METRO*LAB* Instruments SA

PDITOOL

User's Manual

Version 2.1

(Revision 1.2)

October 1996

Contents

PDITOOL : user's manual

PDITOOL is a utility program running on IBM PC, AT and compatibles (DOS 3.3 or higher) to be used with the METROLAB PDI5025 Precision Digital Integrator, or with the PDI5025-fcm (the Fast Cycles Measurement option). PDITOOL gives the user a full range of possibilities for data acquisition, data visualisation and files handling. PDITOOL is an executable program exempting the user to write any code. The different commands and options are accessed using menus.

In order to use the full capabilities of the program PDITOOL and the PDI5025 Digital Integrator, the user must know the principles of operation of the instrument. The principles of operation are described in the PDI5025 user's manual and the user is strongly invited to read it before the program PDITOOL is activated. (For the PDI5025-fcm users, at least the sections 6.6 and 6.7 of the PDI5025-fcm user's manual must be read carefully.)

The commands and parameters for the Fast Cycles Measurements are available in the PDITOOL's menus only when a PDI5025-fcm is used.

In this manual, the paragraphs beginning with: **PDI5025-fcm** concern only the PDI5025-fcm (Fast Cycles Measurement option).

1. Setting up PDITOOL

To execute PDITOOL, the computer must have:

  - at least 640 Ko of memory,
  - an EGA or VGA display,
  - a free serial port or a IEEE-488 controller board.

The disk PDITOOL contains the following files :

              PDITOOL.EXE : executable program.
              PDITOOL.INI : initialisation file.
              *.DAT   : examples of data files.
              PDITOOL.TXT : this file.

It is greatly recommended to run PDITOOL from an hard disk. During the data acquisition process, the program opens a temporary files (PDITOOL.TMP) in the current directory and the access to a floppy disk may be too slow.

To install PDITOOL into a directory on the hard disk (e.g. C:\PDI), execute the following command :

                    COPY A:*.* C:\PDI*.*

The initialisation file PDITOOL.INI contains some parameters and options for the PDI5025 Integrator and the program PDITOOL. At starting time, the program reads the initialisation file and set

parameters according to it. If the program doesn't find the initialisation file in the current directory, it sets the parameters at their default values. At exit time, the program writes a new version of the initialisation file in the current directory. The last parameters and options are saved and will be restored at the next program execution.

Warning: the parameters are correctly restored only if the program PDITOOL is activated after the PDI5025 Integrator is switched on and its autotest completed.

The program PDITOOL takes advantages of colour display: the menu and graphics windows are in colours. However PDITOOL can also run with a black and white monitor. In this case, the initialisation file PDITOOL.INI has to be edited. The 'SCREEN_COLOR' flag set to 0 forces the use of black and white display. Setting the 'SCREEN_COLOR' flag to 1 restores the use of colours. The change of this flag is effective only if it is done before the execution of the program PDITOOL.

To execute the program PDITOOL, type (from the directory containing the program):

PDITOOL↵

2. Using menus and commands

The options and the commands are accessed using menus. Each menu is divided into an certain number of fields. A field can represent a parameter or a group of parameters as well as a command. The active field is usually represented by a reverse video block. Some fields have a shortcut key (highlighted letter) associated with. By pressing the shortcut key, the option or the command is directly validated and does not need further confirmation.

> Parameter fields: to set the parameter value or option, use:
>
> - alphanumeric keys when values or name are required (e.g. "Trigger sequence").
> - UP and DOWN keys to scroll options when ⇕ is present (e.g. "Channel and gain selection").
> - direction keys to move within options (e.g. "Trigger source mode").
> - shortcut keys to select options (e.g. "Trigger source mode").

> Command fields: the command appears in brackets (e.g. <OK>) and is executed by pressing ENTER. The command can also be executed using the associated shortcut key (if any).

The following two keys can always be used:

> The ENTER key validates the highlighted or reversed video command.

The ESC key exits the current menu by restoring the parameters previous to the call of the menu. It also breaks the command in progress. The ESC key has the functions of "Exit" and "Cancel".

Note: with each menu description, there is a recall of keys used within the menu.

Some messages are displayed indicating conditions, warnings or errors. The colour convention is:
 - blue for messages indicating that a command is in progress and the user has to wait for its completion.
 - green for message of completion and success.
 - red for error messages.

3. Status window

The status window gives current conditions on communication, channels setting and gain, trigger source mode and trigger sequence.

PDI5025-fcm: the parameters of the Fast Cycles Measurements are also displayed on the last line when the fast trigger mode is enabled. The status is displayed as following:

Fast mode trigger:e,t,m   per:x Arra.

where 'e' indicates the number of cycles
't' indicates the increment in µs
'm' indicates the mode: 0 for SSY and 1 for IFT
'x' indicates the period of the cycle
'Arra.' or 'Not arr.' indicates if the data are arranged
or not.(see section 4.15.1)

Remark**:** the status window is not continuously updated. If the communication is lost or a new gain is selected using the PDI5025 Integrator front panel, the status window may not reflect the actual conditions for few seconds.

4. PDITOOL's menus and commands

4.1. The main menu

[Hints: TAB, SHIFT+TAB, directions keys and shortcut keys to call menus]

The different command menus are accessed from the main menu. Most of the command menus need to communicate to the PDI5025 Integrator and are not effective if the communication is not established. But some menus can be called without the PDI5025 Integrator connected. They are the data handle menus: "Show/Print data"," Save/Load data" and "Display data". This allows the user to visualise and analyse old data.

The following two commands do not call a menu:

Shell: returns temporarily to the DOS command level. Type 'EXIT' to return to the program PDITOOL.

Exit : terminates program PDITOOL. The parameters and options at exit time are saved into the initialisation file PDITOOL.INI and will be restored at the next execution of PDITOOL.

4.2. Communications

[Hints: TAB and SHIFT+TAB to change field, UP and DOWN keys to select choice within a field.]

The interface type and parameters for the communication between the PDI5025 Integrator and the computer are set in this menu. There are two possible types of interfaces (RS232-C and IEEE-488) each with its own menu (see below). To switch interface, move cursor to the field <IEEE-488> or <RS232-C> then press ENTER, the menu corresponding to the new interface type will appear.

The status window displays the selected interface and the communication condition (OK or NOT OK).

Remarks:

  - The setting of the micro-switches, which are located on the front panel of the 5130 Interfaces module, is given in the menu window according to the selected parameters.

  - If the micro-switches are modified, the PDI5025 Integrator has to be switched OFF - switched ON in order to validate the new configuration.

  - If the communication can not be established, verify the connections and the micro-switches configuration (see previous remark). Then return to menu "Communications" and test again your choice by pressing ENTER.

  - The communication test fails if the PDI5025 autotest is in progress ("Test" is displayed on the PDI5025 front panel). Wait for the end of the autotest and try again to establish the communication.

  - If the communication is interrupted during PDITOOL is running, it's necessary to reinitialise it using menu "Communications". If the PDI5025 Integrator is switched off, some parameters (channel and gain setting, trigger source mode, motor mode) are no more valid and the status window doesn't reflect the actual conditions. The parameters have to be reinitialised either using corresponding menus or quitting and reactivating the program PDITOOL.

4.2.1. RS232-C interface

The first field of this menu sets the serial communication port of the computer. The next five fields set communications parameters. We recommend the following configuration, which is the default one:

```
            Baud rate   9600
            # bits      8
```

```
stop bit     1
parity       no parity
X ON/OFF     off
```

When the communication is established, the following message appears in the status window:

"Communications OK [RS232-C serial interface]"

4.2.2. IEEE-488 interface

The first field selects the IEEE-488 controller board installed in the computer.

Important remark: presently only the "IEEE-488 National Board" is supported by the program PDITOOL. Contact METROLAB Instruments SA if you need to implement another board.

The option "IEEE-488 National Board" is valid for the controller boards provided by:

NATIONAL INSTRUMENTS, GENERAL INSTRUMENTS and IBM.

Depending of the selected board, not all parameters shown in the menu are taking into account. For example, the "IEEE-488 National Board" option needs only "Device's name" and "Primary address" parameters. In this case the other parameters are neglected.

Device's name parameter is used by the configuration file of the IEEE-488 board (see board's manual).

Primary address parameter is the PDI5025 Integrator device address which is defined by the first five micro-switches and can be selected between 0 and 31.

Interface code parameters is the bus code and can be selected between 1 and 16. This parameter is presently not effective and is reserved for further development.

When the communication is established, the following message appears in the status window:

"Communications OK [IEEE-488 National Board]"

4.3. Channel and Gain selection

[Hints: TAB and SHIFT+TAB to change field, UP and DOWN keys to select choice within a field.]

The active channels and gains are selected in this menu. When a parameter is changed (e.g. the gain), it's immediately effective. But to confirm the selected parameters, it's necessary to use the <OK> command to exit the menu otherwise the parameters previous to the call of the menu are restored.

Active channel

The PDI5025 can be equipped with one or two channels. If two channels are present, they are always triggered in parallel. Measurements can be performed with either channel A, channel B or both channels simultaneously. If the PDI5025 Integrator is equipped with only one channel, it's not possible to change the active channel option.

Gain

The gain of each channel can be independently set to any of the following values:

1, 2, 5, 10, 20, 50, 100, 200, 500, 1000.

We recommend that the gain is set in such a manner that the voltage displayed on the bargraph display of the PDI5025 Integrator is the highest possible without an over range being detected during the measurement cycle. An over range condition is indicated by the OVR+ or OVR- LED's on the bargraph display. An over range error is cleared by either setting a new gain or by pressing the button FNC once.

The field "gain channel A" set the gain for channel A and the field "gain channel B" the one for channel B (if present). If a channel is not active, the characters "Off" replace the gain value. In this case the gain value can not be modified.

The GAIN button located on the front panel of the PDI5025 Integrator can also be used to increment or decrement the gain value. Press the button once to increment the gain. Press twice in rapid succession to decrement the gain. If the button is held down the gain will increment continuously until the button is released. This operation can be done independently from the menu "Channel and gain selection". If the GAIN button is used to select a new gain value, the status window may shown a different value until a menu is called.

4.4. Trigger Source mode

[Hints: UP, DOWN and shortcut keys to select the trigger source mode.]

The triggers (integration boundaries) are generated by the 5140 trigger module or are provided by an external device (external triggers). The 5140 trigger module generates triggers in function of time or in function of space. In the later case, the 5140 trigger module is designed to accept the two-phase signal from a bi-directional incremental encoder. In order to give maximum resolution, the module generates 4 pulses for each incoming encoder cycle. When defining the trigger sequence (see below "Trigger sequence"), the user must remember to multiply by 4 the number of encoder cycles corresponding to the angle of displacement for the measurement. In all modes, the minimal time between two triggers is 1 ms. Attention has to be paid when an encoder or external triggers are used.

The menu "Trigger source mode" selects the trigger source. The trigger sequence is defined in the menu "Trigger sequence" and the data acquisition (run) is activated in the menu "Data acquisition" (see below).

Timer

The PDI5025 has an internal quartz controlled time base generator giving triggers in time. The time resolution is 1 ms which is also the minimal time between two triggers. The longest integration period is about 4 hours (2^{23} ms). The trigger sequence begins immediately following the start of the acquisition run.

Timer with external synchronisation

This trigger source is similar to the "Timer" source but the trigger sequence is activated by the first external synchronisation signal which follows the start of the acquisition run. The external synchronisation signal is received on the SYNC input of the 5140 trigger module. Any following signals on the SYNC input are ignored.

Note: the synchronisation precision is better than 0.5µs.

PDI5025-fcm: In this case, the Timer with external synchronisation open a sub-menu called "Fast trigger mode".

Number of repetitive period
This is the number of events (cycles) to record. Valid numbers are 1 to 65535. When 1 is selected, the Fast Cycle Measurement is disabled and the corresponding status line in the status window disappears. This command correspond to the letter 'e' in the CMS command described in section 6.7 of the PDI5025-fcm user's manual.

Period in [µs]
This is the value of the period of one cycle. This is not a command of the PDI5025-fcm but this value is used to rebuild the graphic of a Fast Cycle Measurement. (See section 4.15.)

Increment in [µs]
This correspond to the sliding time between each events. The value is in µs but the resolution is 10µs, so the last digit is truncated. This command correspond to the letter 't' in the CMS command described in section 6.7 of the PDI5025-fcm user's manual.

Mode
There are two possibilities to perform a Fast Cycle Measurement, we say IFT and SSY. Use the up and down arrows keys for the selection. This command correspond to the letter 'm' in the CMS command described in section 6.7 of the PDI5025-fcm user's manual.
IFT mode is described in section 6.7.2 of the PDI5025-fcm user's manual. Since IFT gives a common point in all events, the compensation of the drift of the instrument can be performed, using the command "drift" in the cumulated graphics window **before** the data are rearranged. The disadvantage of this mode is that there is no information inside the first milli-second.

SSY mode is described in section 6.7.1 of the PDI5025-fcm user's manual. The drift of the instrument must be adjusted before a measurement, since a graphical compensation is not possible.

Break on overrange
This command exist also in the "Sub command" menu. Please, refer to section 4.10 for description.

NOTE: The values given in this sub-menu, must be set in concordance with the trigger sequence in order to have a coherent measurement.

Incremental encoder without index signal

The triggers are generated from the reading of an incremental encoder without index signal and external synchronisation. No absolute mechanical reference is defined. The 'zero' position in the trigger sequence is the position at the time of the start of the acquisition run.

Linear incremental encoder with reference signal

This trigger source can be used in two different ways:

a) A linear encoder with an index signal

The reference signal comes from the encoder it-self (index signal) and the signal is supplied to the PDI5025 Integrator via the encoder's connector.

b) A linear or rotational encoder without an index signal, but with an external synchronisation

The reference signal is supplied to the PDI5025 Integrator via the SYNC input located on the front panel of the 5140 trigger module.

Warning: the index input of the encoder connector must not be wired and left open.

In both cases, the index or synchronisation signal is used to defined the 'zero' (reference) position. The values in the trigger sequence are referred to this position. In order to initialise the reference position, the PDI5025 Integrator must receive at least once the index or synchronisation signal. After the trigger source has been validated, the menu "Initialisation of encoder position" appears allowing the initialisation of the reference position. The initialisation must not be necessary done at this stage, the "Encoder initialisation" menu can be called from the main menu (see below). But the initialisation has to be done before a data acquisition can be performed. Each time a trigger source is validated, the reference position is lost and has to be reinitialised.

Once the encoder initialisation is completed, the menu "Motor" appears allowing the setting of the 'MOTOR AUTOMATIC' mode (see below 'Motor'). If the automatic mode is not desired, the option 'MOTOR STOP' has to be selected.

Rotational incremental encoder with n cycles

The triggers are generated from the reading of an incremental rotational encoder with an index signal. With the use of the index pulse, the measurements are referred to a fixed point and can be considered as absolute.

The program prompts the user for the number of cycles per turn of the encoder (see encoder's specifications).

Note: the PDI5025 Integrator generates 4 pulses for each encoder cycle. The trigger sequence uses pulses (see below).

The index point must be passed at least once to initialise the reference position. After the rotational incremental encoder mode has been selected and the number of cycles per turn given, the menu "Initialisation of encoder position" appears allowing the initialisation of the reference position. The initialisation must not be necessary done at this stage, the "Encoder initialisation" menu can be called from the main menu (see below). But the initialisation has to be done before a data acquisition can be performed. Each time a trigger source is validated, the reference position is lost and has to be reinitialised.

Once the encoder initialisation is completed, the menu "Motor" appears allowing the setting of the 'MOTOR AUTOMATIC' mode (see below 'Motor'). If the automatic mode is not desired, the option 'MOTOR STOP' has to be selected.

External trigger

The PDI5025 Integrator accepts also external trigger signals. The external trigger source (the active edge of which can be set by jumper) must be connected to the TRIG input of the 5150 Integrator module. The trigger pulses are not generated by the 5140 trigger module and the trigger sequence doesn't serve any purpose.

Warning:

- If two channels are used, care must be taken to connect the trigger signal to both channels (i.e. in parallel).

- The minimal time between two consecutive triggers is 1 ms. If the trigger rate is faster, the data acquisition run will stop with an error condition.

- Trigger signals must not occur during the autotest as this will cause the autotest to fail.

Following the start of the measurement sequence (see below "Data acquisition") each trigger signal defines the start of a new integration period. The measurement sequence is terminated by the

<Cancel> command in the "Data acquisition" menu after which the external trigger signals are ignored. The acquisition run is also terminated by the measurement buffer full condition (see below "Data acquisition").

External trigger with synchronisation

This trigger source is similar to the "External trigger" one but the trigger signals are disabled until the occurrence of the first synchronisation pulse which follows the start of the acquisition run. The external synchronisation signal is received on the SYNC input of the 5140 trigger module. Any following signals on the SYNC input are ignored.

Note: the synchronisation precision is better than 0.5µs.

4.5. Trigger sequence

[Hints: TAB and SHIFT+TAB to change field, direction keys to move cursor within sub sequences table, BACKSPACE to edit values.]

The integration intervals are delimited by triggers which are generated according to the trigger sequence (except in external trigger modes). Therefore the trigger sequence is one of the main parameters of the measurement. The trigger sequence is activated in the menu "Data acquisition" (see below).

Recall:

 - when an incremental encoder is declared, the encoder cycles are multiplied by 4 giving pulses.

 - The trigger sequence is irrelevant in external trigger source modes.

The fields forming the trigger sequence are:

sign of displacement (+/-): this field appears only when the trigger source mode involves an encoder (see above "Trigger source mode"). It gives the sense of the motor displacement. The up and down arrows toggle the sign.

starting position in ms or pls: this field sets the absolute position of the first trigger. In timer mode, it is the time (in ms) between the start of acquisition run or the synchronisation signal and the first trigger. In encoder mode, it is the number of pulses from the reference position (encoder with index or external synchronisation) or from the start of acquisition run (encoder without index). The choice of the sign of the starting value depends of the trigger source mode:
  - Timer: the value must be always positive.
  - Encoder without index: the value must have the same sign as the sign of displacement.
  - Linear encoder with index: the starting position can be positive or negative. The user has to check if the starting position is reachable.

- Rotational encoder with index: the sign must be always positive and the value cannot be greater than the number of pulses over one turn.

Subsequences table: this field is used to define the 20 subsequences forming the full trigger sequence. For each subsequence, the number of intervals and the interval length in unit of ms (timer mode) or pulses (encoder mode) are defined. The subsequences are executed consecutively without interruption until the first subsequence with a number of intervals equal to 0. Each subsequence can be different and not all have to be defined. The subsequences following the first one with a number of intervals equal to 0 are not taking in account.

Limitations:
- the total number of intervals cannot exceed 5200 (one channel active) or 2600 (two channels active) though values up to 65535 are accepted. If the number of intervals exceeds the maximal value, the data acquisition will terminate with a "buffer full" error condition (see below "Data acquisition").
- the interval length must always be positive. In rotational encoder with index mode, the interval length must be smaller than the total number of pulses over one revolution.

The three commands of the menu are:

The command <OK> validates the trigger sequence. Note that the validity of the sequence is not tested at this point but when the submenu "Data Acquisition" is selected (see below).

The command <clear all> clears all values of the trigger sequence.

The command <Cancel> returns to the main menu by restoring the trigger sequence previous to the call of the menu "Trigger sequence".

The status window displays the trigger sequence in the following form:

$$\text{Trigger : } s,a/n_1,C_1/\ldots/n_i,C_i$$

where:
  s = + or -   sign of the displacement (always + in timer mode).
  a = value   absolute starting position.
  n = 1 to 65535   number of intervals of the subsequence.
  C = 1 to 2^{23} interval length of the subsequence (in ms or pls).

Note: if the trigger sequence string is to large to be displayed in full, characters ".." at the end indicates that the display has been

truncated. The PDI5025 Integrator takes always into account the full
trigger sequence.

4.6. Data acquisition

[Hints: TAB and SHIFT+TAB to change field, shortcut keys for direct
        execution of a command.]

The menu "Data acquisition" handles the data acquisition procedure.
According to the trigger source mode and the trigger sequence, the
PDI5025 Integrator acquires the data which are transferred to the
computer. After decoding, data are loaded into the program's memory
and are available for visualisation, analysis and storage.

A background window displaying the actual parameters appears in
addition of the messages/commands window. During the execution of the
acquisition procedure, messages indicating the current stage are
displaying on screen and on the PDI5025 Integrator front panel.

The different stages of the data acquisition procedure are:

  a) sending parameters to the PDI5025 Integrator which tests them.
     If wrong parameters (e.g. trigger sequence) are detected, they
     have to be corrected before the acquisition menu is called
     again.

  b) waiting for the user to start the run. There are two
     possibilities to start the run. The first one is to validate the
     <OK> command by pressing ENTER. The second one is to press one
     of the 'FNC' buttons located on the PDI5025 Integrator front
     panel. If an encoder is declared and the automatic motor mode
     set, the PDI5025 Integrator starts the motor.
     The messages displayed are (on screen - on PDI5025 front panel):

               "Ready to start" - "RDY"

  c) waiting for the synchronisation signal (only if a
     synchronisation signal is used).
     The messages displayed are :

               "Wait for synchronisation signal" - "SYNC"

  d) execution of the trigger sequence according to the trigger mode.
     The messages displayed are :

               "Run in progress" - "RUN"

  e) processing of the data. The PDI5025 Integrator process the data
     in parallel with the run. Depending on the trigger rate, the
     processing may continue after the trigger sequence has been
     completed.
     The messages displayed are :

               "Run terminated"
               "Data processing in progress" - "CALC"

f) transfer of the data to the computer when the processing is completed. The time for the data transfer depends on the number of data and the communication parameters. It can last from few seconds to several minutes.
The messages displayed are :

"Data transfer in progress" - "READ"

Note: during data reading, no command, including <Cancel>, can be executed.

g) decoding of the data by the computer. The data are saved in program's memory in two forms : individual and cumulated values. The individual values are the flux changes from trigger to trigger. The cumulated values are the total flux changes from the first trigger to trigger delimiting the measurement.
The messages displayed are :

"Data read" - "END"

At almost any stage of the acquisition procedure, the following commands can be called:

The command <Motor> (see below "MOTOR") allows to drive a motor connected to the 5140 trigger module. The options 'MOTOR +', 'MOTOR -' and 'MOTOR STOP' can be activated independently of the trigger source mode. The option 'MOTOR AUTOMATIC' is only effective with a encoder mode.

The command <CANCEL> (or the ESC key) breaks the data acquisition procedure until the data reading stage has been reached. Depending of the breaking stage, no data is available to the computer. The command is used to terminate a data acquisition run in external trigger modes. The execution of trigger sequence can also be interrupted by pressing one of the 'FNC' buttons located on PDI5025 Integrator's front panel.

If an error condition occurs during the execution of the trigger sequence, a message is displayed. Most of the error conditions stop the trigger sequence execution. Usually the data until the occurrence of the error condition are available.

The different error conditions are:

"Overrange occurred" which means that the input voltage, of channel A or B, reached the positive or negative overrange threshold. The acquisition run is stopped following this error.

"Overlap timeout" which means that two triggers occurred within less than 1 ms. The acquisition run is stopped following this error.

"Data buffer full" which means that the internal data buffer is full. The buffer can store up to 5200 measurements (2600 per

channel if both channels are active). The acquisition run is stopped following this error.

"Encoder count error" which can occur only when an encoder with index is used. Each time the index is detected the PDI5025 Integrator verifies if the pulses which are counted are correct. If the check fails, the error is generated.

4.7. Offset adjustment

[Hints: UP and DOWN keys to select channel.]

The user has the possibility to reduce the linear drift of the integrator by adjusting the voltage offset at the input. The voltage offset depends greatly of the gain value. The OFFSET ADJUSTMENT mode facilitates this operation. This mode puts the integrator into an "infinite trigger sequence" using a 300 ms continuous integration period with the values being shown on the front panel display. The values are displayed in units of resolution of the integrator for the selected gain and VFC (for gain 1 to 100) or twice this resolution (for gain 200 to 1000). Therefore, for the 500 kHz VCO, the displayed units are :

Gain	Units*10^{-8} Vs
1	2000
2	1000
5	400
10	200
20	100
50	40
100	20
200	20
500	8
1000	4

The offset voltage is adjusted by turning the OFFSET potentiometer located on the front panel of the 5150 integrator module. When the adjustment mode is active, the user can bring the displayed value close as possible to zero.

Only one channel at a time can be set in the OFFSET ADJUSTMENT mode. The other channel, if present, is disabled and cannot be accessed.

There are two ways to active the OFFSET ADJUSTMENT mode:

- From the "Offset Adjustment" menu. If both channels are active, select the desired channel. After the offset adjustment mode has been activated, a new window appears. In addition of a status message, there is the possibility to turn on or off the internal short circuit at the input (see below "Internal short circuit"). The option is immediately activated and doesn't need further validation. The offset adjustment mode is terminated by executing the <Exit> command. The internal short circuit condition previous to the call of the menu is restored.

- by simultaneously depressing both buttons (GAIN and FNC) on the front panel of 5150 integrator module. To leave the OFFSET ADJUSTMENT mode push one of the two buttons. If the offset adjustment is activated by this way, it is recommended to not address the PDI5025 Integrator using the program PDITOOL.

After the offset adjustment mode has been quit, the integrator returns to its previous state. **Warning: in the case of an encoder with an index or an external synchronisation, the absolute position of the "zero" is lost and has to be reinitialised with the "Encoder Initialisation" submenu**

Note: Generally it is possible to correct the data for the input offset voltage after the acquisition. PDITOOL gives correction facility in the "Display data" menu (see below). Consequently it is not necessary to have a fine and frequent adjustment of the offset voltage.

4.8. Encoder initialisation

[Hints: UP and DOWN keys to select option.]

Note: this menu is accessible only if an encoder is declared in the trigger source mode (see above "Trigger source mode").

The use of an index pulse or an external synchronisation signal allows absolute measurements, the measurement sequence being referred to a fixed point. The reference point must be passed at least once to initialise it. This is done by using the "Encoder initialisation" menu. See "Trigger source mode" menu for a description of the different reference signals.

Three options are available:

MOTOR AUTOMATIC + : the motor is automatically activated into the forward direction until the reference signal is detected. After the reference signal has been detected, the motor is automatically stopped.

MOTOR AUTOMATIC - : similar to MOTOR AUTOMATIC + but in backward direction.

MOTOR MANUAL : this option doesn't active the motor. The PDI5025 Integrator waits for a signal at the SYNC input of the 5140 trigger module. The first signal initialises the reference position.

After an option has been activated, a new window appears. A waiting message is displayed which is replaced by a success message after the reference position has been found. If no reference signal is detected, the initialisation can be interrupted by using the <Cancel> command.

The reference position is lost when the PDI5025 Integrator is switched off, a new trigger source mode is selected or the offset adjustment mode is activated. The initialisation has to be repeated following one of these conditions.

Once the encoder initialisation is completed, the menu "Motor" appears allowing the setting of the 'MOTOR AUTOMATIC' mode (see below 'Motor'). If the automatic mode is not desired, the option 'MOTOR STOP' has to be selected.

4.9. Motor

[Hints: Up and DOWN keys to select option.]

As described in section 5.5 of the PDI5025 User's manual, a DC motor can be connected to the 5140 module to control the movements of the measurement coil.

Four options are available:

MOTOR START + **:** starts the motor in the forward direction.

MOTOR START - **:** starts the motor in the backward direction.

MOTOR STOP : stops the motor.

MOTOR AUTOMATIC **:** controls automatically the motor motion during a measurement cycle. Thus the motor starts when the acquisition run is started and stops when the measurement cycle is completed. The first parameter of the trigger sequence (see above) defines the motion direction. This option remains active and it is not necessary to set it before each measurement cycle. The option is cancelled by the other motor functions: MOTOR START +, MOTOR START-, and MOTOR STOP.

Note: the options MOTOR START +, MOTOR START - and MOTOR STOP can be used with any trigger source modes. The option MOTOR AUTOMATIC is effective only with a trigger source involving an encoder.

The "Motor" menu is reachable from the main menu or by the command <Motor> in the "Data Acquisition" menu (see above).

4.10. Sub commands

[Hints: TAB and SHIFT+TAB to change field, UP and DOWN keys to select options.]

Internal short circuit on channel A (or B)
It is possible to internally short circuit the measurement coil. The short circuit condition is selected independently for each channel. The option "ON" means that the input is short circuited. If the input of one or both channels is short circuited, a message appears in the status window.

Note: The short circuit is made by a semi-conductor analog switch and does not represent a real short circuit (due to the small residual resistance and leakage current in the switch). This fact must be taken into consideration when working with very high precision measurements.

Break on overrange
If "Yes" is selected, the measurement is broken if an overrange
condition occurs during a measurement.
If "No" is selected, the measurement is not broken down on the
occurrence of an overrange condition. This can be useful in some
case, but attention must be paid to the fact that the continuity
of the integration is lost. Use carefully this option.
The up and down arrows keys performs the choice between "Yes" and
"No".

4.11. Read trigger counter

[Hints: the command <Read> repeats the reading of the trigger
counter]

This menu gives the content, at calling time, of the 24 bits trigger
counter located in the 5140 trigger module. In timer mode, the value
is the number of ms elapsed from the start of the last acquisition
run. The counter is reseted at each acquisition run. In encoder
without index mode, the value is the position (number of pulses)
relative to the last starting position. If an index is used with the
encoder, the value gives the position (number of pulses) relative to
the reference point. The position is meaningful only after the
reference point has been initialised (see above "Encoder
initialisation").

4.12. About PDI

This menu gives information on keys used to deal with menus and
commands. The version of the program PDITOOL is given in the top
line. The command < PDI5025 Version > returns the EPROM version of
the connected PDI5025 Integrator.

4.13. Show/Print data

[Hints: TAB, SHIFT+TAB and shortcut keys to change field, UP, DOWN
        PGUP and PGDN keys to scroll data.]

The data in memory are numerically displayed. The header reflects the
conditions at data acquisition time (except for the drift correction
value) which can be different than the current ones.

If a drift correction has been applied to the data (see below
"Display data"), the corrected value are displayed and the correction
value appears in the header ("Drift =..").

The command <Print> send the data to the printer attached to the
computer.

Warning: Do not active the command <Print> if no printer is attached
to the computer. This can jam the execution of the program.

4.14. Save/Load data

[Hints: TAB and SHIFT+TAB to change field, alphanumeric keys to enter
       file's spec, directory and file's name.]

The purpose of this menu is to save and load PDI5025 Integrator's
data. The data can be saved into a file on hard disk or floppy disk
and can be reloaded into the program PDITOOL later. The files are
saved in ASCII format which allows a easy transfer to another program
(e.g. mathematical analysis) and printing. After a file has been
loaded, the data are treated the same way as fresh data.

The three parameters are:

File's spec: defines, according to MS-DOS syntax, the files or
group of files taken into account by the command <DIR> (see
below). If the field is empty, the default is *.* (all files).

Directory: defines the access path. An empty field restore the
default option which is the current directory.

File's name: defines the name of the file to be saved or loaded.
If no extension is given, the default one (.DAT) is applied.

The commands are:

The command <SAVE> stores the data in memory into a file. The
data in memory can be visualised by the menu "Show/Print data"
(see above) and are not altered by the command <SAVE>. If the
data have been corrected for the drift (see below "Display
data"), the corrected values are saved. The program prompts for
confirmation if the selected file exists already.

The command <LOAD> reads the selected file and put data into
program's memory. The file's header is checked and the loading is
rejected if it is not consistent with Metrolab's header.

The command <DIR> opens a window with the list of all files
defined by the options "File's spec" and "Directory". The
direction keys are used to move the cursor within the window. The
file defined by the cursor becomes the active one when the
command <OK> is executed, its name appears in the field "File's
name" of the menu "Save/Load data". If the cursor defines a
directory (previous or sub), the command <OK> lists the files in
this directory.

4.15. Display data

[Hints: UP, DOWN and shortcut keys to select display.]

The selected data in memory are graphically displayed. Some graphics
facilities (e.g. zooming) exist as well as correction facilities for
the integrator drift.

The options are:
Individual values channel A: flux changes from trigger to trigger
for channel A.

Cumulated values channel A: flux change from the first trigger for channel A.

Individual values channel B: same as individual values channel A but for channel B.

Cumulated values channel B: same as cumulated values channel A but for channel B.

After a option has been activated, the graphics window appears.

PDI5025-fcm: a fifth option is displayed:

Rearrange the data: this option allows the user to rearrange the order of the data in case of a Fast Cycle Measurement, to rebuild the shape of the event. When a message indicates that the rearrangement is finished, the result can be seen graphically with the above four options.
If the Fast Cycle Measurement is performed with the IFT mode, it is possible to correct the drift of the instrument **before** rearranging the data. (See PDI5025-fcm remark in section 4.4 and the "drift" command in section 4.15.2)
Warning: When the data are rearranged, **it is not possible to come back to the raw data.** So, it is recommended that the user save the raw data, using "Save / Load data" command in the main menu before rearranging the data.
Note: if the graphical display of a rebuilt event looks strange and garbled, that probably means that the values of the parameters in the "Fast trigger mode" sub-menu does not match the values of the trigger sequence.

4.15.1. Graphics window

In addition to the data, some useful information are displayed at the top and the bottom of the screen:

- the top line gives data file's name, selected channel (A or B), type of data (individual or cumulated) and the numbers of displayed points. If the data has not been linked (saved or loaded) to a file, file's name is replaced by 'UNTITLED'.

- the second and third lines define the axis's. The extremum values (minimum and maximum), the width of one division and the unit of each axis is given.

- the second line from the bottom appears only when the markers are present (see below). It gives information on the markers: coordinates and status (active or not).

- the bottom line gives the correction value for the drift applied to the data (see below "Drift"). The average value (when "Average" command is activated, see below) is also displayed.

Recall: a copy of the graphics window can be sent to the printer (if any attached) using the PRINT SCRN key. The copy screen in graphics mode is only effective after the DOS command "GRAPHICS" has been executed (see DOS manual for use and syntax).

The depression of the ENTER key replaces the top line by a line of menu. This menu access graphics commands.

4.15.2. Graphics commands

[Hints: shortcut keys to execute a command.]

Exit: returns to the menu "Display data".

Marker:

[Hints: space bar to toggle markers, RIGHT and LEFT keys to move markers.]

Enables and disables the markers. There are two markers (A and B) which are represented by two vertical lines (a full yellow line for the active marker and a dotted green line for the other one). To toggle the active marker between markers A and B, press the space bar. In addition to the markers, an information line appears at the bottom of the screen (second line from the bottom) giving the coordinates of the data points defined by the markers. The active marker moves from data point to data point unless the key is depressed many times quickly or if it is kept depressed. In this case the step is increased regularly allowing a fast displacement.

PDI5025-fcm: it is possible after a rearrangement of the data, that some points are in the same position on the 'X' axis. In this case, the displacement of the marker are still from one point to the next one but it is not apparently moving.

Zoom:

[Hints: space bar to toggle markers, directions keys to move markers, ENTER and shortcut keys to validate selected window.]

The top line menu is replaced by a new one and two sets of markers appear (two verticals and two horizontals). The markers are activated by pair (one vertical and one horizontal) and the space bar toggles both pairs. The displacement of the markers is not limited to data points. The values line gives the crossing coordinates of the two markers forming a pair.

The different zoom commands are:

The command ENTER displays the window delimited by the four markers.

The command "Y_Autom." displays the window delimited by the two vertical lines with a automatic vertical scaling (from minimal to maximal values).

The command "Zomm_All" displays the full window (zoom reset).

The command "Previous" displays the previous window.

The zoom commands require at least 3 data points inside the selected window. If the limit is reached, a beep is emitted by the computer.

Drift:

[Hints: shortcut keys to execute command, LEFT and RIGHT keys to move markers.]

This command is used to correct data for a linear drift. The drift is function of time (timer modes) or pulses (encoder or external triggers modes) and is expressed in unit of 10^{-8} V.s/s and 10^{-8} V.s/pls respectively. This is equivalent to a DC voltage at the input. On the individual values, the correction depends on the length of integration interval and appears as a offset. On the cumulated values, the drift correction depends on the time elapsed from the activation of the trigger sequence and appears as a straight line with a slope. The correction value is unique and independent for each channel and keeps effective until a new one is defined or new data are loaded. The "Show/Print data" and "Save/Load data" submenu handle corrected data (see above). The applied correction value appears in the file's header as in the bottom line of the graphics window.

The top line menu is replaced by the drift menu which gives access to three commands giving three possible ways to introduce a correction value:

The command "Marker" forces the two data points defined by the markers to the same cumulated value. The correction is extended to all points.

The command "two_Averages" forces the average value of two regions to the same level. The markers are used to define the regions. If both regions have the same centre, the program doesn't calculate a correction. As if the data points are not equidistant within a region.

The command "Manual entry" accepts direct value from the keyboard. This command is validated by the first numeric or sign key pressed. This command can be used to reset a drift correction by entering 0.

Cross: enables and disables the draw of the crosses at data points.

Grid: enables and disables the draw of the background grid. The grid is drawn every two divisions.

B-W/Col: enables and disables the use of colours for the graphics window. The black and white option can be useful when a "Print-Screen" is desired (see above "Graphics window").

<u>Average</u>: this command appears only when the markers are active. The average, the dispersion (sigma) and the number of data points delimited by the two markers are displayed on the bottom line.

Remarks:
- If data points within the delimited region are not equidistant, the average and dispersion values appears in bracket.
- The average value disappears as soon as the markers are moved or disabled.