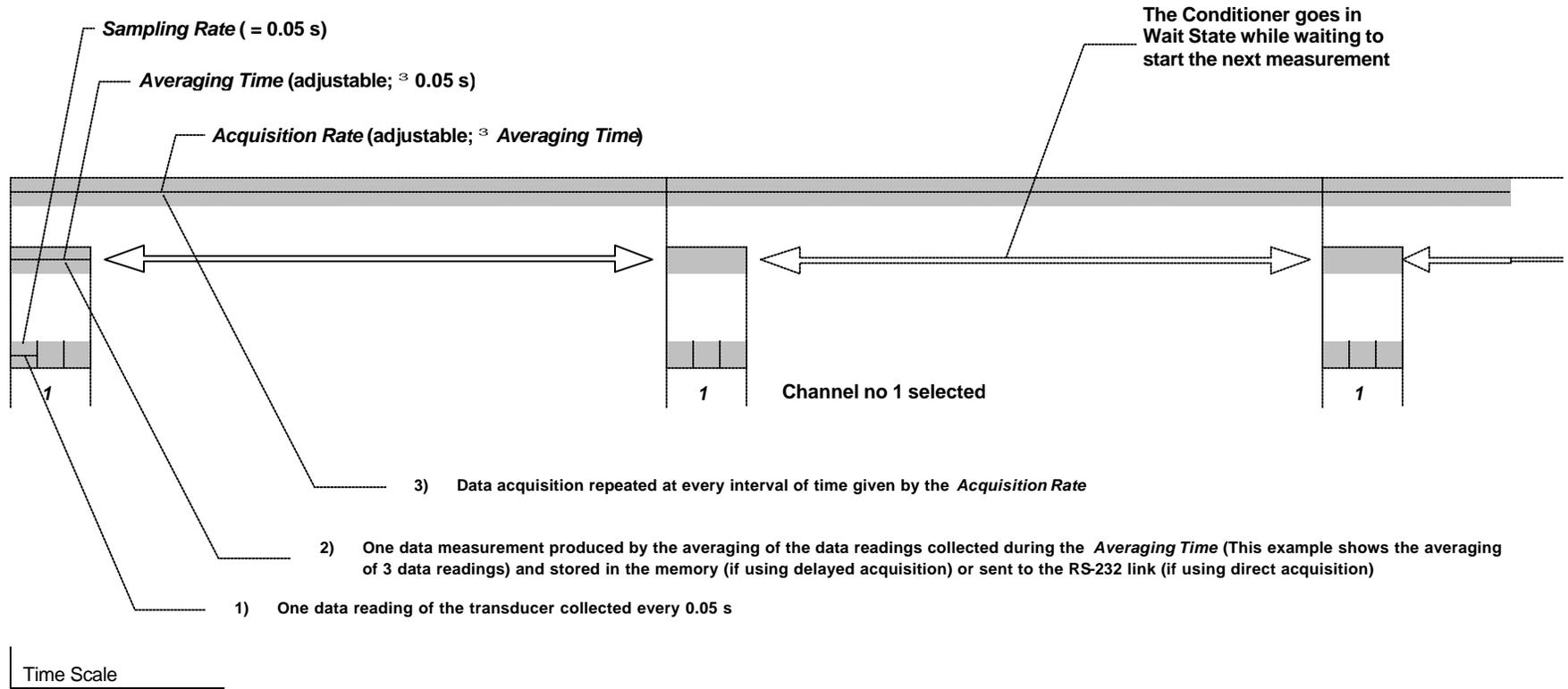
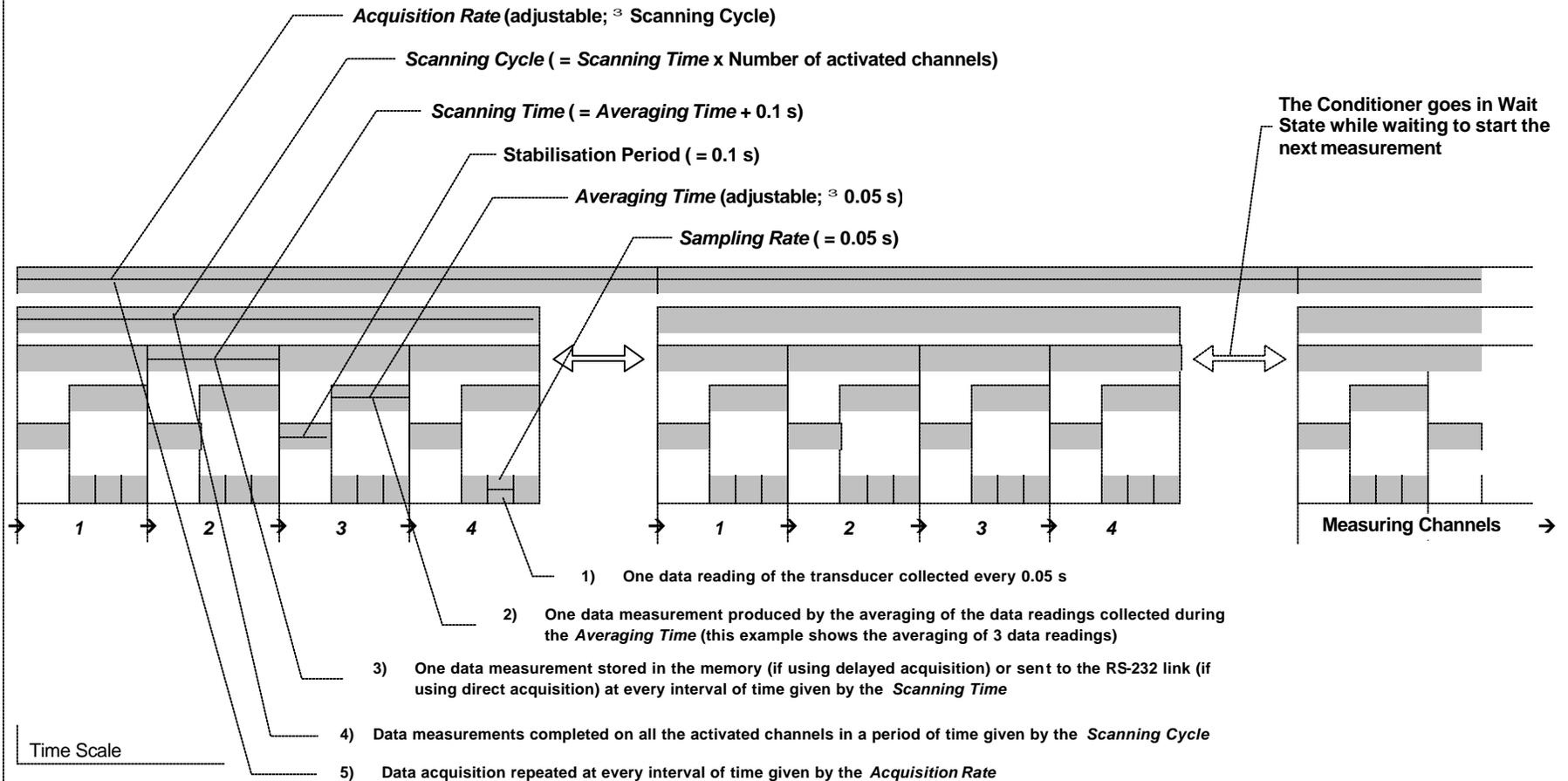




Figure 8: Timing Diagram of Data Acquisition in Automatic Scan Mode
(Example given for model UMI-4 with all the channels activated)





5.0 ERROR MESSAGES WITH REMOTE CONTROL COMMANDS

5.1 NO SIGNAL

When the conditioner detects a defective or noisy measurement condition during an *Acquisition Session*, all the data in the *Acquisition Series* acquired during this condition are replaced by the error message NO SIGNAL. Note that the conditioner does not stop the *Acquisition Session* if that condition occurs. The following example shows the content of an *Acquisition Series* where a defective or noisy measurement condition occurred at the end of the *Acquisition Session*.

```
1\t1.0\t0.5\t1998-05-23\t10h30\tM\n\r  
1\n\r  
GAUG5\n\r  
4229223\n\r  
26\n\r  
26\n\r  
26\n\r  
26\n\r  
26\n\r  
NO SIGNAL\n\r  
NO SIGNAL\n\r  
NO SIGNAL\n\r
```

The possible cause and remedies for a NO SIGNAL error message are:

- No transducer connected to the conditioner or improper connection. Verify connections or clean transducer, cable, and/or conditioner input connectors.
- Fiber optic cable is longer than the maximum length permitted. Use cable with shorter length.
- Fiber optic cable or transducer is damaged. Replace damaged part.
- Conditioner light source is defective. Verify light condition with **DIAGNOSTIC REPORT** command.
- Conditioner is defective. Contact factory.



5.2 ERROR NUMBERS

The following error messages are reported by sending through the RS-232 serial link a specific error number depending of the problem.

ERROR #	MEANING	REMARK OR EXAMPLE
01	MEMORY FULL	No more memory space for data acquisition or for adding a <i>Gauge Factor</i>
02	SYSTEM STOPPED	Command cannot be executed because the conditioner is not reading the sensor.
03	NO SIGNAL	Command cannot be executed because of no signal condition
04	BUFFER OVERRUN	A timeout error occur on the output RS232 port causing the buffer to be cleared or direct acquisition data lost
10	INVALID PARAMETER	Command is send with an invalid parameter
11	COMMAND DENIED	Command cannot be executed because the conditioner is in Wait State, is making a diagnosis, logging reading, etc.
12	ITEM NOT FOUND	Trying to erase or select a non existing <i>Gauge Factor</i> or <i>Gauge Name</i>

The error message is always sent in the following way:

`\a ERRvXX\n\r` where `\a` is the BELL character and `XX` is the error number.

Ex.: The user sent the following **GAUGE SELECT** command: `[#2GA9999999]`. This *Gauge Factor* is not in the *Gauge List* so the conditioner returns the following:

`#2GA9999999\n\r`

`\a ERRv12\n\r`

ERR 12 message means ITEM NOT FOUND. The possible errors that can occur while using the Remote Control Commands are listed by their corresponding error numbers in each command description in the Remote Control Commands Manual.



5.3 DIAGNOSTIC MESSAGES

5.3.1 Reset

The **SYSTEM RESET** remote control command (see remote control commands manual) erases the content of memory and resets the DMI conditioner with its default factory settings. All the *Gage Factors* of the *Gage List* and associated *Gage Zero* as well as the acquisition data will be lost after a reset of the conditioner.

5.3.2 System of Units

The **SYSTEM UNIT** remote control command allows the user to select between the International and Imperial System of Units. When set to International System of Units (SI), the conditioner uses the following units: °C for temperature, **bar** for the pressure, **kg** for the force or load, **mm** for the displacement. The equivalent Imperial Units are: °F, **psi**, **lb**, **in**. The strain unit is the microstrain, $\mu\epsilon$, that is 10^{-6} meter/meter or 10^{-6} inch/inch.

5.3.3 Date and Time

The **DATE** and the **TIME** remote control commands are used to set the date and the time of the conditioner real-time clock.

5.3.4 Miscellaneous

See remote control commands manual for a complete listing of all available.



APPENDIX A: REFRACTIVE INDEX TRANSDUCERS

The refractive index transducer is based on the variation of the optical Fabry-Perot cavity length that results from the refractive index properties of the liquid. The liquid filled cavity length, hereinafter called optical cavity length ($L_{optical}$), is given by the physical cavity length ($L_{physical}$) multiplied by the refractive index of the liquid (n_{liquid}):

$$L_{optical} = n_{liquid} \cdot L_{physical}$$

Since FISO signal conditioner has the capability to measure the absolute cavity length, there is no need for probe calibration. The user must first enter and specify a gage factor that indicates to the system that a refractive index transducer is being used. User is referred to the ADD and SELECT functions described in this manual. While still in air, the probe is zeroed (NULLing function). As a result of the zeroing, the conditioner memorizes the cavity length in air which corresponds to the physical cavity length described above. From there, any new cavity length will be divided by this memorized physical cavity length to give the refractive index. As with other probe types, displayed resolution can be increased by signal averaging.

The gage factor to be ADDED and SELECTED that corresponds to a refractive index transducer is:

G.F.: 08Y00XX

The first 5 digits are specific to a refractive transducer. The Y value is either 0 or 1. The value 1 is useful when measuring an RI above 1,5. The last two digits are used to differentiate the probes that may be used simultaneously on the same conditioner. The physical cavity lengths are saved in a memory location associated with the gage factor (including the zero of the probe). The same last two digits will force the probes to use the same physical length and thus, inaccurate measurements will occur.

It is important to note that the refractive index measured by the system is not for one single wavelength as it is usually reported in the literature, but is the refractive index averaged over the wavelength covered by the internal light source. The light source extends from 650nm to 1000nm. As a rule of thumb, it is generally acceptable to consider that the refractive index is measured for a central wavelength of 800nm.



MANUAL REVISION:

R1:

Remove the preliminary version notice.

Updated the table for the default settings of the ± 5 volts analog output

Added Appendix A regarding the refractive index.

Change the FISO logo throughout this document.

Page 9 : *to set the Averaging time parameter -> Use the arrow-equivalent buttons to set the **Averaging time.***



UMI
Universal Multichannel Instrument

User Guide
MAN-00066 R2

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If the equipment described herein bears the **CE** symbol, the said equipment complies with the applicable European Union Directive and Standards mentioned in the Declaration of Conformity.

Error List	
Syntax:	[ER]
Description	Lists the error type and number.
Parameters:	None
Remarks:	
Returns:	[ER] 1 MEMORY FULL 2 SYSTEM STOPPED 3 NO SIGNAL 4 BUFFER OVERRUN 10 INVALID PARAMETER 11 COMMAND DENIED 12 ITEM NOT FOUND 13 INVALID COMMAND 14 MEMORY ERROR END LF CR

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Units of measurement in this document conform to SI standards and practices.

Hardware Version

Syntax:	[VB]
Description	Returns the hardware information of the conditioner unit.
Parameters:	None
Remarks:	
Returns:	VB LF CR 20V6.0BTC8L115 LF CR where 20V6.0BTC8L115 is the hardware version

Firmware Version

Syntax:	[VR]
Description	Provides the EEPROM version of the unit.
Parameters:	None
Remarks:	
Returns:	VR LF CR version 6.1.16 LF CR where version 6.1.16 is the EPROM version

Serial Number

Syntax:	[SN]
Description	Returns the serial number of the conditioner.
Parameters:	None
Remarks:	
Returns:	SN LF CR 05U6.0003 LF CR where 05U6.003 is the serial number

Diagnostic Report

Syntax:	[DR]
Description	None
Parameters:	None
Remarks:	Make sure that the conditioner is set to manual scan (if not, selects the appropriate Acquisition Mode like [TM2] mode).
Returns:	DR LF CR LIGHT: 3.1V LF CR SIGNAL: 4.5V LF CR MEMORY: 1% LF CR

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Miscellaneous

Date

Syntax: [SY yyyy-MM-dd], [SY]
Description: Sets the unit's date.
Parameters: If none: returns the current date of the conditioner real-time clock
Otherwise: sets the date of the conditioner real-time clock, yyyy is the year (four digits), MM is the month (2 digits) and dd is the day (two digits).
Remarks:
Returns: SY 2005-09-30 LF CR OR
SY LF CR
2005-09-30 LF CR where 2005-09-30 LF CR is the conditioner current date

Time

Syntax: [SThhmm], [ST]
Description: Displays or sets the unit's time.
Parameters: If none: returns the current time of the conditioner real-time clock
Otherwise: sets the time of the conditioner real-time clock, hh =hours and mm = minutes
Remarks:
Returns: ST15302005-09-30 LF CR OR
ST LF CR
1530 LF CR (where 1530 is the conditioner's current time)

System Off

Syntax: [WF]
Description: Turns OFF the unit.
Parameters: None
Remarks:
Returns: WF LF CR

Zero download

Syntax: [#NZD], [ZD]
 Description: Returns the Gauge Zero value of the Gauge Factor currently assigned to the measuring channel N
 Parameters: None
 Remarks: This function is irrelevant for temperature sensors.
 Returns: #NZD LF CR
 XXXXXXX LF CR where XXXXXXX is the Gauge Zero current value in nm
 ZD LF CR
 15000 LF CR

Zero internal

Syntax: [ZPXXXXXXXX], [#XZPXXXXXXXX]
 Description: Returns the Zero internal value of the Gauge Factor currently assigned to the measuring channel N
 Parameters: XXXXXX is the value (in internal units) that offsets the transducer currently assigned to the selected channel.
 Remarks: First, put the conditioner in manual scan by selecting the appropriate Acquisition Mode (ex. Use [TM2] mode). Second, select a channel with the CHANNEL SELECT [CS] command and then proceed with the zero internal command.
 This function is irrelevant for temperature sensors.
 Returns: ZP100 LF CR

Zero Physical

Syntax: [ZOXXXX.XX], [#XZOXXXX.XX]
 Description: Offsets (or makes a zero adjustment) the sensor currently assigned to the selected channel.
 Parameters: XXXX.XX is the value (in physical units) that offsets (or makes a zero adjustment) the transducer currently assigned to the selected channel.
 Remarks: First, put the conditioner in manual scan by selecting the appropriate Acquisition Mode (ex. Use [TM2] mode). Second, select a channel with the CHANNEL SELECT [CS] command and then proceed with the command.
 This function is irrelevant for temperature transducer.
 Use this function to make a zero adjustment as well (send [Z00] command)
 Returns: ZO10 LF CR
 done LF CR

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Certification Information

F.C.C. Information

Electronic test equipment is exempt from Part 15 compliance (FCC) in the United States, but FISO makes reasonable efforts to ensure this compliance.

CE Information

Electronic test equipment is subject to the EMC Directive in the European Union. The EN61326 standard prescribes both emission and immunity requirements for laboratory, measurement, and control equipment.

This unit has been tested and found to comply with the limits for a Class A digital device. Please refer to the Declaration of Conformity.

Independent Laboratory Testing

This unit has undergone extensive testing according to the European Union Directive and Standards. All pre-qualification tests were performed internally, at FISO, while all final tests were performed externally, at an independent, accredited laboratory. This guarantees the unerring objectivity and authoritative compliance of all test results.

- ▶ Use of shielded remote I/O cables, with properly grounded shields and metal connectors, is recommended in order to reduce radio frequency interference that may emanate from these cables.

Gauge Select	
Syntax:	[#NGAXXXXXXX] or [#NGA YYYYY], [#NGA], [#NGA0], [GA0], [GA]
Description	Assigns a gauge factor to a channel, deactivates a channel or returns the gauge factor assigned to a channel.
Parameters:	If none: returns the Gauge Name YYYYY (five-character string format) and Gauge Factor XXXXXXXX currently assigned in the channel N. If = 0: turns the channel number N to OFF, therefore it deactivates the channel number N. Otherwise: assigns the Gauge Factor XXXXXXXX to the channel number N. The Gauge Factor can be assigned by mean of its associated Gauge Name YYYYY as well
Remarks:	
Returns:	#1GA4902763 LF CR OR #1GA TEMP1 LF CR OR #1GA0 LF CR OR #1GA LF CR TEMP1 4902763 LF CR (currently assigned in channel number 1) or #1GA LF CR +OFF+ 000000 LF CR (channel N is OFF) or GA0 LF CR OR GA LF CR TEMP1 4902763 LF CR

System Unit	
Syntax:	[SUX], [SU]
Description	Displays or toggles between measurement units.
Parameters:	If none: returns the current System of Units (0 or 1) If X=0: set the units to the International System of Units (default state) If X=1: sets the units to the Imperial System of Units
Remarks:	
Returns:	SU1 LF CR OR SU LF CR 0 LF CR (where 0 is the current System of Units)

Sensor

Gauge Add

Syntax: [ASXXXXXXXX] or [AS YYYYY XXXXXXXX]
 Description: Registers a sensor in the unit's memory.
 Parameters: XXXXXXXX is the 7-digits Gauge Factor
 YYYYY is the Gauge Name (5 characters maximum)
 Remarks: The Gauge Name is optional.
 Returns: AS4902763 LF CR OR
 AS TEMP1 4902763 LF CR

Gauge Erase

Syntax: [RSXXXXXXXX] or [RS YYYYY]
 Description: Erases a gauge factor from the gauge list.
 Parameters: XXXXXXXX is the 7-digits Gauge Factor
 YYYYY is the Gauge Name (5 characters maximum)
 Remarks:
 Returns: RS4902763 LF CR OR
 RS TEMP1 LF CR

Gauge List

Syntax: [LG]
 Description: Returns the contents of the gauge list.
 Parameters: None
 Remarks: An "END" string is added at the end of the list. The gauge name is sent as a five-character string, so space characters may be present.
 Returns: LG LF CR
 NONE 1000
 TEMP0 4000000
 TEMP1 4902763
 END

1. Introducing the UMI

The UMI Universal Multichannel Instrument is a multi-channel fiber-optic signal conditioner. It is used with FISO's fiber-optic sensors to perform temperature, pressure, refractive index, torque, force and load, and displacement measurements in hostile locations that were formerly inaccessible with other measuring instruments.

Front Panel

The front panel of the UMI Universal Multichannel Instrument features a 4 × 20 characters alphanumeric screen with eight push-button control keys and four (UMI-4) or eight (UMI-8) fiber-optic input connectors.

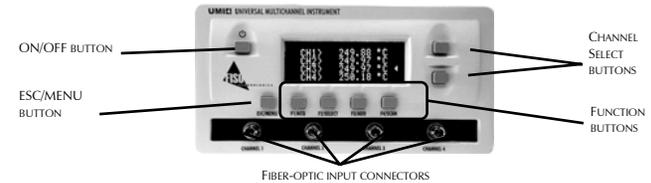


Figure 1. UMI-4 front panel

The ON/OFF button is used to turn the UMI Universal Multichannel Instrument on and off.

The Channel Select buttons perform the following actions:

- ▶ Selection of the channel to be displayed when the conditioner is set to manual scan
- ▶ Selection of the channel for which a specific command of the menu functions has to be performed

The ESC/MENU button has three functions:

- ▶ Accessing the Menu mode
- ▶ Accessing the Reading mode
- ▶ Going one step back in the menus

The function buttons have different uses depending on whether the system is on Menu mode or in Reading mode.

- ▶ In Menu mode, menu functions are displayed on the bottom line of the screen and selected with the F1, F2, F3 or F4 buttons.
- ▶ In Reading mode, the functions are as follows: F1/ACQ starts an acquisition; F2/SELECT brings the user to the gauge factor assignment menu; F3/ADD opens the add gauge factor menu; and F4/SCAN toggles between automatic and manual scan.

Back Panel

The back panel of the UMI Universal Multichannel Instrument comes with different connectors as described in this section.

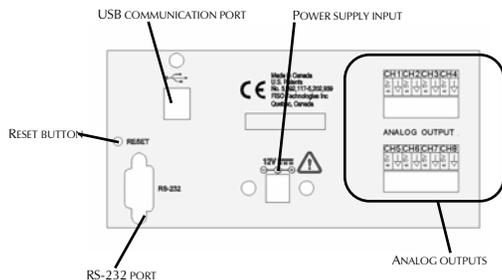


Figure 2. UMI-8 back panel

Power Supply Input

The UMI Universal Multichannel Instrument comes with a 12 VDC wall plug-in power supply.

Analog Outputs

The UMI Universal Multichannel Instrument has, for each of the measurement channels, a corresponding analog output.

The analog outputs provide a voltage within a range of ± 5 Volts. The ratio between the voltage variation measured at the output and the corresponding variation of the physical parameters measured by the sensor is given by the Analog Scale Factor. This factor, expressed in Volts per physical unit (ex: 10 mV/°C), is displayed in the Analog Output Setup sub-menu. See *Configuring Analog Output Parameters* on page 22.

RS-232 Link

The UMI Universal Multichannel Instrument can be remotely controlled via a PC (or other devices) through its RS-232 serial link. The provided software, FISOCommander 2, provides an effective and simple tool for remotely controlling your UMI as well as downloading and viewing in real-time the data measurements directly from your PC computer.

Moreover, a set of remote control commands emulates all the functions available from the front panel of the conditioner. For more details about remotely controlling the UMI, consult the *Remotely Controlling the UMI* section, on page 29.

USB Communication Port

The UMI supports the standard USB 1.1 protocol. This feature is only available when used in conjunction with FISOCommander. You can cascade several UMI systems using a USB hub from a single USB port. More details are provided in the *FISOCommander* section of this user guide.

Analog Zero

Syntax:	[#NAZXXXXX.XX], [#NAZ], [AZ], [AZXXXXX.XX]
Description:	Sets the analog offset value for the analog output of the specified channel.
Parameters:	If none: returns the current ZERO (Analog Offset) value from the analog output of the specified channel number N. Otherwise: XXXX.XX is a positive or negative number that set the ZERO (Analog Offset) on the analog output of the specified channel number N.
Remarks:	The value is in physical units.
Returns:	#1AZ22 LF CR OR #1AZ LF CR 22.00 LF CR where 1 is the channel number and 22.00 is the current ZERO value from the channel N analog output OR AZ 22.00 LF CR 22.00 is the current ZERO value from the active channel analog output OR AZ22 LF CR

Channel Select

Channel Select

Syntax:	[CSN], [CS]
Description:	Selects the channel.
Parameters:	If none: returns the current channel number selected (in manual scan mode). Otherwise: selects the channel number N
Remarks:	Make sure that the conditioner is set to manual scan (if not, selects the appropriate Acquisition Mode like [TM2] mode).
Returns:	CS3 LF CR OR CS LF CR 3 LF CR where N is the current channel number selected

Analog Output

Analog Scale

Syntax:	[#NAVXXXXX.XX], [#NAV], [AVXXXXX.XX], [AV]
Description:	Sets the analog scale factor on the analog output of the specified channel.
Parameters:	If none: returns the current SCALE (Analog Scale Factor) value from the analog output of the specified channel number N. Otherwise: XXXX.XX is a positive or negative number that set the SCALE (Analog Scale Factor) value on the analog output of the specified channel N.
Remarks:	The scale is in mV/unit for a voltage output or μA /unit for a current output. If xxxx equals zero, the scale will be set to the default value.
Returns:	#1AV100 _{LF CR} or #1AV _{LF CR} 100.0 _{LF CR} where 1 is the channel number and 100.0 is the current SCALE value from the channel 1 analog output) or AV 100.0 _{LF CR} 100.0 is the current SCALE value from the active channel analog output or AV100 _{LF CR}

UMI Main Features

The UMI Universal Multichannel Instrument has a 14-bit resolution (without averaging) with a relative dynamic range of 15 000:1. The resolution and the full-scale output depend on the type and sensitivity of the sensors used with the UMI.

The Universal Multichannel Instrument offers the following main features:

- ▶ Data averaging
- ▶ Data logging
- ▶ Automatic scanning
- ▶ Delayed acquisition

More details can be found in the following sections with instructions about installing and using your UMI Universal Multichannel Instrument.

Control Panel Functions

Two operating modes are available through the UMI front panel:

- ▶ Reading mode
- ▶ Menu mode

To access either mode, simply press the ESC/MENU button. This button will toggle between the two display modes.

Reading Mode

In Reading mode, the function buttons are identified by the term following the slash: ACQ, SELECT, ADD, and SCAN.

- ▶ ACQ starts and stops a delayed acquisition.
- ▶ SELECT assigns the gauge factors to the measurement channels.
- ▶ ADD records a gauge factor in the gauge list.
- ▶ SCAN toggles between automatic and manual channel scan mode.

Press the ESC button to go into Menu mode from Reading mode.

Menu Mode

In Menu mode, the function buttons are named F1, F2, F3, and F4 and their functions vary according to the selected menu and are indicated on the display. The following sets of functions are available when in Menu mode:

- ▶ Acquisition
- ▶ Sensor
- ▶ System

If the display is on Menu mode, use the ESC/MENU button to return one step back in the menus or to return to the Reading mode.

System Memory

The UMI Universal Multichannel Instrument is equipped with a non-volatile RAM type memory where all the settings of the conditioner (gauge factors, analog output settings, etc.) are stored. Each time the UMI Universal Multichannel Instrument is powered on, it is reset with the last settings that were in use just before it was powered off.

The UMI Universal Multichannel Instrument has also a non-volatile memory buffer, which can store close to 50000 data points. The stored data can be downloaded to a computer via the RS-232 or USB link.

List Tag	
Syntax:	[LTXXX], [LT]
Description:	Used to update software or calibration in flash memory.
Parameters:	If none: returns a summarized list of all the Acquisition Series. For each of the series, the list provides the Acquisition Series #, the date, the time and the number of data measurements. The list ends with an "END" string. Otherwise: returns a summary of the Acquisition Series # XX. In that case, the summary consists of the four-line header of the Acquisition Series # XX
Remarks:	
Returns:	<pre> LT LF CR 1 2005-09-27 14h00 10 2 2005-09-27 16h40 1 3 2005-09-28 11h20 600 4 2005-09-28 11h21 200 5 2005-09-28 11h34 200 END OR LT2 LF CR 2 1.20 0.05 2005-09-27 16h40 M 1 TEMP1 4902763 (Assigned Gauge Factor and its associated Gauge Name above) </pre>

System Reset	
Syntax:	[RF]
Description	Resets the conditioner to its default state.
Parameters:	None
Remarks:	
Returns:	RF LF CR

Clear Gauge List	
Syntax:	[CG]
Description	Erases the complete gauge factor list.
Parameters:	None
Remarks:	
Returns:	CG LF CR

Data Download	
Syntax:	[DDXX], [DD]
Description	Downloads the contents of the memory buffer.
Parameters:	If none: downloads the content of all the Acquisition Series stored in the memory Otherwise: downloads the content of the acquisition Series number XX stored in the memory
Remarks:	
Returns:	DD5 LF CR OF DD LF CR

2. Safety Information

Safety Conventions

Before using the product described in this manual, you should understand the following conventions:

DANGER	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Do not proceed unless you understand and meet the required conditions.
WARNING	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. Do not proceed unless you understand and meet the required conditions.
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in component damage. Do not proceed unless you understand and meet the required conditions.
IMPORTANT	Refers to information about this product you should not overlook.

Basic Safety Precautions

The following safety instructions must be observed whenever the UMI is operated. Failure to comply with any of these instructions or with any precaution or warning contained in the Universal Multichannel Instrument User Guide is in direct violation of the standards of design, manufacture and intended uses of the Universal Multichannel Instrument. FISO assumes no liability for the customer failure to comply with these safety requirements.

In no case will FISO be liable to the buyer, or to any third parties, for any consequential damage or indirect damage which is caused by product failure, malfunction, or any other problem.

When using any electrical appliance, basic safety precautions should be followed, including the following:

- ▶ Use only the power supply delivered with your Universal Multichannel Instrument
- ▶ Verify that the voltage specifications indicated on the power supply are compatible with the AC voltage and frequency delivered at the power outlet.
- ▶ Do not operate in wet/damp conditions
- ▶ Do not operate in an explosive atmosphere
- ▶ Keep product surfaces clean and dry

WARNING

This equipment must be used as specified or the protection provided by the equipment may be compromised. You must use this product in a normal mode and should not deviate from the written instructions provided.

- ▶ Read all instructions before using this unit.
- ▶ Install or locate this unit only in accordance with the installation instructions.
- ▶ Use this unit only for its intended use as described in this manual.
- ▶ Do not use or store this unit outdoors.

CAUTION

There are no user serviceable parts inside the UMI, other than the ones specified in the *Maintenance* section. Adjusting parts inside the unit can affect the accuracy of the instrument. If you adjust parts, you will need to verify the accuracy of the measurements. Refer servicing of any other parts to FISO qualified technicians.

- ▶ The Universal Multichannel Instrument should not be adjusted or repaired by anyone except FISO qualified technicians.
- ▶ Before using the Universal Multichannel Instrument, you must carefully follow the installation instructions provided in this section. Failure to comply with any of these instructions could result in injury or loss of life.
- ▶ Do not proceed with the installation of the system if one of the items listed is missing.
- ▶ The Universal Multichannel Instrument must be installed in an area at ambient temperature, according to the specifications. Operating the instrument at improper temperatures may cause inaccurate results and possible damage to the instrument.
- ▶ Keep cord away from heated surfaces.
- ▶ Do not use this product near water—for example, in a wet basement, or near a swimming pool or similar locations.
- ▶ Do not immerse unit, cord or plug in water.
- ▶ Do not operate this equipment if it has a damaged cord or plug, if it is not working properly, or if it has been damaged or dropped.

Program# End Time

Syntax:	[SBm X hhmmss]
Description	Sets the end time of a specified acquisition.
Parameters:	hhmmss is the value that sets the Ending Time of the Acquisition Program number X (X= 1 to 5)
Remarks:	
Returns:	SB 1 130000n LF CR

Program# End Date

Syntax:	[SG X yyyyMMdd]
Description	Sets the ending date of a specified program.
Parameters:	yyyyMMdd is the value that sets the Ending Date of the Acquisition Program number X (X= 1 to 5). yyyy is the year (four digits), MM is the month (2 digits) and dd is the day (two digits).
Remarks:	
Returns:	SG 1 20050831 LF CR

Trigger

Syntax:	[TSX]
Description	Triggers an acquisition session on or off.
Parameters:	If X=0: deactivates the Acquisition Session or the Acquisition Programs If X=1: activates the Acquisition Session or the Acquisition Programs
Remarks:	
Returns:	TS1 LF CR

Memory

Clear Buffer

Syntax:	[CB]
Description	Clears the contents of the memory buffer.
Parameters:	None
Remarks:	FISO recommends clearing the memory buffer as soon as the data is downloaded to a computer or are not needed anymore. This releases the memory space for the next acquisition sessions.
Returns:	CB LF CR

Program# Average

Syntax: [SD X mmss.ss]
 Description Sets the averaging time of a specified program.
 Parameters: mmss.ss is the value that sets the Averaging Time of the Acquisition Program number X (X= 1 to 5)
 mm = number of minutes and ss.ss = number of seconds.
 Lowest permitted value: 00m00.05s
 Largest permitted value: 54m36.75s
 Remarks:
 Returns: SD 1 2.0 LF CR

Program# Rate

Syntax: [SC X hmmm.ss]
 Description Sets the acquisition rate of the specified acquisition program.
 Parameters: hmmm.ss is the value that sets the Acquisition Rate of the Acquisition Program number X (X= 1 to 5)
 h= number of hours, mm = number of minutes and ss.ss = number of seconds.
 Lowest permitted value,
 in manual scan mode: 0h00m00.05s
 in automatic scan mode: Scanning Time × Number of active channels
 Largest permitted value: 9h59m59.95s
 Remarks:
 Returns: SC 1 30 LF CR

Program# Show

Syntax: [SEX D], [SEX]
 Description Resets the BIOS software.
 Parameters: X is the Acquisition Program number for which the conditioner returns the program acquisition parameters. The "D" parameters includes the Starting and Ending Date in the returned values (see below)
 Remarks:
 Returns: SE1 D LF CR
 2005-08-30 123000 2005-08-31 130000 30.00
 1.00
 or
 SE1 LF CR
 123000 130000 30.00 1.00

3. Getting Started with the UMI

Unpacking and Inspection

The UMI is packaged in a case designed to give maximum protection during shipment. If the outside of the shipping case is damaged, notify your shipping department immediately. Your shipping department may want to notify the carrier.

If the external shipping case is not damaged, carefully remove and identify all of the components listed below. Contact FISO or your local representative if any of the components are missing. We recommend you save the shipping case for future storage or transportation.

The UMI package should include the following components:

- ▶ UMI unit
- ▶ Power supply and cord
- ▶ RS-232 cable
- ▶ USB cable
- ▶ FISOCommander Software installation CD-ROM
- ▶ User Guide

Installing the UMI

WARNING

Always keep the power cord disconnected during installation of the unit.

Connecting the Interfaces

UMI Power Supply

The UMI Universal Multichannel Instrument comes with its own power supply. Verify that the voltage specifications indicated on the power supply comply with the AC voltage and frequency delivered at the power outlet.

Before proceeding with product setup and use, read the safety information and instructions.

1. Connect the power supply to a power outlet.
2. Connect the power cable to the unit power connector.

A short power-supply cord is provided to reduce the risks resulting from becoming entangled in or tripping over a longer cord. Longer cord sets or extension cords are available and may be used if care is exercised in their use.

If a long cord or extension cord is used:

- ▶ The marked electrical rating of the cord set or extension cord should be at least as great as the electrical rating of the unit.
- ▶ The longer cord should be arranged so that it cannot be pulled on or tripped over accidentally.

Analog Outputs

The analog output of the signal conditioner is adjusted at the factory with default setting values which depends of the type of the sensor. The default value of the Analog Offset is always zero.

The analog outputs have a full scale range of ± 5 Volts with a resolution of approximately 2.44 mV. These outputs are updated at the same rate of the data measurements.

RS-232 Communication Port

The UMI Universal Multichannel Instrument can be remotely controlled via a PC computer, or other devices, with the aid of a RS-232 serial link or a USB link. A set of remote control commands emulates all the functions, and more, available from the front panel of the conditioner.

USB Communication Port

The UMI supports the standard USB 1.1 protocol. This feature is only available when used in conjunction with FISOCOMMANDER version 2.0 or higher. You can cascade several UMI systems using a USB HUB from a single USB port.

IMPORTANT

You must install the software from the FISO software CD before you connect the UMI. Further instructions are provided in the *FISOCOMMANDER Software* section, on page 35.

IMPORTANT

In order to use the USB communication port efficiently, do not use the RS-232 port while using the USB port. This procedure will prevent any risk of unpredictable performance from the UMI system.

Only use with PC equipped with Windows® 2000 or XP version. Any version below that, such as Windows® 98 SE or NT 4.0, is not supported.

Acquisition State	
Syntax:	[BU]
Description	Returns, during an Acquisition Session, the remaining number of data measurements to be acquired until the end of the session.
Parameters:	None
Remarks:	This function is useful for knowing if an Acquisition Session is terminated or not. If 0 value is returned then Acquisition Session is completed; If 1 value is returned then the conditioner is in Wait State.
Returns:	BU LF CR OR BU LF CR 25 LF CR where 25 is equal to the number of remaining data points to be acquired until the end of the Acquisition Session

Program# Start Time	
Syntax:	[SA X hhmmss]
Description	Sets the starting time of the specified acquisition program.
Parameters:	hhmmss is the value that sets the Starting Time of the Acquisition Program number X (X= 1 to 5)
Remarks:	
Returns:	SA 1 123000 LF CR

Program# Start Date	
Syntax:	[SF X yyyyMMdd]
Description	Sets the starting date of the specified program.
Parameters:	yyyyMMdd is the value that sets the Starting Date of the Acquisition Program number X (X= 1 to 5). yyyy is the year (four digits), MM is the month (2 digits) and dd is the day (two digits).
Remarks:	
Returns:	SF 1 20050830 LF CR

Acquisition Mode

Syntax:	[TMX] , [TM]
Description	Sets the unit's acquisition mode.
Parameters:	If none: returns the current Acquisition Mode (0 thru 9) if X = 0: set acquisition in NORMAL mode (default state) if X = 1: set acquisition in SINGLE mode if X = 2: set acquisition in RS232 mode if X = 3: set acquisition in PROGRAM/CONT mode if X = 4: set acquisition in READY mode if X = 6: set acquisition in SCAN mode if X = 7: reserved for internal use if X = 8: set acquisition in RS-232/SCAN mode if X = 9: set acquisition in PROGRAM/DATE mode
Remarks:	
Returns:	TM2 LF CR OF TM LF CR 2 LF CR where 2 is the current Acquisition Mode

Acquisition Rate

Syntax:	[SRhmmss.ss] , [SR]
Description	Sets the unit's acquisition rate.
Parameters:	If none: returns the current value of the Acquisition Rate Otherwise: h m m s s . s s is a positive number that sets the Acquisition Rate of the Acquisition Session. h = number of hours; mm = number of minutes and s s . s s = number of seconds. Lowest permitted value, in manual scan mode: 0h00m00.05s in automatic scan mode: Scanning Time x Number of activated channels Largest permitted value: 9h59m59.95s
Remarks:	
Returns:	SR5.0 LF CR OF SR LF CR 5.0 LF CR where 5.0 is the current Acquisition Rate

Installing the Sensors

CAUTION

Use care in handling fiber optic connectors. Always clean the fiber end prior to insertion into the connector for optimum performance and to avoid measurement errors.

Read the handling precautions in section before installing and using the sensors for the first time:

1. On the unit, determine the channel you want to use for each sensor.
2. Connect the sensors to the input connectors of the unit. To establish a good connection between the unit and the sensor, follow the key way on the sensor connector and make sure to lock it to the rotating unit.
3. Put the sensors in place so their sensitive parts are at the desired position in the location or device under test.

Powering Up the Unit

WARNING

To avoid damage to the unit, make sure that the power fed into the power connector complies with technical specifications power input range. No other voltage level or range is accepted.

The procedure below describes how to connect and power up the UMI:

1. Make sure that power is off when connecting the power supply to the unit.
2. Connect the wall plug-in power supply to a power outlet.
3. Connect the power cable to the power connector.
4. Press the ON/OFF button to power up the unit.

Data Acquisition

Acquisition Average

Syntax: [TCmmss.ss], [TC]
 Description: Sets the unit's averaging time.
 Parameters: If none: returns the current value of the Averaging Time
 Otherwise, mmss.ss is a positive number that sets the Averaging Time.
 mm = number of minutes and ss.ss = number of seconds.
 Lowest permitted value: 00m00.05s
 Largest permitted value: 54m35.95s
 Remarks:
 Returns: TC1.LF CR OR
 TC.LF CR
 1.LF CR where 1.0 is the current Averaging Time

Error Number

Acquisition Duration

Syntax: [DAhhmmss.ss], [DA], [DA0]
 Description: Sets the unit's acquisition duration time.
 Parameters: If none: returns the current value of the Acquisition Duration
 Otherwise: hhmmss.ss is a positive number that set the Acquisition Duration of the Acquisition Session. hh = number of hours; mm = number of minutes and ss.ss = number of seconds.
 Lowest permitted value: 00h00m00.05s
 Largest permitted value: 23h59m59.95s
 Special value: 00h00m00.00 = continuous acquisition until memory buffer is full
 Remarks:
 Returns: DA5.LF CR OR DA.LF CR
 5.00.LF CR where 5.00 is the current Acquisition Duration or
 DA0.LF CR

This page intentionally left blank.

System unit	[#NGA 'YYYYY']
Zero download	[#NZD]
Zero internal	[ZPXXXXXXXX]
Zero physical	[ZOXXXXX.XX]
Miscellaneous	
Date	[SY 'yyyy-MM-dd']
Time	[ST 'hhmm']
System off	[WF]
Hardware version	[VB]
Firmware version	[VR]
Serial number	[SN]
Diagnostic report	[DR]
Error list	[ER]
<p>Note: HT = TAB character LF = LINE FEED character CR = CARRIAGE RETURN character BEL = BELL character Arguments within '' are optional</p>	

Table 3. List of control commands

Note: All commands are case sensitive.

Communication

RS-232 Shutdown	
Syntax:	[RPX] , [RP]
Description	Enables or disables the automatic feature that turns OFF the RS-232 port when not in use.
Parameters:	If none: returns the current state of the conditioner RS-232 port (0 or 1) If X=0: set RS-232 port always ON If X=1: set RS-232 in auto shut-down (default state)
Remarks:	You should normally never disable this automatic feature. You may disable this feature if you continuously receive non-relevant characters when communicating with the conditioner.
Returns:	RP1 LF CR OF RP LF CR 1 LF CR (where 1 is the current state of the RS-232 port)

4. Setting Up the UMI

Three different types of parameters can be configured directly on the unit's front panel interface, in the Menu mode.

- ▶ Acquisition parameters
- ▶ Sensor parameters
- ▶ System parameters

These parameters must be set before starting an acquisition session.

Configuring Acquisition Parameters

The acquisition parameters determine the frequency and the number of data points that will be accumulated during an acquisition session. The calculations are based on the sampling rate, a fixed value, of 20 Hz or 20 data points per second, for a time interval between two data points of 0.05 second. The time interval between two channels is of 0.15 seconds, so the duration of an acquisition cycle is variable and depends on the number of active channels.

The acquisition parameters include:

- ▶ The acquisition rate: the frequency at which measurements will be performed for a given channel.
- ▶ The averaging time: the time interval over which the average measurement is calculated.
- ▶ The duration: the time over which all the measurements will be performed.
- ▶ Clear memory buffer: clears the contents of the memory buffer.

Deleting the Memory Buffer

FISO recommends clearing the contents of the memory buffer once the measurements from the last session have been downloaded. This ensures that the full capacity of the memory buffer is available for the next acquisition sessions.

To delete the contents of the memory buffer:

1. Push the ESC/MENU button to access the Menu mode.
2. Select the ACQ menu (F1).
3. Select the CLBF sub-menu (F3).

To return one step back in the menu, press ESC/MENU.

Setting the Averaging Time

The averaging time is the time interval, equal to or greater than the sampling rate of 0.05 second, over which an average value will be calculated. The Averaging Time is the refresh rate for the displayed data.

The minimum value for the averaging time is 0.05 second, equal to the sampling rate, and the maximum value can be as high as 54 minutes, 35.95 seconds.

To set the averaging time:

1. Push the **ESC/MENU** button to access the Menu mode.
2. Select the **ACQ** menu (F1).
3. Select the **RATE** sub-menu (F1).
4. Press **ENTR** (F4) to go to the averaging time setup screen.
5. Use the arrow-equivalent buttons **↑↑↑** (F1), **↓↓↓** (F2), and **→→→** (F3) to set the averaging time.
6. Press **ENTR** to save the new setting or **ESC** to quit without saving.

To return one step back in the menu after saving the parameter, press **ESC/MENU**.

Setting the Acquisition Rate

The acquisition rate is the time interval, equal to or greater than the averaging time, between two acquisitions for any given channel. In other words, the acquisition rate represents the time to go around a complete channel sequence or cycle and takes into account the switching time between two channels.

The minimum value is equal to the selected averaging time and the maximum value you can enter can be as high as nine hours, 59 minutes and 59.95 seconds.

If the user tries to set an acquisition rate smaller than the averaging time, it will be automatically reset (at the start of the acquisition session) to a value equal to the averaging time.

To specify an acquisition rate:

1. Push the **ESC/MENU** button to access the Menu mode.
2. Select the **ACQ** menu (F1).
3. Select the **RATE** sub-menu (F1).
4. Use the arrow-equivalent buttons **↑↑↑** (F1), **↓↓↓** (F2), and **→→→** (F3) to set the acquisition rate.
5. Press **ENTR** to save the new setting or **ESC** to quit without saving.

Pressing **ENTR** (F4) opens the averaging time setup interface. To return one step back in the menu after saving the parameter, press **ESC/MENU**.

Setting the Duration of the Acquisition

The number of acquisition points for any channel, and as a consequence, the total number of data points, is determined when configuring the acquisition duration. An acquisition session terminates when the elapsed time since the beginning of the session becomes equal to the acquisition duration parameter.

Note: The memory buffer stores close to 50000 data points. That may limit the maximum value of the acquisition duration. To use the full capacity of the memory, simply set the acquisition duration to 00h00m00.0. In that case, the acquisition session will terminate when the memory buffer is full.

The minimum input value is 00h00m00.00, for continuous acquisition until the memory buffer is full. The maximum duration is 23 hours, 59 minutes and 59.95 seconds or until the memory buffer is full (close to 50000 data measurements).

The possible cause and remedies for a **NO SIGNAL** error message are:

- ▶ No sensor connected to the conditioner or improper connection. Verify connections or clean sensor, cable, and/or conditioner input connectors.
- ▶ Fiber optic cable is longer than the maximum length permitted. Use cable with shorter length.
- ▶ Fiber optic cable or sensor is damaged. Replace damaged part.
- ▶ Conditioner light source is defective. Verify light condition with **DIAGNOSTIC REPORT** command.
- ▶ Conditioner is defective. Contact factory.

List of Remote Control Commands

Command name	Syntax
Communication	
RS232 shutdown	[RP'X']
Data Acquisition	
Acquisition average	[TC'mmss.ss']
Acquisition duration	[DA'hhmmss.ss']
Acquisition mode	[TM'X']
Acquisition rate	[SR'hhmmss.ss']
Acquisition state	[BU]
Program# start time	[SA X hhmmss]
Program# start date	[SF X YYYYMMDD]
Program# average	[SD X mmss.ss]
Program# rate	[SC X hhmmss.ss]
Program# show	[SEX 'D']
Program# end time	[SB X hhmmss]
Program# end date	[SG X YYYYMMDD]
Trigger	[TS'X']
Memory	
Clear buffer	[CB]
System reset	[RF]
Clear gage list	[CG]
Data download	[DD'XX']
List tag	[LT'X']
Analog output	
Analog scale	[#NAV'XXXXX.XX']
Analog zero	[#NAZ'XXXXX.XX']
Channel select	
Channel select	[CS'Z']
Sensor	
Gauge add	[ASXXXXXXXX] or [AS YYYY XXXXXX]
Gauge erase	[RSXXXXXXXX] or [RS YYYY]
Gauge list	[LG]
Gauge select	[#NGA'XXXXXXXX'] or

Error Numbers

The following error messages are reported by sending through the RS-232 serial link a specific error number depending of the problem.

Error #	Meaning	Remark or example
01	MEMORY FULL	No more memory space for data acquisition or for adding a Gauge Factor
02	SYSTEM STOPPED	Command cannot be executed because the conditioner is not reading the sensor.
03	NO SIGNAL	Command cannot be executed because of no signal condition
04	BUFFER OVERRUN	A timeout error occur on the output RS232 port causing the buffer to be cleared or direct acquisition data lost
10	INVALID PARAMETER	Command is send with an invalid parameter
11	COMMAND DENIED	Command cannot be executed because the conditioner is in Wait State, is making a diagnosis, logging reading, etc.
12	ITEM NOT FOUND	Trying to erase or select a non existing Gauge Factor or Gauge Name
13	INVALID COMMAND	
14	MEMORY ERROR	

Diagnostic messages

When the conditioner detects a defective or noisy measurement condition during an Acquisition Session, all the data in the Acquisition Series acquired during this condition are replaced by the error message NO SIGNAL. Note that the conditioner does not stop the Acquisition Session if that condition occurs. The following example shows the content of an Acquisition Series where a defective or noisy measurement condition occurred at the end of the Acquisition Session.

```

1 HT 1.0 HT 0.5 HT 2005-05-23 HT 10h30 HT M LF CR
1 LF CR
TEMP1 LF CR
4229223 LF CR
26.60 LF CR
26.65 LF CR
26.60 LF CR
26.60 LF CR
26.65 LF CR
NO SIGNAL LF CR
NO SIGNAL LF CR
NO SIGNAL LF CR
    
```

To set the duration of an acquisition:

1. Push the ESC/MENU button to access the Menu mode.
2. Select the ACQ menu (F1).
3. Select the DURA sub-menu (F2).
4. Use the arrow-equivalent buttons ↑↑↑ (F1), ↓↓↓ (F2), and →→→ (F3) to set the acquisition duration.

The screen will display the number of data measurements (automatically calculated) that will be made and saved during the acquisition session. The memory buffer can contain close to 50000 data measurements.

5. Press ENTR to save the new setting or ESC to quit without saving.

To return one step back in the menu after saving the parameter, press ESC/MENU.

Configuring Sensor Parameters

Sensor parameter configuration stores in the unit's internal memory all the sensor parameters required for any acquisition. These parameters include:

- ▶ Adding a sensor
- ▶ Removing a sensor
- ▶ Assigning a sensor to a channel

Adding a Gauge Factor to the Gauge List

The gauge factor is a seven-digit number that is printed on a label close to the fiber-optic connector of the sensor. This number provides the UMI Universal Multichannel Instrument with the information related to the sensor (type, sensitivity, etc).

The Gauge List contains a default Gauge Factor that is the number 0001000 (or 1000). The Gauge Name associated to this factor is FISO. This factor is permanently saved into the conditioner memory and cannot be erased.

Prior to using a sensor, its Gauge Factor must first be saved into the non-volatile RAM memory of the conditioner. A new gauge factor can be added to the gauge list as follows:

1. Push the ESC/MENU button to access the Menu mode.
2. Push the function button under GAGE (F2).
3. Push the function button under ADD (F1).
4. Use the arrow-equivalent buttons ↑↑↑ (F1), ↓↓↓ (F2), and →→→ (F3) to enter a new gauge factor.
5. Press ENTR (F4) to proceed with the following step or press ESC/MENU to cancel and return one step back in the menu.

Pressing ENTR will bring you to the sensor name configuration interface.

Entering the Gauge Name and Saving the Gauge Factor

The next step before saving the sensor name and gauge factor is to assign a name to the recently entered gauge factor. The gauge name is a five-character string. To assign a name to a gauge factor:

1. Once you have entered a new gauge factor, press **ENTR (F4)**.
2. The conditioner prompts you to enter a gauge name to identify the corresponding sensor. You may enter a name with up to five alphanumeric characters: {0-9}; {A-Z}; {;};.
3. Use the arrow-equivalent buttons **↑↑↑ (F1)**, **↓↓↓ (F2)**, and **→→→ (F3)** to enter a gauge name.

OR

Press **ENTR** to save the gauge factor with a default name automatically assigned by the conditioner.

4. Press **ENTR (F4)** to save the entries.

Note: If you exit the gauge name menu with the **ESC/MENU** button, your new gauge factor will not be added to the gauge list.

Repeat the preceding steps for all the sensors that will be used with your UMI Universal Multichannel Instrument in order to populate the gauge list. This list can contain up to 50 different gauge factors.

Removing a Gauge Factor from the Gauge List

To erase a gauge factor from the gauge list, proceed as follows:

1. Push the **ESC/MENU** button to access the Menu mode.
2. Push the function button under **GAGE (F2)**.
3. Push the function button under **REMV (F2)**.
4. Use the arrow-equivalent buttons **↑↑↑ (F1)**, **↓↓↓ (F2)**, and **→→→ (F3)** to scroll the list and select the gauge factor to erase.
5. Press **ENTR (F4)** to confirm your selection or press **ESC/MENU** to cancel and return one step back in the menu.

Setting an Offset Value to a Sensor

The sensor's readings can be offset or shifted to a different value from the standard setting. Offset values can be assigned to a sensor using two different formats. Both procedures are mutually exclusive:

- ▶ **Internal units:** a value specific to the sensor, in nm, equivalent to its zero value. Setting an offset value using the internal units shifts the direct reading in nm before applying the conversion factor into physical units.
- ▶ **Physical units:** the measurement value, expressed in engineering units. The selected offset value is applied after the internal conversion of the reading into physical units.

You must first select a measurement channel before activating the calibration functions. Use the **Channel Select** buttons to select one of the measurement channels.

C. RS-232 Commands for the UMI

Convention

The following table gives a description of the symbols for special characters that will be used in this appendix.

Symbol	Corresponding ASCII character	Description
LF	0x0a	line-feed
CR	0x0d	carriage return
BEL	0x07	bell
HT	0x09	tab
	0x20	space

Table 2. Special characters

Error String Syntax

The error message is always sent in the following way:

```
BEL ERR XX LF CR
```

where BEL is the BELL character and XX is the error number.

Ex.: The user sent the following **GAUGE SELECT** command: [#2GA9999999]. This Gauge Factor is not in the Gauge List so the conditioner returns the following:

```
#2GA9999999 LF CR
```

```
BEL ERR 12 LF CR
```

ERR 12 message means **ITEM NOT FOUND**. The possible errors that can occur while using the Remote Control Commands are listed in the following section.

Default settings of the ± 5 Volts analog output								
Sensor type	Analog Scale Factor (SCALE)		Analog Offset (ZERO)		Range		Resolution	
	SI	Imperial	SI	Imperial	SI	Imperial	SI	Imperial
Temperature	10 mV/°C	10 mV/°F	0 °C	0 °F	± 500 °C	± 500 °F	0.24 °C	0.24 °F
Strain	2 mV/με	2 mV/με	0 με	0 με	± 2500 με	± 2500 με	1.22 με	1.22 με
Temperature	10 mV/°C	10 mV/°F	0 °C	0 °F	± 500 °C	± 500 °F	0.24 °C	0.24 °F
Pressure	75 mV/bar	5 mV/psi	0 bar	0 psi	± 66.66 bar	± 1000 psi	0.032bar	0.48 psi
Load	2 mV/kg	1 mV/lb	0 kg	0 lb	± 2500 kg	± 5000 lb	1.22 kg	2.44 lb
Displacement	500 mV/mm	10000 mV/in	0 mm	0 in	± 10 mm	± 0.5 in	4.88 μm	0.24 μ-in
Refractive	10000 mV/RI	10000 mV/RI	1 RI	1 RI	0.5 RI	0.5 RI	0.00024 RI	0.00024 RI
Internal unit (nm)	1 mV/nm		0 nm		± 5000 nm		2.44 nm	

Default value (Voltage output)

#gauge	Type of gauge	SI	Imperial
0	No type gauge	1mv/nanometer	1mv/nanometer
4 and 9	Temperature gauge	10mV/°C	10mV/°F

To offset the readings of a sensor with a value given in internal units:

1. Push the ESC/MENU button to access the Menu mode.
2. Select the GAGE menu (F2).
3. Press the CAL button (F3).
4. Use the Channel Select buttons to select one of the measurement channels.
5. Press the button under OFFS (F2).
6. Select INTR (F1) to set the offset in internal units.
7. Use the arrow-equivalent buttons ↑↑↑ (F1), ↓↓↓ (F2), and →→→ (F3) to enter the offset value.
8. Press ENTR to save your entry or ESC/MENU to cancel and return one step back in the menu.

Note: The offset value displayed when entering this menu is the current gauge zero value.

To offset the readings of the sensor with a value given in physical (engineering) units:

1. Push the ESC/MENU button to access the Menu mode.
2. Select the GAGE menu (F2).
3. Press the CAL button (F3).
4. Use the Channel Select buttons to select one of the measurement channels.
5. Press the button under OFFS (F2).
6. Use the arrow-equivalent buttons ↑↑↑ (F1), ↓↓↓ (F2), and →→→ (F3) to enter the offset value.
7. Press ENTR to save your entry or ESC/MENU to cancel and return one step back in the menu.

Once the offset is completed, the conditioner displays the new gauge zero value and then returns to the Reading mode.

Performing a Zero Adjustment of the Sensor

The zero adjustment, performed with the NULL function, forces the reading of the sensor to be equal to zero immediately after it is activated. The zero adjustment of the sensor is required when using a strain gauge, force & load, refractive index or a pressure sensor for the first time.

The zero adjustment function (NULL) is automatically disabled in case of a temperature sensor.

To perform a sensor zero adjustment:

1. Push the ESC/MENU button to access the Menu mode.
2. Select the GAGE menu (F2).
3. Press the CAL button (F3).
4. Use the Channel Select buttons to select one of the measurement channels.
5. Press the button under NULL (F3) to make a zero adjustment of the sensor connected to the selected channel.

Once the zero adjustment is completed, the conditioner displays during a few seconds the new value of the gauge zero and then returns to the Reading mode.

Note: The value of the Gauge Zero value will be associated to (and saved with) the corresponding Gauge Factor assigned to that channel.

Configuring System Parameters

System parameters include those that are not directly related to an acquisition but that affect the way acquisitions are stored, transmitted, and displayed in general. Some of the parameters related to system performance are:

- ▶ Analog output parameters
- ▶ Displaying diagnostic information
- ▶ Other general parameters

Configuring Analog Output Parameters

Analog output parameters include:

- ▶ The scale factor
- ▶ The offset value

The scale factor is provided in mV per physical unit. The physical unit is determined by the gauge factor of each sensor type. This value is configured with the **SCALE** function.

The offset is the value of the data measurement at which the analog output voltage is zero. This value is configured with the **ZERO** function.

The **SCALE** and **ZERO** parameters allow the user to adjust an analog output so its ± 5 V range fits with the full scale of the corresponding measurement sensor.

The analog output of the signal conditioner is adjusted at the factory with default setting values which depend upon the sensor type. The default value of the analog offset is always zero. To restore the analog scale factor and the analog offset to their default value, set the **SCALE** parameter to zero.

The table on page 70, provides the analog output default setting values for different type of sensors along with the corresponding range and resolution.

Note: You must first select a measurement channel before activating the analog output functions.

To set an offset on the analog output:

1. Push the **ESC/MENU** button to access the **Menu** mode.
2. Select the **SYST** menu (F3).
3. Press the **ANLG** button (F1).
4. Use the **Channel Select** buttons to select one of the measurement channels.
5. Press the button under **ZERO** (F1).
6. Use the arrow-equivalent buttons $\uparrow\uparrow$ (F1), $\downarrow\downarrow$ (F2), and $\rightarrow\rightarrow$ (F3) to enter an offset value.
7. Press **ENTR** to save your entry or **ESC/MENU** to cancel and return one step back in the menu.

Pressing **ENTR** will bring you to the scale factor configuration interface.

To set the analog scale factor:

1. Push the **ESC/MENU** button to access the **Menu** mode.
2. Select the **SYST** menu (F3).

B. Analog Outputs

For each output, the user has control of both the Analog Scale Factor (mV per Physical Unit) and the Analog Offset (the value of the data measurement M at which the analog output voltage is zero). The analog output voltage is proportional to the data measurement obtained from the sensor. It is given by the following equations:

$$V_{out} = SCALE (M - ZERO) \text{ (Volts)}$$

where: $SCALE$ is the Analog Scale Factor in mV/Physical Units

M is the data measurement displayed by the conditioner

$ZERO$ is the Analog Offset

The analog outputs provide a voltage within a range of ± 5 Volts. The ratio between the voltage variation measured at the output and the corresponding variation of the physical parameters measured by the sensor is given by the Analog Scale Factor. This factor, expressed in Volts per physical unit (ex: 10 mV/°C), is displayed when entering into the Analog Output Setup sub-menu.

The linear relationship between the analog voltage output and the measured value of the sensor depends on the type of the sensor and its own measuring range. Both the Analog Offset (given by the **ZERO** parameter) and the Analog Scale Factor (given by the **SCALE** parameter) of the analog output can be adjusted by the user or set to their defaults value. The **SCALE** and **ZERO** parameters allow the user to adjust the analog output so its ± 5 V range fits with the full scale of the sensor measurements. These setting parameters are adjusted with the aid of the Analog Output Setup sub-menu functions.

With the aid of the functions available in the Analog Output Setup sub-menu the user can adjust independently for each analog output, the values of the **SCALE** (Analog Scale Factor) and **ZERO** (Analog Offset) parameters so to cover the entire range of the instrument. However, for highest resolution, use the highest possible Analog Scale Factor. The voltage range of the output can be determined by using the above equation and substituting in the highest measured value of M , and lowest measured value of M .

Assigning another Gauge Factor from the Gauge List (i.e. selecting another sensor) will restore the Analog Scale Factor and the Analog Offset to their default values only if this sensor is a different type than the previously assigned one. In other words, selecting another sensor but of same type, will not change the analog output settings.

3. Press the **ANLG** button (F1).
4. Use the **Channel Select** buttons to select one of the measurement channels.
5. Press the button under **ZERO** (F1).
6. Use the arrow-equivalent buttons $\uparrow\uparrow\uparrow$ (F1), $\downarrow\downarrow\downarrow$ (F2), and $\rightarrow\rightarrow\rightarrow$ (F3) to enter a zero value.
7. Press **ENTR** to save your entry or **ESC/MENU** to cancel and return one step back in the menu.

Note: For highest resolution, FISO recommends using the highest possible analog scale factor.

Assigning another gauge factor from the gauge list to a measurement channel (i.e. selecting another sensor) will not change the analog output settings, unless the sensor is of a different type than the previously one assigned.

Displaying Diagnostic Information

With the aid of the diagnostic function, you can obtain useful information for evaluating the performance of both the conditioner and the sensors. The diagnostic information includes:

- ▶ Light source intensity (in Volts)
- ▶ Signal intensity (in Volts)
- ▶ Memory in use (%)

To display the diagnostic information:

1. Push the **ESC/MENU** button to access the **Menu** mode.
2. Select the **SYST** menu (F3).
3. Press the **DIAG** button (F2).
4. Use the **Channel Select** buttons to select a measurement channel.
5. Use the arrow-equivalent buttons $\uparrow\uparrow\uparrow$ (F1), $\downarrow\downarrow\downarrow$ (F2), and $\rightarrow\rightarrow\rightarrow$ (F3) to scroll through the list of diagnostic parameters: LIGHT, MEMORY, and SIGNAL.
6. Use the **REFR** (F4) button to refresh the actual value of the selected parameters.

By comparing the diagnostic information with the following evaluation table, the user can make a diagnosis of its setup measurement.

Parameter	Defective	Poor	Normal
Light	< 0.4 V	0.4 - 1.0 V	> 1.0 V
Signal	< 0.3 V	0.3 - 1.5 V	> 1.5 V
Memory	0 - 100 % of memory in use		

Resetting to Factory Default Parameters

To reset the conditioner and restore all the parameters to the default (factory) settings:

1. Push the **ESC/MENU** button to access the **Menu** mode.
2. Push the function button under **SYST** (F3).
3. Push the function button under **MORE** (F3).
4. Select **RST** (F1) to reset the unit to its factory default parameters.
5. Press **ENTR** (F4) to confirm or **ESC/MENU** to cancel and return one step back in the menu.

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IMPORTANT

Resetting the conditioner will erase the content of the memory buffer and the RAM memory. The Gauge Factors, Gauge Names and associated Gauge Zeros as well as the data acquisitions will be lost.

Setting the Time of the UMI Real Time Clock

The UMI uses an internal real-time clock to calculate acquisition times and parameters. The internal real-time clock of the UMI can be set as follows:

1. Push the ESC/MENU button to access the **Menu** mode.
2. Push the function button under **SYST** (F3).
3. Push the function button under **MORE** (F3).
4. Push the function button under **TIME** (F2).
5. Use the arrow-equivalent buttons ↑↑↑ (F1), ↓↓↓ (F2), and →→→ (F3) to set the time.
6. Press **ENTR** (F4) to save your entry or press **ESC/MENU** to cancel and return one step back in the menu.

Pressing **ENTR** will bring you to the date configuration interface.

Setting the Date of the Conditioner Real Time Clock

The date of the internal real-time clock of the UMI can be set as follows:

1. Push the ESC/MENU button to access the **Menu** mode.
2. Push the function button under **SYST** (F3).
3. Push the function button under **MORE** (F3).
4. Push the function button under **TIME** (F2).
5. Select **ENTR** to access the date configuration interface.
6. Use the arrow-equivalent buttons ↑↑↑ (F1), ↓↓↓ (F2), and →→→ (F3) to set the date (yyyy-mm-dd).
7. Press **ENTR** (F4) to save your entry or press **ESC/MENU** to cancel and return one step back in the menu.

Selecting the Units of Measurements

The UMI system can display the results using either the International (SI) or the Imperial System (IM) of units. When set to International System of Units (SI), the conditioner uses the following units: °C for temperature, bar for the pressure, kg for the force or load, mm for the displacement. The respective Imperial Units are: °F, psi, lb, in. The strain unit is the microstrain, $\mu\epsilon$, that is 10⁻⁶ meter/meter or 10⁻⁶ inch/inch.

To select the units of measurement:

1. Push the ESC/MENU button to access the **Menu** mode.
2. Push the function button under **SYST** (F3).
3. Push the function button under **MORE** (F3).
4. Push the function button under **UNIT** (F3).
5. Press **F3** to toggle between the two systems of units.

A. Technical Specifications

Number of channels:	4 or 8
Compatibility:	Compatible with all of FISO's line of fiber-optic sensors
Sampling rate:	20 Hz
Switching time:	150 ms (in scan mode: time to switch between two channels)
Averaging:	1 to 500 samples
Precision:	0.025% of full scale
Resolution:	0.01% of full scale
Dynamic range:	15 000 : 1
Display:	4 lines by 20 characters Vacuum Fluorescent Display
Operating mode:	Direct (front panel) or through RS-232 (software included)
Data logging:	50 000 samples; Programmable data logger
Analog outputs:	± 5 Volts (scale and offset software adjustable)
Communication:	RS-232 and USB 1.1
Diagnostic:	Yes
Upgradability – firmware:	Flash ROM Upgradable
Lamp life	~ 40 000 hours of continuous use (MTBF)
Weight:	2.2 kg
Enclosure material:	Zinc-plated steel and PVC
Enclosure dimensions (WxDxH):	191 X 228 X 111 mm
Power Requirements:	10 to 20 Volts (5 Watts); wall-plug adapter included
Operating temperature:	-20 °C to 40 °C

Table 1. Product specifications

Service and Repairs

FISO commits to providing product service and repair for five years following the date of purchase.

To send any equipment for service or repair:

1. Call one of FISO's authorized service centers. Support personnel will determine if the equipment requires service, repair, or calibration.
2. If equipment must be returned to FISO or an authorized service center, support personnel will issue a Return Merchandise Authorization (RMA) number, a detailed instruction sheet, and provide an address for return.
3. If the unit has an internal storage device, perform a data backup before sending the unit for repairs.
4. Pack the equipment in its original shipping material. Be sure to include a statement or report fully detailing the defect and the conditions under which it was observed.
5. Return the equipment, prepaid, to the address given to you by support personnel. Be sure to write the RMA number on the shipping slip. FISO will refuse and return any package that does not bear an RMA number.

Note: A test setup fee will apply to any returned unit that, after test, is found to meet the applicable specifications. Likewise, a fee will apply if the only trouble found is related to dirty connectors.

After repair, the equipment will be returned with a repair report. If the equipment is not under warranty, the customer will be invoiced for the cost appearing on this report. Return-to-customer shipping costs will be paid by FISO for equipment under warranty. Shipping insurance is at the customer's expense.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- ▶ Pack the unit in its original packing material when shipping.
- ▶ Avoid high humidity or large temperature fluctuations.
- ▶ Keep the unit out of direct sunlight.
- ▶ Avoid unnecessary shock and vibration.

FISO Service Centers Worldwide

If your product requires servicing, contact the authorized service center nearest you.

FISO Technologies Inc 500, St-Jean-Baptiste Avenue, Suite 195 Québec (Québec) CANADA G2E 5R9	Telephone: Fax: E-mail: URL:	+ 418-688-8065 + 418-688-8067 sales@fiso.com support@fiso.com http://www.fiso.com
--	---------------------------------------	---

5. Preparing an Acquisition Session

Once the unit's parameters have been configured, you may proceed with the final adjustments to perform an acquisition session.

The following steps are required prior to an acquisition session:

1. Configure the unit as explained in the previous chapter.
2. Connect the fiber-optic sensors to the UMI. Detailed instructions are available on page 15.
3. Assign the gauge factors to the measurement channels as explained in the following section.
4. Select the scanning mode.
5. Perform a zero adjustment of the sensors. Go directly to the next step if you are using temperature sensors only.
6. Begin data acquisition.

The UMI Universal Multichannel Instrument is now ready to display the data measurements taken with the fiber-optic sensors. For this purpose, the screen of the UMI must be set to the Reading mode. Press the ESC/MENU button as many times as necessary to go back to the Reading mode.

The data measurements are available through the analog outputs, the USB port, and the RS-232 serial output as well.

Assigning Gauge Factors to Measurement Channels

To use a sensor with the UMI and before proceeding with an acquisition, you must first assign a gauge factor to the corresponding measurement channel, that is, the one to which the sensor is connected.

To assign a gauge factor to a measurement channel:

1. From the Reading mode, press F2 to display the **Gauge Factor Assignment** menu.
2. Select a measurement channel with the **Channel Select** buttons.
3. Press the F2 or F3 buttons, many times as necessary, to scroll through the Gauge List and select a Gauge Factor. Your selection must correspond to the Gauge Factor of the sensor actually connected to the measurement channel.
4. Repeat the preceding steps for all the measurement channels that will be used.
5. Select the **OFF** option of the Gauge List to deactivate the unused channels.
6. When finished, press ESC to return to the Reading Level display mode.

FISO strongly recommends deactivating all unused channels.

Selecting a Scanning Mode

For any acquisition, two scanning modes are available:

- ▶ Automatic scan: the UMI Universal Multichannel Instrument performs measurements by sequentially switching through all the active channels and the display is refreshed at a rate given by the acquisition rate. The fastest acquisition rate in Automatic scan mode is 0.15 s.
- ▶ Manual scan: the UMI Universal Multichannel Instrument performs measurements on one selected channel only and the display is refreshed at a rate given by the acquisition rate or once every 0.5 s, whichever is the slowest rate. The fastest acquisition rate available in Manual scan mode is of 20 Hz or 0.05 s.

To select a scanning mode:

1. From the Reading mode, press **F4** to toggle between the two scanning modes.
2. In manual scan mode, use the Channel Select buttons to select the desired measurement channel.

It is strongly recommended to deactivate all unused channels to minimize the time required for a complete automatic scan of the measurement channels.

Starting and Stopping an Acquisition

Once the unit is configured, the gauge factors are assigned to their respective channel, the sensors have been connected zeroed, and the scanning mode has been selected, you may proceed with the acquisition, as follows:

1. Press once on **F1** to start an acquisition.
2. Press **F1** again to stop the acquisition.

14. Warranty

General Information

FISO Technologies (FISO) warrants this equipment against defects in material and workmanship for a period of one year and its fiber optic transducers and sensors for ninety (90) days from the date of original shipment. FISO also warrants that this equipment will meet applicable specifications under normal use.

During the warranty period, FISO will, at its discretion, repair, replace, or issue credit for any defective product, as well as recalibrate the product free of charge should the equipment need to be repaired or if the original calibration is erroneous.

IMPORTANT

The warranty can become null and void if:

- ▶ the equipment has been tampered with, repaired, or worked upon by unauthorized individuals or non-FISO personnel.
- ▶ the warranty sticker has been removed.
- ▶ case screws, other than those specified in this manual, have been removed.
- ▶ the case has been opened, other than as explained in this manual.
- ▶ the equipment serial number has been altered, erased, or removed.
- ▶ the equipment has been misused, neglected, or damaged by accident.

Liability

FISO shall not be liable for damages resulting from the use of the purchased product, nor shall be responsible for any failure in the performance of other items to which the purchased product is connected or the operation of any system of which the purchased product may be a part.

FISO shall not be liable for damages resulting from improper usage or unauthorized modification of the product, its accompanying accessories and software.

Exclusions

FISO reserves the right to make changes in the design or construction of any of its products at any time without incurring obligation to make any changes whatsoever on units purchased. Accessories, including but not limited to fuses, pilot lamps, and batteries used with FISO products are not covered by this warranty.

Certification

FISO certifies that this equipment has met its published specifications at the time of shipment from the factory.

6. Data Logging

The UMI Universal Multichannel Instrument has an integrated data logger (memory buffer) for real-time measurement data storage. The process of making a data acquisition and data storage in memory is called an acquisition session.

The duration of the acquisition session is adjusted with the acquisition duration parameter. Normally, an acquisition session terminates when the elapsed time since the beginning of the session reaches the defined acquisition duration time.

The memory buffer stores close to 50000 measurements. As explained before, this capacity may limit the acquisition duration time. To use the full capacity of the memory, set the acquisition duration to 00h00m00.0, and the acquisition session will terminate only when the memory buffer is full.

Each time an acquisition session begins a new data file is created and opened in the memory of the UMI Universal Multichannel Instrument. The content of this file includes the data measurements and other useful information of the acquisition. The file (tab-delimited text file) is called the acquisition series and can be downloaded to a computer, either through remote control commands or with the FISOC Commander software, described on page 35.

The acquisition series file includes a four-line header and the data measurements taken during the duration of the acquisition session.

The first line of the file header contains:

- ▶ The acquisition series number
- ▶ The value of the acquisition rate
- ▶ The value of the averaging time
- ▶ The date of the acquisition session
- ▶ The time at which the acquisition session was started
- ▶ The system of units used (M for metric, I, for imperial)

Note: The acquisition series number indicates the chronological order of the acquisition session, i.e. 1 is the first acquisition session, 2 is the second acquisition session, etc.

The second line of the file header indicates the channel numbers from which the measurement data was taken. Each channel number defines a row header.

The third line of the file header contains a gauge name, under their corresponding channel.

The fourth line of the file header contains the gauge factor for each sensor.

The file header information is then followed by the measurement data, each line of data corresponding to a scanning cycle (if in automatic scan mode).

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The following table schematizes an acquisition file for a seven-cycle acquisition, performed in automatic scan mode:

3	HT	0.6	HT	.05	HT	2000-10-25	17h35	HT	M	CR	LF
1	HT	2	HT	3	HT	4					CR LF
Temp1	HT	Temp2	HT	Press1	HT	Press2					CR LF
4755823	HT	4852321	HT	6024195	HT	6025592					CR LF
152.1	HT	148.9	HT	54.96	HT	55.10					CR LF
152.3	HT	148.8	HT	54.96	HT	55.14					CR LF
152.5	HT	148.6	HT	54.92	HT	55.10					CR LF
152.6	HT	148.8	HT	54.94	HT	55.16					CR LF
152.8	HT	148.9	HT	54.94	HT	55.10					CR LF
153.9	HT	148.7	HT	54.92	HT	55.14					CR LF
154.0	HT	148.5	HT	54.94	HT	55.12					CR LF

Technical Support Group

FISO Technologies Inc. 500, St-Jean-Baptiste Avenue, Suite 195 Québec (Québec) CANADA G2E 5R9	Telephone: Fax: E-mail: URL:	+ 418-688-8065 + 418-688-8067 support@fiso.com http://www.fiso.com
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To accelerate the process, please have information such as the name and the serial number of your product as well as a description of your problem close at hand.

Transportation

Maintain a temperature range within specifications when transporting the unit. Transportation damage can occur from improper handling. The following steps are recommended to minimize the possibility of damage:

- ▶ Pack the unit in its original packing material when shipping.
- ▶ Avoid high humidity or large temperature fluctuations.
- ▶ Keep the unit out of direct sunlight.
- ▶ Avoid unnecessary shock and vibration.

Program starts in XXhXXmXXs	INFORMATION When the delayed Acquisition Session is activated, the conditioner goes in Low Power State until the activation of the Acquisition Programs at the preset date and time.	This message appears only when a delayed Acquisition Session is activated.
-----------------------------	---	--

If your problem is not listed in this table, you can reset the unit's parameters to factory defaults.

Hardware Reset Button

This button is used to debug the UMI Universal Multichannel Instrument firmware. The UMI screen should blink and the firmware should run as normal.

Software Reset

The user can reset the UMI to its factory settings by using the RST function of the More sub-menu. If for whatever reasons, the RAM memory contents has been damaged or lost, the message **SYSTEM RESET** will be displayed for a few seconds and the conditioner will be reinitialized to its default factory settings. When this message appears, all the Gauge Factor and their associated Gauge Zero are lost.

Low Power State

When it goes in low power state, the UMI Universal Multichannel Instrument keeps the minimum hardware ON for remote communication, and turns OFF all other non-necessary hardware (ex. Lamps). The user still has access to the Remote Control Commands such as, downloading data or programming the conditioner. This state means that one of the UMI Acquisition Modes is activated and still active (for example an Acquisition Program is to be started at a set date and time), but no data measurements is being taken nor is being planned for at least the next 2m30s. The lower power state will be set automatically by the system.

Contacting the Technical Support Group

To obtain after-sales service or technical support for this product, contact FISO at one of the following numbers. Technical Support Group is available from Monday to Friday, 8:00 a.m. to 5:00 p.m. (Eastern Time in North America).

7. Remotely Controlling the UMI

The remote controls commands allow the user to emulate from a PC computer all the control panel functions of the conditioner and more. With the aid of these commands, you can create your own remote control software.

All the remote control commands are made of ASCII type characters, which can be sent to through the RS-232 link by using simple communication software such as HyperTerminal on Windows®. These commands can also be used with programs made with VISUAL BASIC, VISUAL C/C++ compilers, or with third party software such as LAB-VIEW® or LAB-WINDOWS®.

Configuring the RS-232 Connection

The RS-232 connection to the unit is made with the DB-9 connector located on its back panel. Use a standard RS-232 extension cable (all wires straight through) to connect to the unit. Do not use a null modem cable or adapter.

The serial link must be configured as follows:

BAUD RATE:	9600
PARITY:	NONE
DATA BITS:	8
STOP BIT:	1

The conditioner makes use of hardware flow control also called Handshaking or RTS/CTS control. When activated, the Request To Send (RTS) line of the serial link informs the conditioner that the receiver of the host computer or controlling system is ready to exchange data. The Clear To Send (CTS) line indicates, when activated, that the conditioner is ready to exchange data. The RTS line corresponds to PIN 7 and the CTS corresponds to PIN 8 of the DB-9 connector.

Using Remote Control Commands

All remote control commands begin with a two-capital letter identifier referred to as the prefix of that command. The commands without arguments are composed solely of their prefix.

All commands must start with a left bracket ([) and end with a right bracket (]) to be interpreted correctly. These two characters are the delimiters of a command. Everything typed inside the brackets is considered part of the command. A command is not interpreted by the conditioner until the right delimiter is encountered in the incoming flow of characters.

Everything between the brackets is sent back over the serial link as soon as the right delimiter is encountered. In other words, all the commands sent to the conditioner are echoed back to the computer.

Whenever a command must be followed by an argument, the command prefix and the argument are strung together. Each line of characters returned to the computer by the conditioner terminates with a line feed (LF) and carriage return (CR) character. Note also that each string of characters on the same line is normally separated by a tab (HT) character or by a space character in this manual.

The following sections will provide a practical overview of the capabilities of the UMI using remote control commands. A complete list of remote control commands can be found at the end of this instruction manual.

Selecting Acquisition Modes

In remote control mode, the UMI offers two different methods for data acquisition:

- ▶ Direct data acquisition: measurement data is immediately sent to the RS-232 port of the conditioner without storing it to memory.
- ▶ Delayed data acquisition: measurement data is stored into memory and must be downloaded after the acquisition for viewing and analysis.

Each acquisition mode offers other options such as data acquisition in automatic or manual scan of the measurement channels.

Note: The UMI switches immediately to manual or automatic scan according to the acquisition modes that is selected.

The acquisition modes are selected with the Acquisition Mode [TMX] (X=0-9) remote control command set.

Direct Data Acquisition

If a direct data acquisition mode is selected, each data measurement is immediately sent to the RS-232 link of the conditioner without storage in the memory.

1. Use the Acquisition Mode [TM2] or [TM8] command to select the appropriate direct acquisition mode.
2. Send the Trigger [TS1] command to activate the acquisition, or press the F1/ACQ button on the unit's front panel.

When the direct data acquisition is set in manual scan [TM2], a space character separates each data measurement (taken on a single channel) sent to the RS-232 output. The string READY is sent at the end of the last data measurement.

When the direct data acquisition is set in automatic scan mode [TM8], each data measurement collected on the different channels is placed on a separate line. The line begins with the channel number, followed by a tab character, then the data measurements, and it terminates with a line feed (LF) and carriage return (CR) character. No information is given on the acquisition parameters, the gauge factor or the measurement unit.

The duration of the direct data acquisition can be adjusted only in the RS-232 [TM2] mode. The RS-232/SCAN [TM8] mode runs continuously and stops with the Trigger [TS0] command or by pressing the F1/ACQ button on the unit's front panel.

The other time-based parameters of the acquisition session are the averaging time and the acquisition rate. These parameters can be manually adjusted via the control panel or with their remote control equivalent commands:

Acquisition Average: [TC]

Acquisition Rate: [SR]

13. Troubleshooting

The UMI Universal Multichannel Instrument has an auto-diagnosis feature that informs the user in case of defective or noisy measurement conditions. Depending of the conditions, the UMI will display different messages:

Message	Type and description	Possible cause & remedies
MEMORY LOST	ERROR The content of the RAM memory has been erased.	The RAM memory has been corrupted so the UMI Universal Multichannel Instrument is automatically reset with the factory default settings. Contact factory if that problem persists.
NO SIGNAL	ERROR The conditioner detects a low level signal or no signal.	No sensor connected to the UMI or improper connection. Verify connections or clean sensor, cable, and/or UMI input connector. Fiber optic extension cable is longer than the maximum length permitted. Use cable with shorter length. Cable or sensor is damaged. Replace damaged part. UMI Universal Multichannel Instrument is defective. Contact factory.
SYSTEM FAULT	ERROR The conditioner has detected a faulty condition.	The UMI Universal Multichannel Instrument has detected a faulty condition other than NO SIGNAL. Contact factory if problem persists.
SETTLING	INFORMATION OR ERROR The conditioner is settling.	This is not a defective condition if the message disappears, normally after 2 or 3 seconds. This message is displayed just after the UMI Universal Multichannel Instrument is turned ON or just after a sensor is connected to the UMI.
WAIT AVRG	INFORMATION The conditioner is averaging the data readings of the sensor.	This message appears when the conditioner displays the first data measurement and the Averaging Time is greater than 2 s. Wait until the Averaging Time elapsed.
Next acquisition in XXhXXmXXs	INFORMATION During an Acquisition Session, the conditioner goes in Low Power State between two successive data measurements.	This message appears only during a delayed Acquisition Session. It is displayed between two successive data measurements and when the Acquisition Rate is larger than 2m30s + averaging time.

1. Dip a lint-free swab in optic grade 99% isopropyl alcohol (not provided with the instrument).
2. Gently turn the swab in the connector to clean the ferrule inside the connector.
3. Allow ten seconds for the alcohol to evaporate.
4. Insert the fiber-optic cable or cover the detector port for later use.

Replacing Parts

When handling optical fiber and fiber-optic connectors as well as for cleaning a fiber-optic connector, follow the general recommendations of this section.

There are no user serviceable parts inside the UMI, other than the ones specified in the Maintenance Section. Adjusting parts inside the unit can affect the accuracy of the instrument. If you adjust parts, you will need to verify the accuracy of the measurements.

Recalibrating the Unit

The unit is pre-calibrated and tested prior to shipping. Under normal use, the unit should not need recalibration. For more information on this specific device as well as the required procedure, please contact one of FISO's service centers.

Delayed Data Acquisition

The UMI Universal Multichannel Instrument has an integrated data logger (memory buffer) for real time storage of the data measurements. The process of making a delayed data acquisition and data storage in memory is called an Acquisition Session. The term delayed means that the data measurements will be available as soon as the acquisition session has started logging.

The delayed data acquisition mode is subdivided into two other classes:

- ▶ data acquisition at set duration
- ▶ programmable data acquisition

Data Acquisition at Set Duration

Use the Acquisition Mode [TMX] command to select the appropriate acquisition mode among the ones that have a set duration. The duration of the acquisition session is adjusted with the acquisition duration parameter. Use the Acquisition Duration [DA] command to set the value of this parameter or go at the acquisition sub-menu of the control panel.

To activate the acquisition session:

- ▶ Send the Trigger [TS1] command

OR

- ▶ In Reading mode, press the F1/ACQ button on the unit's front panel

To stop the acquisition session:

- ▶ Send the Trigger [TS0] command

OR

- ▶ In Reading mode, press the F1/ACQ button on the unit's front panel

Otherwise, the acquisition session will end when the elapsed time since the beginning of the session becomes equal to the acquisition duration.

Note: The memory buffer stores close to 50 000 data measurements — that may limit the maximum value of the acquisition duration. To use the full capacity of the memory, simply set the acquisition duration to 00h00m00.0. In that case, the acquisition session will terminate when the memory buffer is full.

Programmable Data Acquisition

Up to five different acquisition sessions can be programmed and each can be activated at a specific date and time. These programmed acquisition sessions are called the acquisition programs. To create an acquisition program, the user must download the program parameters into the conditioner memory from a PC.

You may create your own Acquisition Programs via the different Program# remote control commands. Each acquisition program is numbered from one to five. An acquisition program consists of the following parameters:

Starting Date	Starting Time	Ending Date	Ending Time	Program Rate	Program Average
1996-01-01	000000	1996-01-01	000000	0.00	0.05
[SF X yyyymmdd]	[SA X hhmss]	[SG X yyyymmdd]	[SB X hhmss]	[SC X hmmss.ss]	[SD X mmss.ss]

Parameter	Remote Control Command
Starting time (0 to 23h59m59.9)	Program# Start Time
Starting date (yyyMMdd)	Program# Start Date
Acquisition rate (0.05 to 09h59m59.95)	Program# Rate
Averaging time (0.05 to 54m36.75)	Program# Average
Ending time (0.05 to 23h59m59.95)	Program# End Time
Ending date (yyyMMdd)	Program# End Date

The programmed mode of acquisition can be activated in different ways:

- ▶ By pressing twice on the **F1** button on the unit's front panel

OR

- ▶ By using the [TS1] remote control command

OR

- ▶ Through FISOC Commander remote control software

When activated, the UMI Universal Multichannel Instrument will start the acquisition programs in chronological order as given by their respective starting date and time.

An acquisition program is said enabled when its acquisition rate value is different from zero.

To disable an acquisition program, set its acquisition rate to zero.

To activate a set of enabled acquisition programs:

1. Select the appropriate programmable acquisition mode with the Acquisition Mode [TM3] or [TM9] command.
2. Send the Trigger [TS1] command or press twice the **F1/ACQ** button on the unit's front panel.

The UMI will run the set of activated acquisition programs in chronological order as given by the starting time and starting date (TM9 mode only) of each program.

12. Maintenance

Handling the Sensors

Read the following precautions prior to installing and when using sensors:

- ▶ Avoid sharp bending radius in the fiber-optic cable (< 10 mm).
- ▶ Avoid tension, pinch points or twisting of the fiber-optic cable.
- ▶ Do not pull on fiber-optic cable to clear tangles; instead, carefully unwind.
- ▶ Do not allow the fiber-optic connectors to drop or scrape on hard surfaces.
- ▶ Keep the surface of the fiber-optic connector clean.
- ▶ Always use protector caps on the fiber-optic connectors when sensors are disconnected from the signal conditioner.

Cleaning a Fiber Optic Connector

To make good optical measurements, it is extremely important to clean the fiber-optic connector before each connection. Dirt on the connector can degrade the reliability of the measurement and cause permanent damage to the connector resulting in non-functional sensors.

Modern fiber-optic connectors rely on a glass-to-glass contact to reduce Fresnel reflections at the connector interface. A dirty or damaged connector on the cable can damage the input connector. Always use a good quality cable connector. If there is any question of the surface quality on the tip of the cable connector, inspect it under a microscope for scratches or debris.

Some general recommendations:

- ▶ Never use a metal or other hard object for cleaning that would scratch the ferrule.
- ▶ Do not apply index-matching gel or oils.
- ▶ Always keep connectors covered for protection when not in use.

To clean the end of the connector on the fiber-optic cable,

1. Gently wipe the tip with a lint-free swab, "Optic Prep" pad or lens paper dipped in 99% isopropyl alcohol (not provided with the instrument).
2. Dry it by wiping gently with a clean dry lint-free lens paper or a connector swab.
3. As soon as the connector is dry, insert it in the panel or cover it for later use.

Cleaning Detector Ports

It is equally important, to make good optical connections, to clean the fiber-optic detector port before each connection. Dirt on the detector can degrade the reliability of the measurement and cause permanent damage to the connector resulting in an expensive repair.

To clean the connector on the fiber-optic detector port,

In case of time and date overlap between different acquisition programs, the starting time (or date) of a given acquisition program has priority over the ending time (or date) of the preceding acquisition program. It means that the UMI may jump to the next acquisition program, even if the current acquisition program is not terminated.

Note: In TM3 mode, the acquisition programs are run again every 24 hours (the date is ignored) until the next Trigger command is received by the UMI or until the user has pressed twice the F1/ACQ button on the unit's front panel.

The following example shows a list of the remote control commands to send to the UMI to create a TM9 acquisition program:

Command	Action
[SF 2 20001124]	Set the starting date of acquisition program # 2 to 2000-11-24
[SA 2 013000]	Set the starting time of acquisition program # 2 to 01h30m00s
[SG 2 20001126]	Set the ending date of acquisition program # 2 to 2000-11-26
[SB 2 023000]	Set the ending time of acquisition program #2 to 02h30m00s
[SC 2 000100.00]	Set the acquisition rate of acquisition program #2 to 1 minute
[SD 2 0010.00]	Set the averaging time of acquisition program #2 to 10 seconds

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The Program# Show command provides the listing of a given acquisition program.

Viewing Acquisition Files

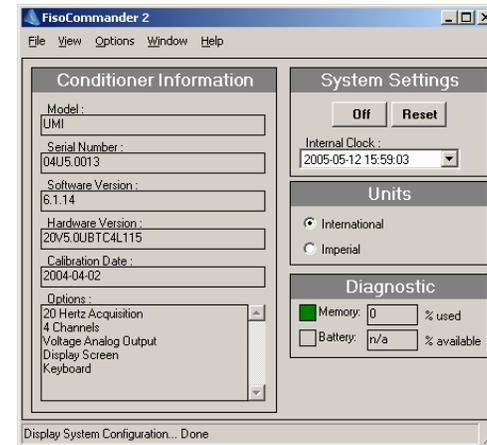
Each time an acquisition session is started, a new data files is created and opened in the memory of the UMI Universal Multichannel Instrument. The content of this file includes the data measurements and other useful information of the acquisition. The file (comma-separated values text file) is called the acquisition series and can be easily downloaded to a computer with the aid of the Data Download [DD] command.

The acquisition series file is described in the *Data Logging* section, on page 27.

Use the List Tag [LT] command to get a list of all the acquisition series stored in the memory buffer without the data measurements.

Viewing Diagnostic Information

The **Diagnostic Information** window is in the **Conditioner Information** window.



The **Diagnostic** section presents the following information:

- ▶ **Memory:** Percentage of used memory for stored data into conditioner during delayed or memory acquisition.

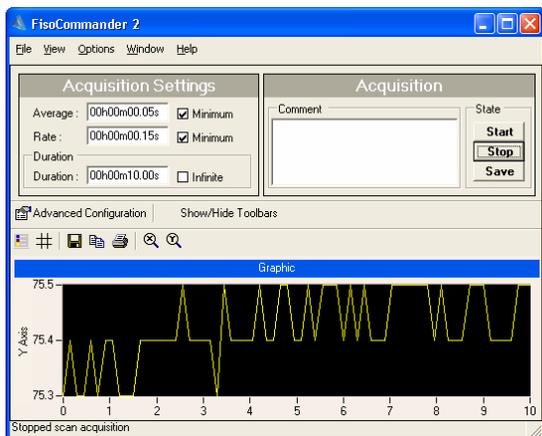
Note: Maximum number of data is approximately 50000 points. You can clear conditioner data memory via the Memory Acquisition screen section Memory Data.

- ▶ **Battery:** When available for the conditioner, it represents the percentage of standalone battery remaining.

Note: The unit has no battery for standalone use purpose. It will however keep internal settings and data.

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To save data to a disk:



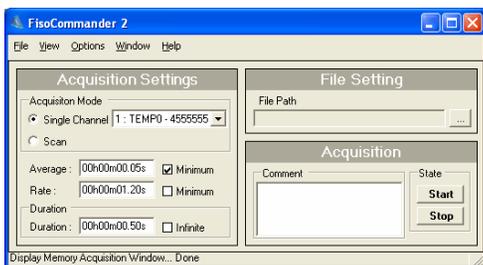
- Once the acquisition session is over, click on **Save**. Two choices are available:
Save Graph: to save the graph in .bmp format.
Save: to save the acquisition data in .csv format.
- Select a file path.
- Assign a filename to the data file.

Note: The **Options** menu provides access to the file settings for saving purposes. These parameters must be set prior to the acquisition session.

- Click on **Save**.

Saving Data from a File Acquisition

When you configured a file acquisition, you defined a file path and a filename. To obtain information on configuring a file acquisition, refer to section *Performing a File Acquisition*, on page 53.



Once the acquisition session is over, your data should have been saved in the directory you selected and with the name and format you assigned to the target file.

8. FISOC Commander Software

The FISOC Commander is designed to configure the Universal Multichannel Instrument and retrieve all the data stored in the unit. It is possible to communicate directly through the USB or RS-232 ports of the unit for direct, real-time acquisitions.

Here is a list of actions you can perform with the UMI system:

- Configure the sensors from your computer
- Start/Stop programmed acquisitions
- Proceed to a real-time acquisition session
- Save the data under a file format that can be opened with a database program

System Requirements

Minimum requirements for USB conditioner control:

- Intel® Pentium® II or compatible processor at speed above 400 MHz with Microsoft® Windows® XP
- USB 1.1 compatible
- Minimum 128 megabytes RAM and 50 megabytes of hard disk space

Recommended system:

- Intel® Pentium® III processor at speed above 700 MHz with Microsoft® Windows® XP or 2000
- Monitor resolution at 1024 × 768
- 256 megabytes RAM and 150 megabytes of hard disk space

Instrument Accessibility with the Software

You can use the software directly with a serial cable between your PC RS-232 or USB port and the Universal Multichannel Instrument for configuration before installation or on-site modifications or data retrieval.

Getting Started with the FISOC Commander

Installing and Removing the Program

You must follow the following procedure if it is the first time you install FISOC Commander on your computer. If an older version is already installed, you must uninstall it prior to installing the new version. If an older version is detected, the installation will stop and you will be prompted to uninstall the previous version and start the process over.

To uninstall an older version of the FISOC Commander software:

1. From the Start menu, select Control Panel.
2. Double-click on **Add or Remove Programs**.
3. Select the FISOC Commander software from the program list.
4. Click on the **Remove** button.
5. You may now proceed with the installation process.

To install the software for the first time on the computer:

1. Place the CD-ROM provided with the system on the CD-ROM drive. The Welcome page should appear on the screen.

Note: If autorun doesn't start, open Windows Explorer to view the CD-ROM's contents and double-click on **setup.exe**.

2. The **InstallShield Wizard** will automatically start.

IMPORTANT

To proceed with the installation, .NET must be installed on your computer. If .NET is not detected, you will be prompted to install it on your computer. To do so:

1. When the prompt message appears, click on **I Agree**.
2. On the next window, click on **Install**.
3. At the end of the .NET installation process, click on **OK**. **FISOC Commander InstallShield** now opens.
4. Click on **Next** to proceed with the installation.
5. Follow the wizard instructions on screen.
6. When the installation is over, click on **Finish** to exit the wizard.

To remove the program:

1. From the Start menu, select Control Panel.
2. Double-click on **Add or Remove Programs**.
3. Select the FISOC Commander 2 software from the program list.
4. Click on the **Remove** button.

Accessing and Exiting the Program

A desktop icon should now be available for quick access to the FISOC Commander program. Otherwise, it should be in the installed program list, under **FISO Technologies**. To execute the program:

- ▶ Double-click the icon on the desktop

OR

- ▶ Select the program from the program list, in the Windows Start menu

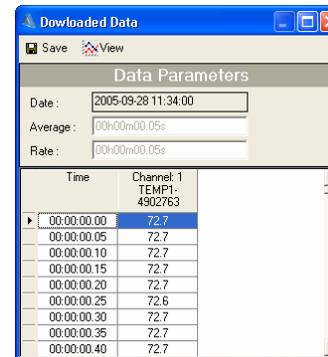
Saving Acquisition Data

Saving Data from a Direct or Delayed Acquisition

During a direct or delayed acquisition, that data is stored in the unit's memory and you need to download it and view it before storing it to a PC.

To save acquisition data from a direct or delayed acquisition:

1. Download the data from the unit's memory to your computer. For instructions on how to download the data, refer to section *Downloading Acquisition Data*, on page 55.



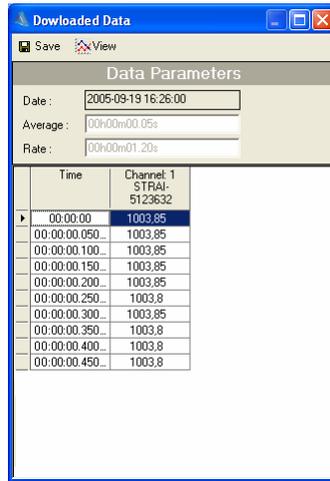
2. Click the **Save** button, at the top of the window.
3. Select a file path.
4. Assign a filename to the data file. You may choose from two different file formats: .txt or .csv.

Note: The **Options** menu provides access to the file settings for saving purposes. These parameters must be set prior to the acquisition session.

5. Click on **Save**.

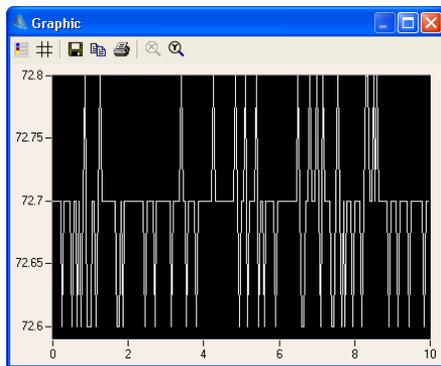
Saving Data from a Graphic Acquisition

The information obtained through a graphic acquisition is directly transferred to the PC to plot the graphic and can be saved to a file at the end of the acquisition section, both in bitmap and text formats.



From the **Downloaded Data** window, you will obtain the date of the acquisition, and the average and rate parameters that were defined for the selected acquisition session. The table underneath the data parameters lists all the data points, along with the time each point was taken, the first data point starting at zero.

To view the information in graph format, click on the **View** button.



9. FISOCommander Overview

The first visible application screen is the connection window. This is the only available screen before establishing a connection with a unit. Once the connection is established you may have access to the rest of the application interface by using the **Window** menu in the Menu bar or the Tool Box buttons.

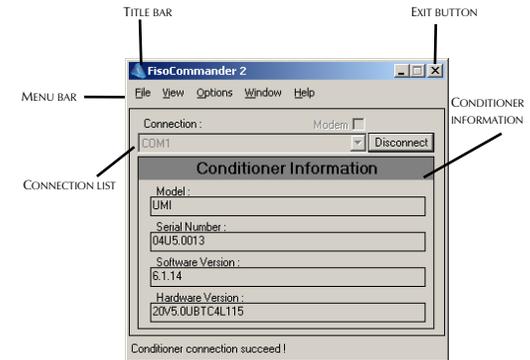


Figure 3. FISOCommander 2 connection window

Tool Box

The Tool Box is a separate window that gives access to all the items found in the **Window** menu. Each button opens the respective application screen.

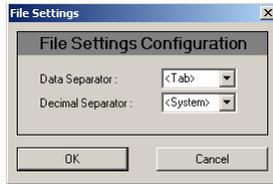


Viewing of the Tool Box is optional. You may toggle its displaying on and off from the **View** menu.

Menu Bar

The menu bar is always visible on all application screens. It contains five menu items:

- ▶ The **File** menu gives access to the Exit command to close the application.
- ▶ The **View** menu provides the choice of viewing or closing the initialization splash screen and the Tool Box.
- ▶ The **Options** menu provides access to the file settings for saving purposes.



IMPORTANT

The parameters on the **File Settings** window must be determined prior to any acquisition session to ensure that the data will be properly formatted in the output file. Output files can have the .txt or the .csv extensions.

- ▶ The **Window** menu provides access to all the other application windows: **Connection**, **System Configuration**, **Gage/Channel Configuration**, **Memory Acquisition**, **File Acquisition**, and **Graphic Acquisition**.
- ▶ The **Help** menu gives access to the online help files and the **About** window.

Connection Window

The Connection window provides the necessary controls to establish communication with the UMI unit.



The **Connection** drop-down list provides the list of port options that are available on your PC to establish a connection with a UMI unit.

The Conditioner Information section displays the description of the unit with which communication has been established.

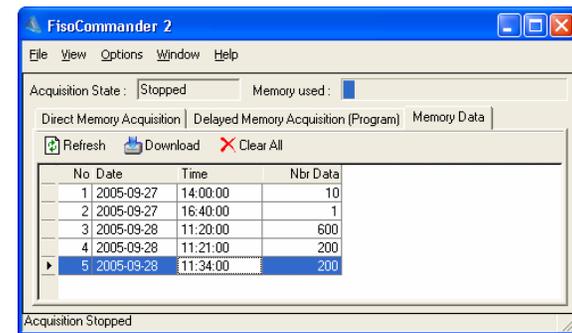
11. Managing Acquisition Results

Downloading Acquisition Data

When you perform either a direct or a delayed (programmed) acquisition, you will need to download and view the data stored in the unit's memory before saving it to your computer.

To download acquisition data:

1. Select **Memory Acquisition** either from the Toolbox or from the **Window** menu.
2. Stop the current acquisition before downloading.
3. Select the **Memory Data** tab. The list of recorded test sessions, defined by their date, time and number of data points, will display in the table on the lower part of the window.



4. Select the desired session from the list by clicking on the corresponding line on the table.
5. Click on **Download** to download the data to your computer.

The **Clear All** button will erase all acquisition sessions from the unit's memory buffer.

The **Refresh** button will download and display the latest information.

6. Click on **OK** in the **Transfer In Progress** pop-up window to display acquisition data.

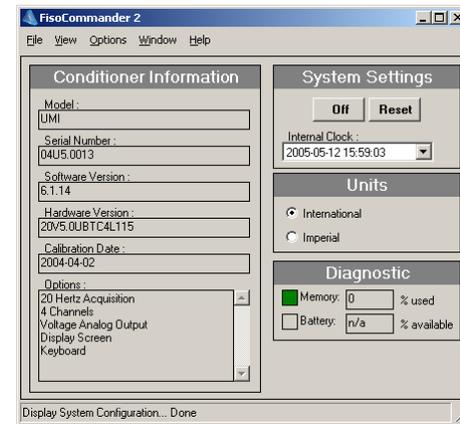
3. Specify the scanning average and rate. For a definition of average and rate, refer to the section *Configuring Acquisition Parameters*, on page 17.
4. Type the time length of the session to specify the duration of the test session in the **Duration** text box.

Note: Selecting the **Infinite** option in the **Duration** group starts an acquisition session that will stop when you click on **Stop**. Otherwise, the acquisition will continue until there's no more memory available on the PC.

5. Specify a file location to save the acquisition data by either typing it directly in the **File Path** textbox or by clicking on the browse [...] button to select a file location.
6. Type in any desired comments in the **Comment** text box.
7. Click on **Start** to begin the acquisition session
8. Click on **Stop** to end the acquisition session.

System Configuration Window

The System Configuration window displays the UMI's information too, but it adds the date of the most recent calibration, and the list of installed options.

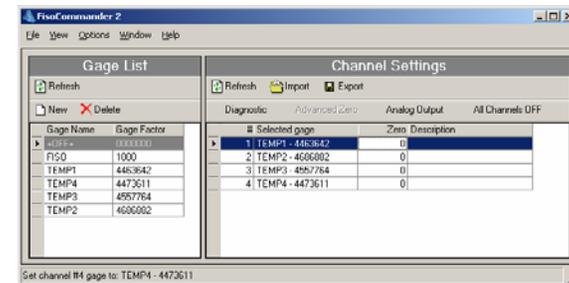


The **System Settings** group provides controls to turn the unit off, to reset the conditioner's information to factory default values, to adjust the internal clock, and to select the measurement units that will be used for the acquisitions. It also provides a quick diagnostic chart to evaluate the unit's performance.

Note: The **Off** button is disabled when communicating with the unit through an USB link.

Gage/Channel Configuration Window

It is on the **Gage/Channel Configuration** window that all parameters concerning the sensors and the measurement channels are set.



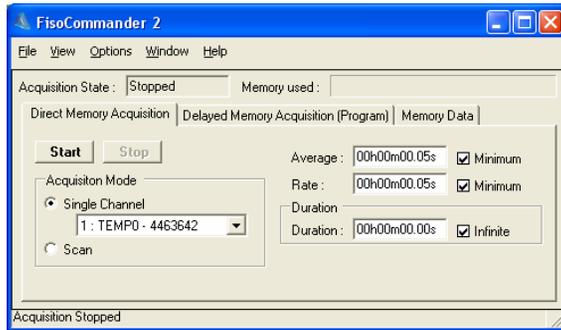
The Window is divided into two sections:

- ▶ The **Gage List** section allows the creation of a sensors list with the name and the gauge factor off all the sensors that are compatible with the unit.
- ▶ The **Channel Settings** section is the table where the correlation between the sensors and the measurement channels is established.

Memory Acquisition Window

The Memory Acquisition window is divided into three tabs:

- ▶ Direct Memory Acquisition
- ▶ Delayed Memory Acquisition (Program)
- ▶ Memory Data

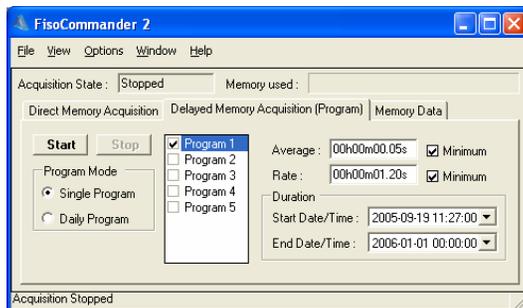


Direct Memory Acquisition Tab

In this tab, you may start and stop an acquisition in real time. You may set the acquisition on multiple channels (scan mode) or on a single channel. You may also determine the averaging time, the rate, as well as the duration of the acquisition. The data obtained through a direct memory acquisition is stored in the unit's internal memory and will have to be downloaded before being able to store it to a computer.

Delayed Memory Acquisition (Program) Tab

In the **Delayed Memory Acquisition (Program)** tab, you may select pre-programmed acquisitions to be executed at a specific date and time.



Up to five programs may be stored in the unit and executed through the FISOCommander software. The data obtained through a delayed memory acquisition is stored in the unit's internal memory and will have to be downloaded before being able to store it to a computer.

- ▶ Single Program: Acquisition sessions can be activated at a specific date and time.

Once the graphic characteristics have been set, you may save the configuration for later use. To do so:

1. Click on the **Export** button.
2. You will be prompted to select a location and a name for the graphic configuration file.
3. Click on **Save**.

To create a new graphic configuration file:

1. Click on the **New** button.
2. Follow the instructions above to configure the graphic and the Y axes.
3. Save the new configuration by following the instructions above.
4. Repeat steps 1 to 3 for any new graphic configuration file you want to create.

Starting and Stopping the Graphic Acquisition

Once the graphic elements are defined and the acquisition parameters are set, you may proceed with the acquisition session.

To start the acquisition session, click **Start**. The acquisition will begin, all active channels will be scanned at the time intervals specified during configuration, and the graphic will appear on the plot area.

To stop the acquisition, click **Stop**. This button is useful if you wish to stop the acquisition before the end of the specified duration time.

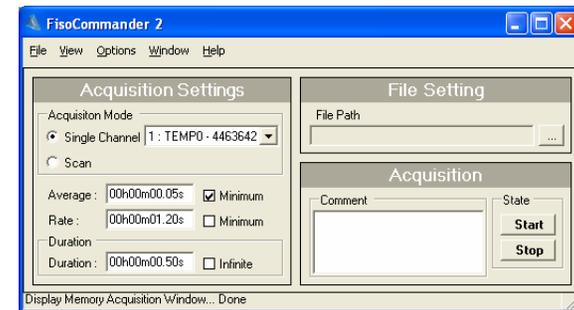
The data used to plot the graphic will not be saved unless you click the **Save Data** button. By doing so, all points used to trace the graphic will be saved to a file. You will be prompted to name the file and select a location.

Performing a File Acquisition

It is from the **File Acquisition** window that you can perform a monitoring session where the data is sent directly to a predefined file in your computer, without stocking the information in the unit's memory.

To perform a file acquisition:

1. Select **File Acquisition** either from the Toolbox or from the **Window** menu.



2. Select the radio button of the desired scanning mode for your acquisition: **Single Channel** or **Scan**.

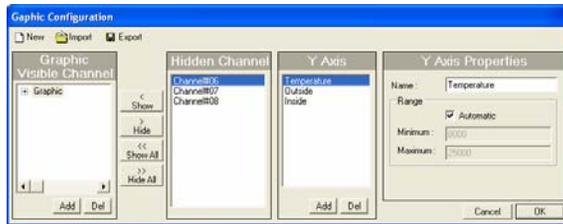
Scope: restarts the plot when the trace reaches the right end of the screen.

Scroll: the timeline continually increases in value when the trace reaches the right end of the screen.

- For the scope and scroll modes, define the number of data points that will be visible on screen during the acquisition.

To configure a Y axis:

- Click on the Y Axis table. The leftmost table will change to Y Axis Properties.



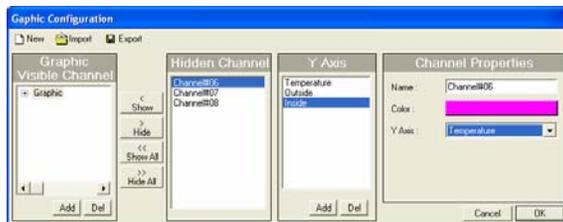
- In the **Name** field, type the name of the Y axis being defined.
- In the **Minimum** and **Maximum** fields, type the lowest and highest axis limits, respectively. The values are in internal units (nm) or in physical units, depending on how measurement were configured.
- To add a new axis, click the **Add** button at the bottom of the Y Axis table.
- Repeat steps 2 to 4 for all the Y axes you wish to add.

To configure a channel:

- Click on a channel from either the Graphic Visible Channel or the Hidden Channel lists.

Note: You may configure all channels from this window, even if they are selected as hidden and will not show during the acquisition.

- On the leftmost table, **Channel Properties**, define channel settings: color and assign it to a previously defined Y axis.

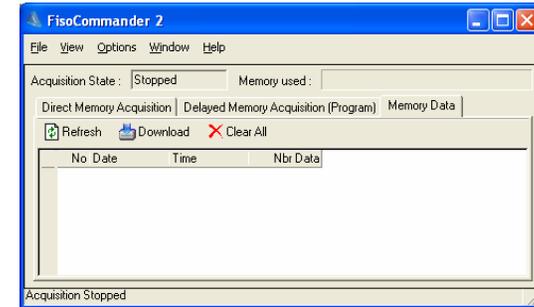


- To select a color, click the color bar and pick a new color for the selected channel.
- To assign a Y axis to a channel select the axis from the Y axis drop-down list. See instructions above to configure a Y axis.

- **Daily Program:** This mode is normally used to perform repetitive daily acquisitions. Acquisition sessions run every 24 hours.

Memory Data Tab

The Memory Data tab is the interface to download acquisition data stored in the unit.



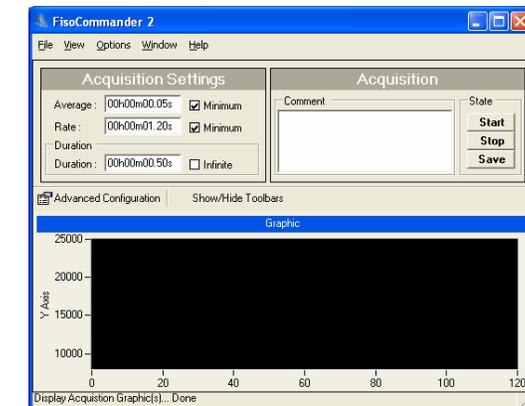
The acquisition state displays the current acquisition status of the unit:

- **Stopped:** No acquisition process is currently running.
- **Waiting:** An acquisition process is waiting for an acquisition session to be started.
- **Running:** An acquisition session is actually running and remaining data to acquire is shown.

The table on this tab summarizes the data stored in the unit's memory, grouped by acquisition session. The buttons provided allow refreshing, downloading, and clearing of the acquisition information.

Graphic Acquisition Window

The **Graphic Acquisition** window displays the acquisition information in real time and in graphical form.



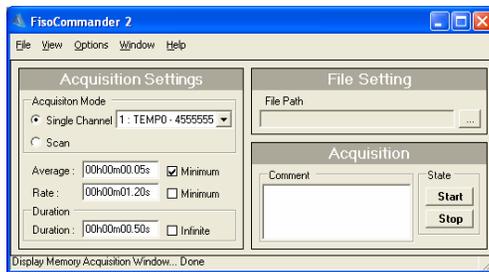
It is possible, from this window, to start and stop real-time acquisitions. You may also determine the averaging time, the rate, as well as the duration of the acquisition. Data obtained through this acquisition mode can be saved to a file at the end of the session.

The **Advanced Configuration** button gives access to further graphic configuration parameters. The **Show/Hide Toolbars** button, as its name indicates, displays and hides the Graphic Toolbar. The available functions are:

-  Show/Hide legend
-  Show grid
-  Save graph to image file
-  Copy graph to clipboard
-  Print graph
-  Configure X axis
-  Configure Y axis

File Acquisition Window

The File Acquisition Window groups all the functions that are necessary to perform an acquisition that sends its data directly to the computer.



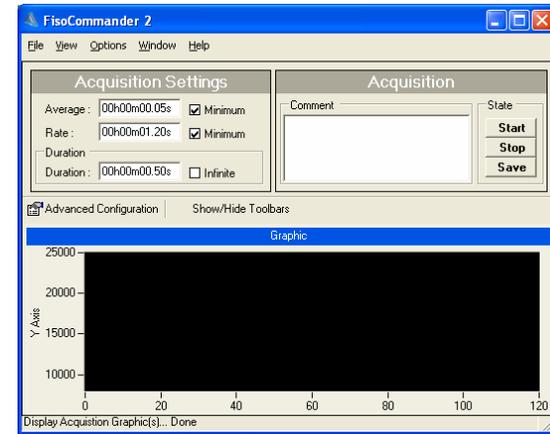
In the **Acquisition Settings** group, you define the acquisition mode, as defined previously, as well as all the necessary parameters to determine the duration and the frequency of each reading.

In the **File Setting** group, you provide the path where you want to save the resulting acquisition file. Data will be automatically sent to this file.

The **Acquisition** group provides the controls to start and stop an acquisition and to insert comments into the file.

Performing a Graphic Acquisition

A graphic acquisition is a real-time acquisition session, performed in single channel or scan mode that is directly represented as a graph in the **Graphic Acquisition** window plot area.



Three steps are required to perform a graphic acquisition:

- ▶ To configure the graphic
- ▶ To set the acquisition parameters
- ▶ To start the acquisition

Configuring the Graphic

To view the acquisition traces from the desired channels, you must configure the graphic prior to a graphic acquisition. To do so,

1. On the **Graphic Acquisition** window, click the **Advanced Configuration** button.



2. Make sure that the channels that will be used to plot the graph are present in the **Graphic Visible Channel** table.
3. Select the channels you will not be using and send them to the **Hidden Channel** table by clicking the right (**Hide**) arrow. To send these channels back to the **Graphic Visible Channel** table, select them and click the left (**Show**) arrow.
4. On the leftmost table, **Graphic Properties**, assign a name to the graph, and select a display mode:

Full: squeezes the graphic to fit the complete acquisition timeline on the screen

Daily Program: This mode is normally used to perform repetitive daily acquisitions. Daily programs run every 24 hours.

- 5. Set the average, the rate, and the start/stop date and time.

Note: The acquisition rate must always be equal to or higher than the average time interval.

- 6. Repeat steps 3 to 5 for the remaining programs, if desired.

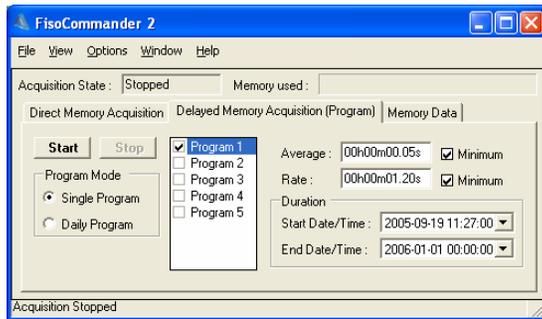
Performing a Delayed Memory Acquisition

A delayed memory acquisition has been programmed to start and stop at specific dates and times. The information is stored in the unit's memory and is available for later download through the FISOC Commander software.

Delayed acquisitions are always executed in scan mode. It is thus important to deactivate those channels that do not have an assigned sensor.

To perform a delayed acquisition using any of the programs that are stored in the unit's memory, proceed as follows:

- 1. In FISOC Commander software, go to the **Memory Acquisition** window.
- 2. Select the **Delayed Memory Acquisition (Program)** tab.



- 3. Activate or deactivate the desired programs by clicking on the appropriate checkbox.
- 4. Click on **Start**. The software will start and stop each active program according to the specified schedule.

Whenever you want to stop the current acquisition, click on the **Stop** button.

Note: In case of time and date overlap between different acquisition programs, the starting time (or date) of a given acquisition program has priority over the ending time (or date) of the preceding acquisition program. It means that the UMI may jump to the next acquisition program, even if the current acquisition program is not terminated.

10. Operating the UMI with FISOC Commander

Now that the hardware is properly configured, the sensors are in place and the FISOC Commander software is installed, you are ready to operate the Universal Multichannel Instrument. In this section, you will be guided to perform, among others, the following actions:

- ▶ Set the unit's system parameters
- ▶ Configure the sensors from your computer
- ▶ Proceed to a real-time acquisition session
- ▶ Create and execute programmed acquisitions
- ▶ Save the data

Setting the Unit's Date and Time

When the connection between the PC and the UMI is established, the software will compare the date and time parameters on both units and prompt for synchronization, assuring that the PC provides the current time.

To change the unit's date or time:

When selecting the **Settings** window, the **Device Clock** window appears, click **OK** to set the unit's time or **Cancel** to keep the unit's current time settings.



To set a time different from the one provided by the PC:

- ▶ Highlight each date and time element and type in the desired value.

OR

- ▶ Highlight each date and time element and, with the up and down arrows on your PC keyboard, increase or decrease the numbers until they reach the desired value.

OR

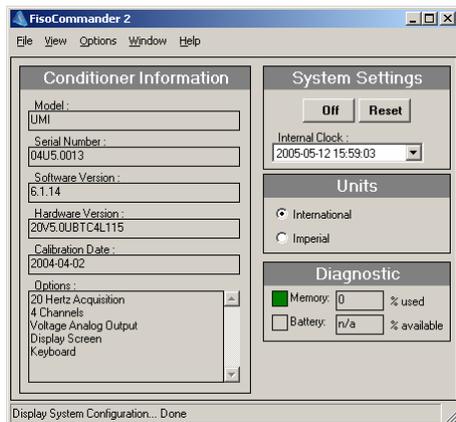
- ▶ For the date, click the arrow to open the drop-down calendar and select a date.



Selecting the Measurement Units

To change the unit system used to display measurements:

1. Go to the **System Settings** window.



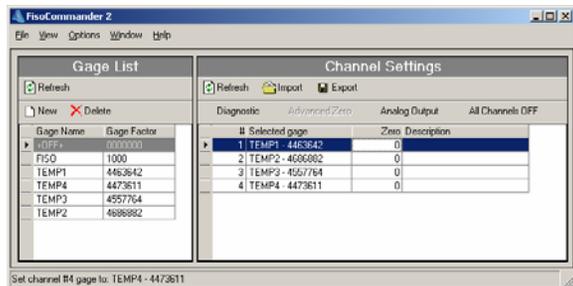
2. In the **Units** box, select the radio button corresponding to the desired measurement units.

Configuring the Sensors

The UMI Universal Multichannel Instrument recognizes and uses the sensors that are defined in FISOCommander sensors list. Prior to a test, make sure that the sensors list contains the required information. The most important information is the gauge factor, used in the calculations. The gauge factor is stored in the unit's memory. The value will remain in memory even if the sensor is not assigned to any channel.

To populate the sensors list:

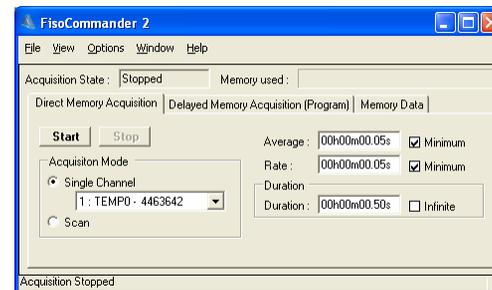
1. In FISOCommander software, go to the **Gage/Channel Configuration** window.



2. In the **Gauge List** group, click the **New** button.

To start a direct memory acquisition:

1. Go to the **Memory Acquisition** window and select the **Direct Memory Acquisition** tab.



2. Configure the parameters (average, rate, and time) according to your test requirements.
3. Select whether you wish to make a single-channel acquisition or an all-channel scan in the **Acquisition Mode** group.
4. Click **Start**. The software will start to count down the remaining data points to acquire until the end of the acquisition session.

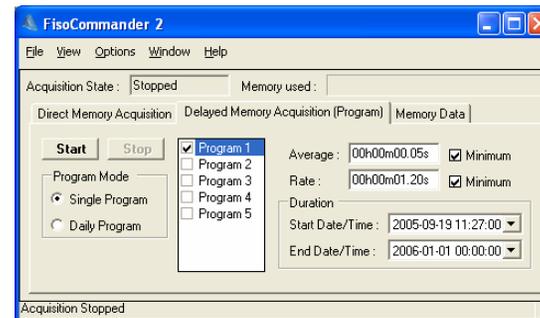
Whenever you want to stop the acquisition, click on the **Stop** button.

Creating Acquisition Programs

The unit may store up to five different acquisition programs that can be executed at different dates and times.

To create an acquisition program, proceed as follows:

1. In FISOCommander software, go to the **Memory Acquisition** window.
2. Select the **Delayed Memory Acquisition (Program)** tab.



3. Check the desired program number and make sure it is highlighted.
4. In the **Program Mode** group, select whether you want to perform a single program session or a daily program session.

Single Program: Up to five acquisition sessions can be activated at a specific date and time.

To set a duration time:



- ▶ Highlight each time fraction and type in the desired value.

OR

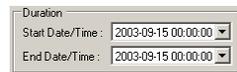
- ▶ Highlight each time fraction and, with the up and down arrows on your PC keyboard, increase or decrease the numbers until they reach the desired value.

OR

- ▶ Select the **Infinite** checkbox if you want to perform a continuous acquisition that will stop only when the unit's memory buffer is full.

For programmed acquisitions, the duration is determined by a start and an end date and time. The date is defined by a year, a month, and a day, while the time is defined by an hour, minutes, and seconds.

To set the start and end date and time:



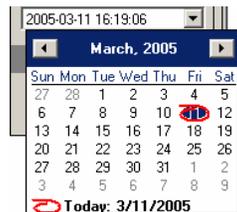
- ▶ Highlight each date and time element and type in the desired value.

OR

- ▶ Highlight each date and time element and, with the up and down arrows on your PC keyboard, increase or decrease the numbers until they reach the desired value.

OR

- ▶ For the date, click the arrow to open the drop-down calendar and select a date.

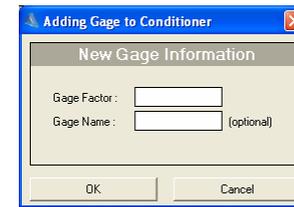


Performing a Direct Memory Acquisition

A direct memory acquisition is an acquisition that starts and stops with the commands sent through the FISOCOMMANDER software, whether it is the specified duration, or the **Stop** command.

Before performing an acquisition, make sure the following are properly configured:

- ▶ Sensors
- ▶ Measurement channels



3. Enter the sensor's name and its gauge factor number.

IMPORTANT

Pay attention not to confuse the gauge factor with the sensor serial number.

4. Click on **OK** to save the entry or cancel to quit without saving.

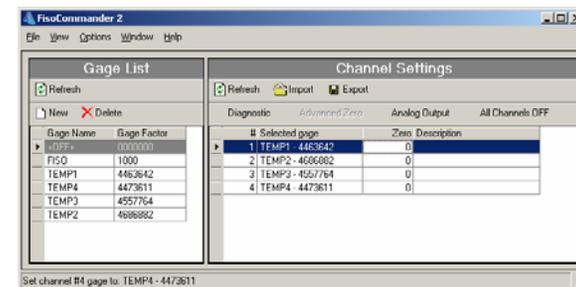
Note: The sensor name entry is optional. However, for easier sensor management, FISO recommends that you enter a mnemonic name (up to five characters) for every gauge factor stored.

Configuring Measurement Channels

Before performing a measurement, each temperature channel that will be used during the test must have a sensor assigned to it.

To assign a sensor to a measurement channel:

1. Open the **Gage/Channel Configuration** window.
2. Move the mouse pointer over the **Channel Settings** table.



3. Click on the channel you want to use. Make sure that your pointer is located on the **Channel N°** column. The channel will be displayed in bold.
4. Click on the corresponding **Selected gage** line. A drop-down menu will appear and propose you all the sensors that you previously stored in the sensors list.
5. Select the sensor that will be assigned to the channel.
6. Repeat steps 2 to 4 for all the measurement channels that will be used for the test.
7. After completing the channel assignment, click on **Save**.

It is equally important, before performing an acquisition, that the unused channels be deactivated.

To deactivate a measurement channel:

1. Move the mouse pointer over the **Channel Settings** table.
2. Click on the channel you want to deactivate. Make sure that your pointer is located on the **Channel N°** column.
3. Click on the corresponding **Selected gage** line. A drop-down menu will appear and propose you all the sensors that you previously stored in the sensors list.
4. Select the option **OFF** for the selected channel.
5. Repeat steps 2 to 4 for all the channels you wish to deactivate.
6. After completing the channel deactivation, click on **Save**.

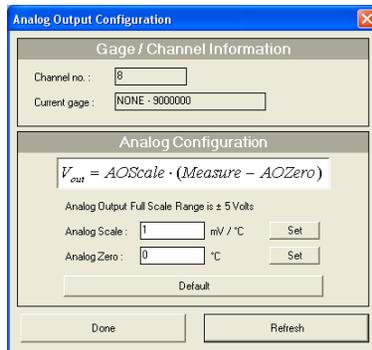
Analog Output Configuration

Analog output configuration consists in correlating the physical measurement obtained through the sensor with the unit's voltage or current scale.

Analog outputs are configured prior to shipping. Factory settings should address most measurement requirements. However, these settings can be modified through the FISOCommander software.

The **Analog Output Configuration** window is accessible from the **Gage/Channel Configuration** window, by clicking the **Analog Output** button located above the **Channel Settings** table.

Depending on the selected channel and its corresponding sensor, the **Analog Output Configuration** window will display physical parameters that correspond to the selected sensor. The parameters that need to be taken into account when configuring an analog output are described below.



- ▶ V_{out} ; I_{out} : is the analog output reading (V for volts, I for current) of the corresponding channels.
- ▶ **AOScale**: is the Analog Scale Factor which is the ratio between the voltage or current variation measured at the output and the corresponding variation of the physical parameters measured by the sensor. When the output is configured in current, the Analog Scale Factor is in μ -A per physical unit. When the output is configured in voltage, the Analog Scale Factor is in mV per physical unit.
- ▶ **Measure**: is the data measurement displayed by the unit (including advanced zero configuration offset).

- ▶ **AOZero**: Analog Zero/Offset is the Analog Output Offset which is the measurement, in physical units, that represent 0V.

To modify the analog output configuration:

1. Make sure that the sensor selected corresponds to the sensor you wish to configure.
2. In the Analog Scale field, type, in mV or μ A per physical unit, the ratio between the analog output voltage or current and a physical unit value.
3. Press the Set button.
4. In the Analog Zero field, type the physical measurement that shall correspond to the analog zero value.
5. Press the corresponding Set button.
6. If you wish to return to factory setting default values, press the **Default** button.

Configuring Measurement Parameters

For any type of acquisition you wish to perform, you need to determine the following settings:

- ▶ **Averaging time**: the time interval over which the average measurement is calculated.
- ▶ **Acquisition rate**: the frequency at which measurements will be performed for a given channel.
- ▶ **Duration**: the time over which measurements will be performed.
- ▶ **Start/Stop date and time**, for delayed programmed acquisitions.

The average and rate parameters are defined in hours, minutes, seconds, and hundredths of a second.

To set the acquisition average and rate parameters:



- ▶ Highlight each time fraction and type in the desired value.
- OR
- ▶ Highlight each time fraction and, with the up and down arrows on your PC keyboard, increase or decrease the numbers until they reach the desired value.
- OR
- ▶ Select the **Minimum** checkbox if you want to set the parameters to their minimum value allowed. The acquisition rate must always be equal to or higher than the average time interval.

When the time values are at their minimum, the **Minimum** checkbox will be automatically selected.

The duration of a real-time acquisition session is set in the **Duration** settings group. The duration is defined in hours, minutes, seconds, and hundredths of a second.