

# User Manual

## DAS30 / DAS50 / DAS60

### High Speed Multi-Function Recorders



**BK PRECISION**

1.888.610.7664

 [www.calcert.com](http://www.calcert.com)

[sales@calcert.com](mailto:sales@calcert.com)

---

## Safety Summary

---

The following safety precautions apply to both operating and maintenance personnel and must be followed during all phases of operation, service, and repair of this instrument.



Before applying power to this instrument:

- Read and understand the safety and operational information in this manual.
- Apply all the listed safety precautions.
- Verify that the voltage selector at the line power cord input is set to the correct line voltage. Operating the instrument at an incorrect line voltage will void the warranty.
- Make all connections to the instrument before applying power.
- Do not operate the instrument in ways not specified by this manual or by B&K Precision.

Failure to comply with these precautions or with warnings elsewhere in this manual violates the safety standards of design, manufacture, and intended use of the instrument. B&K Precision assumes no liability for a customer's failure to comply with these requirements.

### Category rating

---

The IEC 61010 standard defines safety category ratings that specify the amount of electrical energy available and the voltage impulses that may occur on electrical conductors associated with these category ratings. The category rating is a Roman numeral of I, II, III, or IV. This rating is also accompanied by a maximum voltage of the circuit to be tested, which defines the voltage impulses expected and required insulation clearances. These categories are:

**Category I (CAT I):** Measurement instruments whose measurement inputs are not intended to be connected to the mains supply. The voltages in the environment are typically derived from a limited-energy transformer or a battery.

**Category II (CAT II):** Measurement instruments whose measurement inputs are meant to be connected to the mains supply at a standard wall outlet or similar sources. Example measurement environments are portable tools and household appliances.

**Category III (CAT III):** Measurement instruments whose measurement inputs are meant to be connected to the mains installation of a building. Examples are measurements inside a building's circuit breaker panel or the wiring of permanently-installed motors.

**Category IV (CAT IV):** Measurement instruments whose measurement inputs are meant to be connected to the primary power entering a building or other outdoor wiring.



Do not use this instrument in an electrical environment with a higher category rating than what is specified in this manual for this instrument.



You must ensure that each accessory you use with this instrument has a category rating equal to or higher than the instrument's category rating to maintain the instrument's category rating. Failure to do so will lower the category rating of the measuring system.

## Electrical Power

This instrument is intended to be powered from a CATEGORY II mains power environment. The mains power should be 115 V RMS or 230 V RMS. Use only the power cord supplied with the instrument and ensure it is appropriate for your country of use.

## Ground the Instrument

### WARNING

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical safety ground. This instrument is grounded through the ground conductor of the supplied, three-conductor AC line power cable. The power cable must be plugged into an approved three-conductor electrical outlet. The power jack and mating plug of the power cable meet IEC safety standards.

### WARNING

Do not alter or defeat the ground connection. Without the safety ground connection, all accessible conductive parts (including control knobs) may provide an electric shock. Failure to use a properly-grounded approved outlet and the recommended three-conductor AC line power cable may result in injury or death.

### WARNING

Unless otherwise stated, a ground connection on the instrument's front or rear panel is for a reference of potential only and is not to be used as a safety ground. Do not operate in an explosive or flammable atmosphere.

### WARNING

Do not operate the instrument in the presence of flammable gases or vapors, fumes, or finely-divided particulates.

### WARNING

The instrument is designed to be used in office-type indoor environments. Do not operate the instrument

- In the presence of noxious, corrosive, or flammable fumes, gases, vapors, chemicals, or finely-divided particulates.
- In relative humidity conditions outside the instrument's specifications.
- In environments where there is a danger of any liquid being spilled on the instrument or where any liquid can condense on the instrument.
- In air temperatures exceeding the specified operating temperatures.
- In atmospheric pressures outside the specified altitude limits or where the surrounding gas is not air.
- In environments with restricted cooling air flow, even if the air temperatures are within specifications.
- In direct sunlight.

This instrument is intended to be used in an indoor pollution degree 2 environment. The operating temperature range is 0°C to 40°C and 20% to 80% relative humidity, with no condensation allowed. Measurements made by this instrument may be outside specifications if the instrument is used in non-office-type environments. Such environments may include rapid temperature or humidity changes, sunlight, vibration and/or mechanical shocks, acoustic noise, electrical noise, strong electric fields, or strong magnetic fields.

### **Do not operate instrument if damaged**

---

#### **⚠ WARNING**

If the instrument is damaged, appears to be damaged, or if any liquid, chemical, or other material gets on or inside the instrument, remove the instrument's power cord, remove the instrument from service, label it as not to be operated, and return the instrument to B&K Precision for repair. Notify B&K Precision of the nature of any contamination of the instrument.

### **Clean the instrument only as instructed**

---

#### **⚠ WARNING**

Do not clean the instrument, its switches, or its terminals with contact cleaners, abrasives, lubricants, solvents, acids/bases, or other such chemicals. Clean the instrument only with a clean dry lint-free cloth or as instructed in this manual. Not for critical applications

#### **⚠ WARNING**

This instrument is not authorized for use in contact with the human body or for use as a component in a life-support device or system.

### **Do not touch live circuits**

---

#### **⚠ WARNING**

Instrument covers must not be removed by operating personnel. Component replacement and internal adjustments must be made by qualified service-trained maintenance personnel who are aware of the hazards involved when the instrument's covers and shields are removed. Under certain conditions, even with the power cord removed, dangerous voltages may exist when the covers are removed. To avoid injuries, always disconnect the power cord from the instrument, disconnect all other connections (for example, test leads, computer interface cables, etc.), discharge all circuits, and verify there are no hazardous voltages present on any conductors by measurements with a properly-operating voltage-sensing device before touching any internal parts. Verify the voltage-sensing device is working properly before and after making the measurements by testing with known-operating voltage sources and test for both DC and AC voltages. Do not attempt any service or adjustment unless another person capable of rendering first aid and resuscitation is present.

Do not insert any object into an instrument's ventilation openings or other openings.

#### **⚠ WARNING**

Hazardous voltages may be present in unexpected locations in circuitry being tested when a fault condition in the circuit exists.

#### **⚠ WARNING**

Fuse replacement must be done by qualified service-trained maintenance personnel who are aware of the instrument's fuse requirements and safe replacement procedures. Disconnect the instrument from the power line before replacing fuses. Replace fuses only with new fuses of the fuse types, voltage ratings, and current ratings specified in this manual or on the back of the instrument. Failure to do so may damage the instrument, lead to a safety hazard, or cause a fire. Failure to use the specified fuses will void the warranty.

### **Servicing**

---

#### **⚠ WARNING**

Do not substitute parts that are not approved by B&K Precision or modify this instrument. Return the instrument to B&K Precision for service and repair to ensure that safety and performance features are maintained.

### For continued safe use of the instrument

- Do not place heavy objects on the instrument.
- Do not obstruct cooling air flow to the instrument.
- Do not place a hot soldering iron on the instrument.
- Do not pull the instrument with the power cord, connected probe, or connected test lead.
- Do not move the instrument when a probe is connected to a circuit being tested.

### Safety Symbols

| Symbol                                                                              | Description                                                                                    |
|-------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
|    | indicates a hazardous situation which, if not avoided, will result in death or serious injury. |
|    | indicates a hazardous situation which, if not avoided, could result in death or serious injury |
|    | indicates a hazardous situation which, if not avoided, will result in minor or moderate injury |
|   | Refer to the text near the symbol.                                                             |
|  | Electric Shock hazard                                                                          |
|  | Alternating current (AC)                                                                       |
|  | Chassis ground                                                                                 |
|  | Earth ground                                                                                   |
|  | This is the In position of the power switch when instrument is ON.                             |
|  | This is the Out position of the power switch when instrument is OFF.                           |
|  | is used to address practices not related to physical injury.                                   |

# Contents

|        |                                                 |    |
|--------|-------------------------------------------------|----|
| 1      | Introduction                                    | 10 |
| 1.1    | Recording Modes                                 | 10 |
| 1.1.1  | Direct mode                                     | 10 |
| 1.1.2  | Memory mode                                     | 10 |
| 1.1.3  | Go No-Go mode                                   | 10 |
| 1.1.4  | File mode                                       | 10 |
| 1.1.5  | Power Analysis mode                             | 10 |
| 2      | Getting Started                                 | 11 |
| 2.1    | Measurement Types                               | 11 |
| 2.2    | Powering the Recorder                           | 11 |
| 2.3    | Connections                                     | 11 |
| 2.3.1  | Analog Inputs                                   | 12 |
| 2.4    | Ground the Recorder                             | 12 |
| 2.5    | Thermal Printer                                 | 13 |
| 2.5.1  | Loading Paper                                   | 13 |
| 2.5.2  | Storing Printed Recordings                      | 13 |
| 2.6    | Power-up Configuration                          | 13 |
| 2.7    | Routine Maintenance                             | 13 |
| 2.8    | Battery                                         | 14 |
| 2.8.1  | To recharge the battery                         | 14 |
| 2.8.2  | Safety precautions                              | 14 |
| 2.9    | Offset calibration                              | 14 |
| 2.10   | Default calibration                             | 15 |
| 2.11   | Screen brightness                               | 15 |
| 2.11.1 | Locking of the recorder                         | 16 |
| 2.12   | User mode                                       | 16 |
| 2.13   | Update of the internal software                 | 16 |
| 3      | Home Screen                                     | 17 |
| 4      | Setup Screen                                    | 19 |
| 4.1    | Logic channels                                  | 20 |
| 4.2    | Real time on-screen display of the measurements | 21 |
| 4.3    | XY display                                      | 24 |
| 4.4    | Digital display                                 | 24 |
| 4.5    | Trigger menu                                    | 25 |
| 4.6    | Memory output key                               | 25 |
| 4.7    | Record key                                      | 26 |
| 4.8    | Screen copy                                     | 27 |
| 5      | FILE MANAGEMENT                                 | 28 |
| 5.1    | Save setup files                                | 29 |
| 5.2    | Load setup files                                | 29 |
| 5.3    | Save data acquisitions                          | 29 |
| 5.4    | Recovery of the data acquisition files          | 30 |
| 5.5    | Transfer via FTP                                | 30 |
| 5.6    | Display under SeframViewer                      | 31 |
| 5.7    | Managing with SeframPilot                       | 31 |

|           |                                                                         |    |
|-----------|-------------------------------------------------------------------------|----|
| 6         | Direct Mode                                                             | 33 |
| 6.1       | Launching the printing                                                  | 33 |
| 6.2       | Configuration of print                                                  | 34 |
| 6.2.1     | Relaunching the printing                                                | 35 |
| 6.2.2     | Writing information                                                     | 35 |
| 7         | Memory Mode                                                             | 36 |
| 7.1       | Setup and start of the data acquisition                                 | 36 |
| 7.2       | Sampling period                                                         | 37 |
| 7.3       | Internal memory, blocks                                                 | 37 |
| 7.4       | Trigger position                                                        | 38 |
| 7.5       | Double Trigger mode                                                     | 38 |
| 7.6       | Recording                                                               | 38 |
| 7.7       | Memory output                                                           | 40 |
| 8         | File Mode                                                               | 42 |
| 8.1       | Setup and triggering of the data acquisition                            | 42 |
| 8.1       | Restrictions                                                            | 43 |
| 9         | Go/No Go Mode                                                           | 44 |
| 9.1       | Setup and launching of the data acquisition                             | 44 |
| 9.2       | Blocks: parting of the internal memory in blocks                        | 44 |
| 9.3       | Real time save: simultaneous record of the data acquisition into a file | 44 |
| 9.4       | Start: start condition of the data acquisition                          | 45 |
| 9.5       | Automatic: automatic stop when the block is full                        | 45 |
| 9.5.1     | Creation of the template                                                | 45 |
| 9.6       | Use of the template                                                     | 46 |
| 10        | Power Analysis Mode                                                     | 47 |
| 10.1      | Power Analysis                                                          | 47 |
| 10.2      | Network setup                                                           | 48 |
| 10.3      | Wiring and check                                                        | 49 |
| 10.4      | Fresnel diagram                                                         | 50 |
| 10.5      | Warning messages                                                        | 50 |
| 10.6      | Recording additional channels                                           | 50 |
| 10.7      | Real time display of the signals                                        | 50 |
| 10.8      | Power analysis setup                                                    | 52 |
| 10.9      | Parameter acquisition file                                              | 52 |
| 10.10     | Record launch                                                           | 52 |
| 10.10.1   | Manual launch                                                           | 52 |
| 10.10.2   | Automatic trigger                                                       | 53 |
| 10.10.3   | Parametric trigger                                                      | 53 |
| 10.11     | You can select a stop condition (recording time or manual stop)         | 53 |
| 10.11.1   | Trigger according to an inrush                                          | 53 |
| 10.11.2   | In version 1.1 of the firmware or later                                 | 54 |
| 10.11.2.1 | Trigger according to a duration or a date                               | 54 |
| 10.12     | Recordable parameters                                                   | 54 |
| 10.12.1   | Voltage and Current                                                     | 54 |
| 10.12.2   | Power                                                                   | 54 |
| 10.12.3   | Power Factor                                                            | 54 |
| 10.13     | Record                                                                  | 55 |
| 10.14     | Measurement process                                                     | 56 |

|          |                                             |    |
|----------|---------------------------------------------|----|
| 11       | Channel Setup                               | 57 |
| 11.1     | Analog channels                             | 58 |
| 11.2     | Type of measurement $\Delta V / \Delta t$   | 59 |
| 11.2.1   | Example                                     | 60 |
| 11.2.2   | Type of measurement $\int V dt$             | 60 |
| 11.2.3   | Example                                     | 61 |
| 11.3     | Additional functions between channels       | 62 |
| 12       | Triggers                                    | 64 |
| 12.1     | Analog channel trigger                      | 64 |
| 12.1.1   | Single threshold                            | 64 |
| 12.1.2   | Multiple thresholds                         | 65 |
| 12.1.3   | Example                                     | 66 |
| 12.1.4   | Parasites                                   | 66 |
| 12.1.5   | Trigger on Logic Channels                   | 66 |
| 13       | Math Functions                              | 68 |
| 13.1     | Definitions                                 | 68 |
| 13.2     | Types of calculations                       | 68 |
| 13.2.1   | Math Functions                              | 69 |
| 14       | Input - Output                              | 71 |
| 14.1     | Additional Input/Output Connectors          | 71 |
| 14.2     | Logic inputs                                | 71 |
| 14.2.1   | Use                                         | 72 |
| 14.3     | Alarm outputs                               | 72 |
| 14.3.1   | Use                                         | 72 |
| 14.4     | Power supply output                         | 72 |
| 14.5     | External voltage box input/output interface | 73 |
| 15       | Ethernet Interface                          | 75 |
| 15.1     | General                                     | 75 |
| 15.1.1   | Crossover cable                             | 75 |
| 15.2     | WIFI interface                              | 75 |
| 15.3     | FTP transfer                                | 76 |
| 15.4     | Managing with VNC                           | 77 |
| 15.4.1   | Changing the password                       | 77 |
| 15.4.2   | External software VNC Viewer                | 77 |
| 16       | Programming                                 | 78 |
| 16.1     | Message Format                              | 78 |
| 16.2     | Response Format                             | 78 |
| 16.3     | Message Syntax                              | 78 |
| 16.3.1   | Header                                      | 78 |
| 16.3.2   | Header separator                            | 78 |
| 16.3.3   | One or several pieces of data               | 78 |
| 16.3.4   | Data separator                              | 79 |
| 16.3.5   | Data                                        | 79 |
| 16.3.5.1 | Alphanumeric data                           | 79 |
| 16.3.5.2 | Decimal digital data                        | 79 |
| 16.3.5.3 | Text                                        | 79 |
| 16.4     | Message Response Format                     | 79 |
| 16.4.1   | Syntax                                      | 79 |
| 16.4.1.1 | Single Header                               | 79 |
| 16.4.2   | Data                                        | 80 |

|    |                           |    |
|----|---------------------------|----|
| 17 | Specifications            | 81 |
| 18 | LIMITED TWO-YEAR WARRANTY | 82 |
| 19 | Service Information       | 83 |

# Introduction

The DAS30, DAS50 and DAS60 programmable recorders measures and records voltage, current, temperature, etc. on up to 6 channels. The recorders also include digital input capabilities using the 12 logic input channels. An optional feature of the recorders is a port for measuring temperature with Pt100 or Pt1000 temperature sensors.

## 1.1 Recording Modes

Finally, the optional thermal printer adds the ability to print recorded signals (saved and in real-time).

### 1.1.1 Direct mode

Print measured signals to the thermal printer<sup>1</sup>

**Use** Print readings and/or charts. Useful for recording long duration signals.

**Enables** Complex triggers of the drawing, action after the end of the drawing, simultaneous recording to a file.

### 1.1.2 Memory mode

Quick acquisition into internal memory of the measured signals

**Use** quick short data acquisition (transient)

**Enables** complex triggers of the data acquisition, action after the end of the data acquisition, simultaneous record on file

### 1.1.3 Go No-Go mode

Quick acquisition into internal memory of the measured signals

**Use** quick short data acquisition (transient) for capture of non repetitive events

**Enables** complex triggers, particularly when outrunning a pre-recorded template from a channel, action after the end of the data acquisition, simultaneous record on file

### 1.1.4 File mode

Quick acquisition into internal memory of the measured signals

**Use** quick protracted data acquisition (only restricted by the size of the saving means)

**Enables** complex triggers, action after the end of the data acquisition, acquisition of very big amounts of data.

### 1.1.5 Power Analysis mode

single-phase network analysis

three-phase analysis, Aaron mode, Star and Delta. (two-wattmeter method) .

Data acquisition on internal memory.

<sup>1</sup> Requires Printer option installed at time of order

# Getting Started

You turn on the recorder by pressing the button at the top of the device.

When the device is on, the ON/OFF button is lit blue.

After launching the software, the recorder displays a homepage that specifies the hardware version, then switches automatically to the « **Direct display** » mode (oscilloscope).

You can display this homepage any time in the main menu by pressing .

To turn off the device, you only have to press the ON/OFF button twice.

If the device does not stop correctly, you must press the power button for 5 seconds and the recorder will shut off; in this case, the instrument configuration will not be saved.

## 2.1 Measurement Types

**Voltage** The voltage is measured between the red and black terminals of the inputs with wires and male security pin plugs (according to CEI 1010).

**Thermocouple Temp** The voltage resulting from thermocouple effect must be measured between the red and black terminals of the relevant input. To provide right measure values, connect the two ends of the thermocouple cord directly onto the quick fastening socket. Plug the two pin plugs onto the selected input with respect of the polarity. (Do not use welding male pin plugs: the welding would alter the thermocouple effect.)

**Platinum RTD** The Pt100 probe must be connected on the « I+ » and « I- » terminals.  
The voltage from the Pt100 must be measured between the « + » and « - » terminals with one of the two following mountings: 2, 3 or 4 wires. The 3 or 4-wire mountings make the measurement independent from the resistance of the line.

**Current** You can make current measurements by **shunt** between the red and black terminals of the relevant input.  
In this case, select the "**current**" type among the parameters of the relevant channel. Connect the measurement wires to the terminals of the shunt.  
The results are directly displayed in Amperes or milliamperes according to the caliber of the selected channel.

**Logic** Using the Logic input (25 pin connector) digital signals can included in the recording or used as triggers. The logic connector also includes pins that can be used as output signals (alarms) for other equipment. Up to 16 signals are available for recording and triggering and 4 signals for alarm outputs.

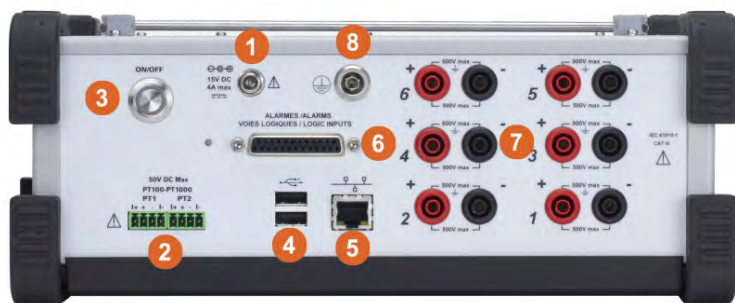
## 2.2 Powering the Recorder

Each recorder includes an internal rechargeable Lithium-Ion battery. The recorder is powered and charged by a 15 V 4 A charger. The charger included with the recorder is powered by 100-240 VAC at 50-60 Hz. The recorder runs with or without the power supply connected and provides up to 8 hours of power when running on battery. When the power supply is connected a green LED lights beside the 25-pin logic input connector.

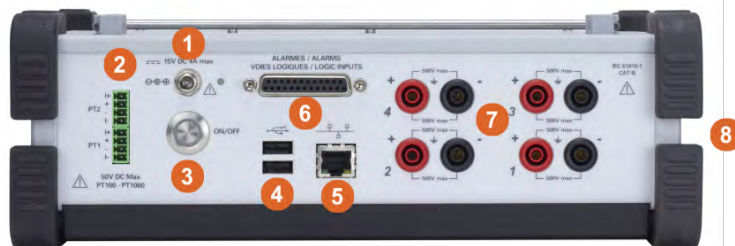
To turn on the recorder, press the button labeled "ON/OFF" located on the top surface of the recorder. When on, the ring around the button lights up blue. Battery charge state is shown on the front screen.

To turn off the recorder press the power button. A window will appear on-screen prompting for confirmation; press the green "Check Mark" to shut down the recorder. If the red "X" is pressed or if the green "check mark" is not pressed within 10 seconds, the recorder will not turn off.

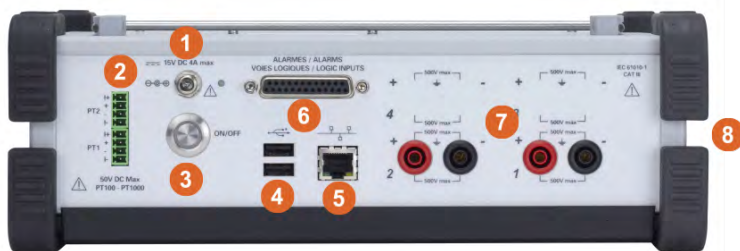
## 2.3 Connections



DAS60



DAS50



DAS30

| Item | Description             |
|------|-------------------------|
| 1    | DC Power                |
| 2    | PT100-PT1000 (optional) |
| 3    | Power Switch            |
| 4    | USB Ports               |
| 5    | Ethernet Port           |
| 6    | Logic Signal Connector  |
| 7    | Analog Inputs           |
| 8    | Grounding Terminal      |

**Figure 2.1** Recorder Connections

### 2.3.1 Analog Inputs

Isolated inputs have 2 shielded banana jack type terminals for each input:

**Red** Positive Input

**Black** Negative Input

The inputs are capable of measuring  $\pm 500$  VDC or 440 VAC.

For best results and to eliminate noise, twisting or shielding the leads is recommended. If the source of the signal you have to record has low internal impedance, use twisted wires. For high impedance signal sources, using shielded wires is recommended.

When gathering grounds from the various items on the measurement line, it is good to check that there is no voltage difference between them, in order to prevent any shortcut. If any doubt, make a measurement with a voltmeter on a low resistance (i.e.  $1k\Omega$ ) between the terminals.

### 2.4 Ground the Recorder

For safety, the unit should be connected to Earth ground. The recorder includes a terminal for this purpose located on the top surface of the DAS60 and on the right-hand side of the DAS30 and DAS50.

---

## 2.5 Thermal Printer

---

The DAS30, 50 and 60 recorders may be ordered with a thermal printer. The printer prints to 110mm wide thermal paper. Paper must always be loaded in the printer to avoid printing without paper and risking damage to the thermal print heads.

### 2.5.1 Loading Paper

---

- Lay the device on the right side
- Press the black button to open the door to the printer
- Install the paper into the receptacle ("no de ref" must be on the side of the plugs) and insert the paper through the slot in the door.
- Close the lid securely

**Note:** If the printer outputs paper and the paper is blank, it is possible that the paper is loaded upside down.

**Note:** Only one face of the paper is heat-sensitive. Reversing the paper at loading will result in the absence of any printing out.

### 2.5.2 Storing Printed Recordings

---

In order to maintain the quality of the paper recordings, the following is recommended:

- Avoid using laminated sleeves
- Store away from light, in a dry and cool place.
- Store in a cardboard sleeve

---

## 2.6 Power-up Configuration

---

At power-up, the recorder will be configured how it was when it was shut down. If it becomes inconsistent, the recorder may need to be repaired. Contact B&K Precision for service information.

A default setup can be loaded from the "Setup Screen".

---

## 2.7 Routine Maintenance

---

Maintenance simply consists of cleaning the outside the device. The recorder should be periodically cleaned.

- Use water and soap to clean the metal surfaces
- never use any product that contains petroleum products, benzene, or alcohol. These may damage screen printed details.
- Wipe all surfaces with a soft lint-free cloth
- Use some antistatic screen cleaner for the touchscreen

## 2.8 Battery

The device is equipped with a lithium-ion battery (Li-ion) that should last at least 200 full charge cycles. It is shipped charged. Upon receipt or if the device has remained unused for more than one month, check its status and recharge if necessary. When the battery is nearly discharged, the device will close all open files and shut itself off.

To extend the life of the battery:

- Avoid complete discharge
- Do not store the batteries too long without using them
- Store the battery charged to 40%
- Do not fully charge or discharge the battery before storage.

**Note:** Any service on the battery requires dismantling of the device and should be done by a B&K staff.

### 2.8.1 To recharge the battery

1. Connect the provided external power supply on the jack plug of the device
2. Connect AC power to the charger

When the internal charger starts loading the battery; the green light of battery charge will light. Charging may be done when it is on or off. When the battery is full, the green light turns off automatically. The recorder can run from AC power indefinitely.

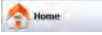
### 2.8.2 Safety precautions

- Never heat up or expose the battery to fire
- Never shunt parts of the battery: risk of explosion!
- Do not puncture the battery
- Do not dismantle the battery pack
- Do not reverse the polarities of the battery
- This battery pack includes a protective item that shall not be damaged or removed
- Do not store the pack in a place exposed to excessive heat
- Do not store the device in a vehicle in direct sunlight

**Warning:** When the charger is connected to the device, the metal frame is grounded.

## 2.9 Offset calibration

Calibration of the recorder inputs for voltage and thermocouple offsets can help remove any offsets present on each channel. All enabled analog channels are calibrated when the offset calibration is performed. Disable any channels that should not be calibrated.

1. Let the device work for 20 minutes (ambient temperature 68 - 77 F)
2. Enable all desired channels in the channel configuration menu
3. Short the terminals of the active channels
4. Go to the setup menu
  1. Press 
  2. Press 
5. From setup, go to calibration
  1. Press 
  2. Press 
6. Press . The recorder will perform the offset adjustment and save the values when complete.

---

## 2.10 Default calibration

---

To return the instrument to the factory calibration values, use the “Recover factory calibration” function.

1. Go to the setup menu
  1. Press 
  2. Press 
2. From setup, go to calibration
  1. Press 
  2. Press 
3. Press “Recover factory calibration” and confirm the operation by pressing the green check mark.

---

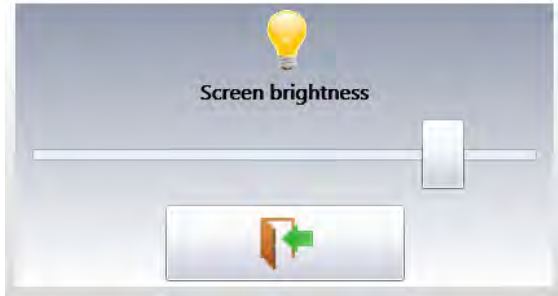
## 2.11 Screen brightness

---

Screen brightness is set in the setup screen under “Additional Options”.

1. Go to the setup menu
  1. Press 
  2. Press 
2. From setup, press 
3. Press 

4. Use the slider to adjust screen brightness.



5. Press the “Return” button to accept the change.

### 2.11.1 Locking of the recorder

The touchscreen of the recorder can be disabled by locking the recorder. Press  and then the green check mark to lock the recorder. The recorder will enter lock mode in 10 seconds.

To unlock the recorder, press   5 times. This button is located at the top right of the screen.

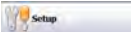
## 2.12 User mode

User mode disables most configuration settings leaving other menus available.

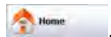
**The password is: Sefram.**

## 2.13 Update of the internal software

Software updates to the recorders may be available. These updates are available on the Sefram website in the “Software Updates” section. Only update the recorder when connected to power and/or with a charged battery.

1. Copy the file to USB stick
2. Plug the USB stick into one of the USB connectors
3. Press 
4. Press 
5. Press 
6. Select the update file
7. Initiate the update and wait till it is complete. The internal software automatically copies the files required for the new version.
8. Restart the recorder

# Home Screen

The home screen provides access to all of the settings and functions of the recorder. It is accessed by pressing .



| Item | Description           | Item | Description              |
|------|-----------------------|------|--------------------------|
| 1    | "Direct Mode"         | 11   | Logic Setup              |
| 2    | "Memory Mode"         | 12   | X-Y Plotting             |
| 3    | "File Mode"           | 13   | Start Recording          |
| 4    | "Go/No Go Mode"       | 14   | Chart Mode               |
| 5    | "Power Analysis Mode" | 15   | Display Stored Recording |
| 6    | Startup Screen        | 16   | Numeric Display          |
| 7    | "Setup Screen"        | 17   | Logic Channel Status     |
| 8    | "Channel Setup"       | 18   | Analog Channel Status    |
| 9    | "Triggers"            | 19   | Screen Capture Button    |
| 10   | Channel On/Off Menu   |      |                          |

**Figure 3.1** Home Screen

Pressing the buttons on screen activates the different modes and menus. Some areas, like the Analog Channel Status on the left side of the screen, also have areas within them to open configuration screens. For example when not in Power Analysis mode, the analog channels are shown. Pressing in one of the channels opens a configuration screen for that channel like [Figure 3.2](#).

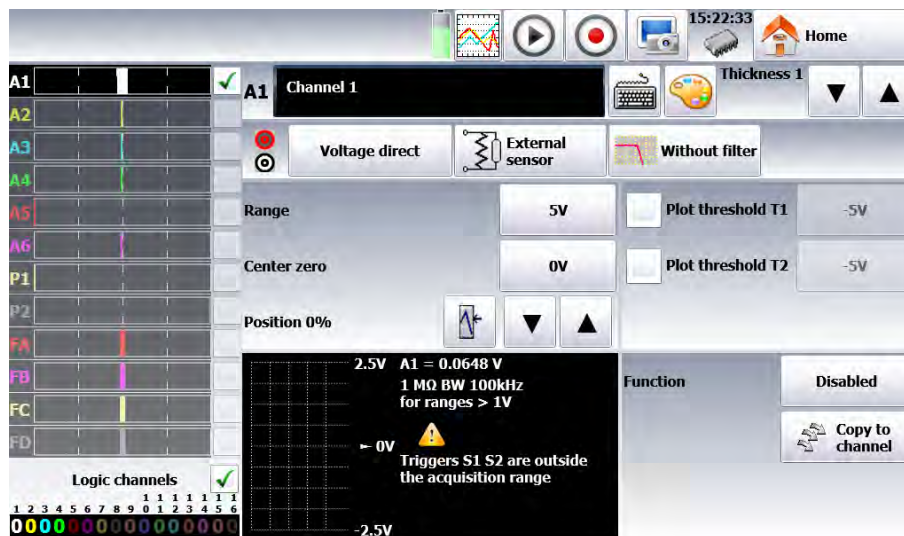


Figure 3.2 Single Analog Channel Configuration Screen

# Setup Screen

General configuration of the device, monitoring of the alarm outputs, network address TCP/IP, calibration of the channels, update of the internal software.

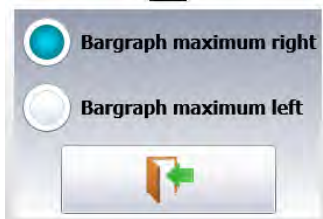


Figure 4.1 Setup Screen

1. Language:



2. Screen shutoff time setting
3. System time settings
4. Graphic Options: The display orientation of the data in the bargraph (**Item 15**)



**Right** Max value to the right

**Left** Max value to the left

5. Additional option: More settings



6. Software update: update of the internal software (see chapter Presentation)

7. Default setup: Set all settings to default values

8. Load on disk: load a stored configuration from memory (internal or USB drive)

9. Save on disk: save the current configuration to memory (internal or USB drive)

10. Export to a text file

11. Network: Setup and status of network communication.

12. Alarm: Setup and status of the alarm outputs A, B, C or D.

13. Alarm setup keys

14. Logic channel status and states

15. Bargraph showing live measurements

## 4.1 Logic channels

The 16 logic channels can be recorded simultaneously with the analog channels.

To set the parameters of the logic channels, you can press the « logic channels » menu on the main window or directly press the logic channels part at the bottom of each configuration window:

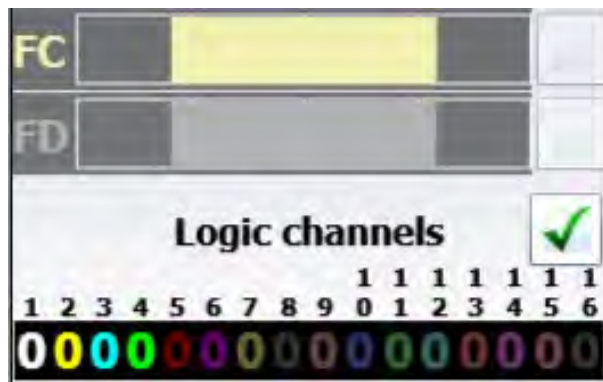


Figure 4.2

You access the configuration page of the logic channels:



Figure 4.3

1. Selection of the name of each channel on screen
2. Selection of the color of each channel on screen
3. Logic validity: validation of the data acquisition and plotting of the logic channels
4. **Validation of the channels**

You can validate or not the channels to record or print out in the various configuration menus of the recorder.

In order to validate or not the record or the printing of a channel, you must check (to validate) or uncheck (not to validate) the checkbox right to the bargraph of the channel.

4. « Direct display » key 

## 4.2 Real time on-screen display of the measurements

1. Screen configuration: configuration of the display of measurements on screen. Selection of the mode of graphic display:
  - $F(t)$
  - XY
  - Digital measures (full screen)
  - Full screen to display the reticule on the whole screen (mode  $f(t)$ )
  - Colors to customize the display (background, reticule, cursor)
  - Graphic option
  - Custom reticule
2. Channels validation: Validation of the channels to display

If the logic channels are actives, you shall select whether the diagram of the logic channels should be distinct from the analog channels or not (see chapter 4.3.3).

Freeze screen: freeze the measurements on screen to make measurements by cursors, make calculations, save or print the measures on screen (1000 dots) in  $F(t)$  mode.



Figure 4.4

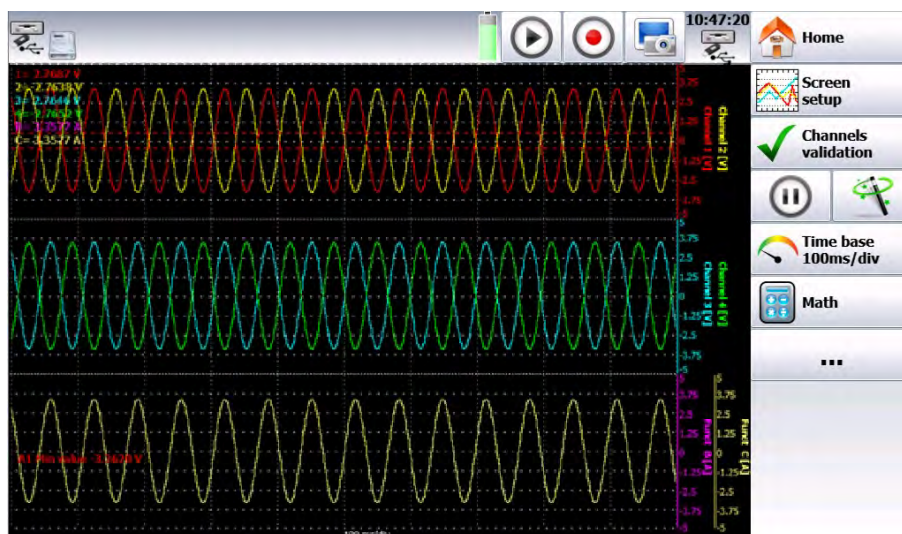


Figure 4.5

You get access to:

**Relaunch** – relaunches the sweep

**Time Cursors** displays the vertical cursors (2) to make measurements on the screen; move the cursor by selecting it with your fingers or the mouse.

**Voltages Cursors** displays the horizontal cursors (2) to make amplitude measurements on the screen; proceed like for the time cursors to move them. You can also change the caliber / zero to expand and move your measurement on screen.

1. Autoset: This function allows you to have automatically the caliber of the active channels and the time base compatible with the frequency of the signal.
2. Time base: Allows you to settle the time base.
3. Math: Makes it possible to display values of mathematical calculations on screen.
4. Access to the channel configuration page:

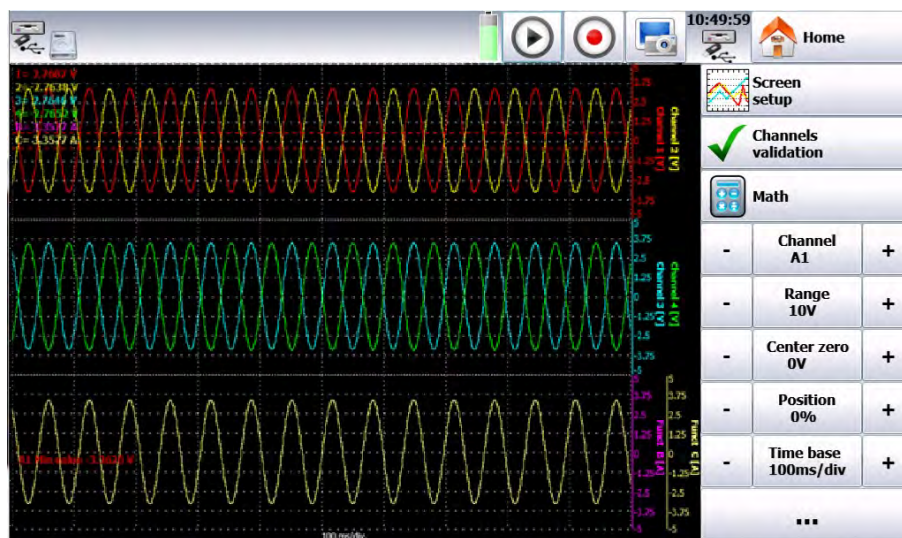


Figure 4.6

1. Screen setup: configuration of display of measurements on screen Selection of the graphic display mode:
  - $F(t)$
  - XY
  - Digital measures (full screen)
  - Full screen to display the reticule on the whole screen (mode  $f(t)$ ) Colors to customize the display (background, reticule, cursor).
  - Graphic option
  - Custom reticle
2. Channels validation: Allows you to activate or deactivate the channels.
3. Math: Displays values of mathematical calculations on screen.
4. Selection of the channel to modify (with the « + », « - » and central keys).
5. Modification of the range of the selected channel (with the « + », « - » and central keys).
6. Modification of the position of zero (with the « + », « - » and central keys).

7. Modification of the position of the selected channel (with the « + », « - » and central keys).
- 8- Time base: Allows you to adjust the time base.
8. Back to the previous page.

### 4.3 XY display

The **XY** display mode makes it possible to display the validated channels in real time one against the other. One of the channels defines the horizontal axis; the other channels provide dots on the vertical axis.

You can access the XY mode via the main menu by pressing .

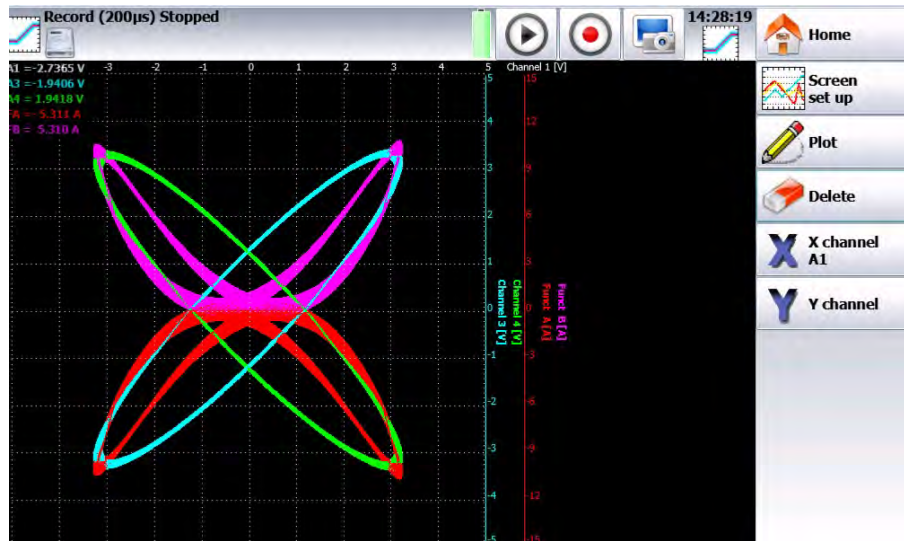


Figure 4.7

1. Screen setup: configuration of the display of measurements on screen. Selection of the mode of graphic display:
  - $F(t)$
  - XY
  - Digital measures (full screen)
  - Full screen to display the reticule on the whole screen (mode  $f(t)$ )
  - Colors to customize the display (background, reticule, cursor)
  - Graphic option
  - Custom reticule
2. Plot: starts or stops of the plot
3. Delete: erases the screen
4. X channel: selection of the channel on the horizontal axis (sweep)
- 5- Y channel: the Y channels are the valid channels

### 4.4 Digital display

The **Digital display** mode displays the digital values of all channels in real time on screen. When pressing one of the channels, you access directly to the parameter page of the corresponding channel.

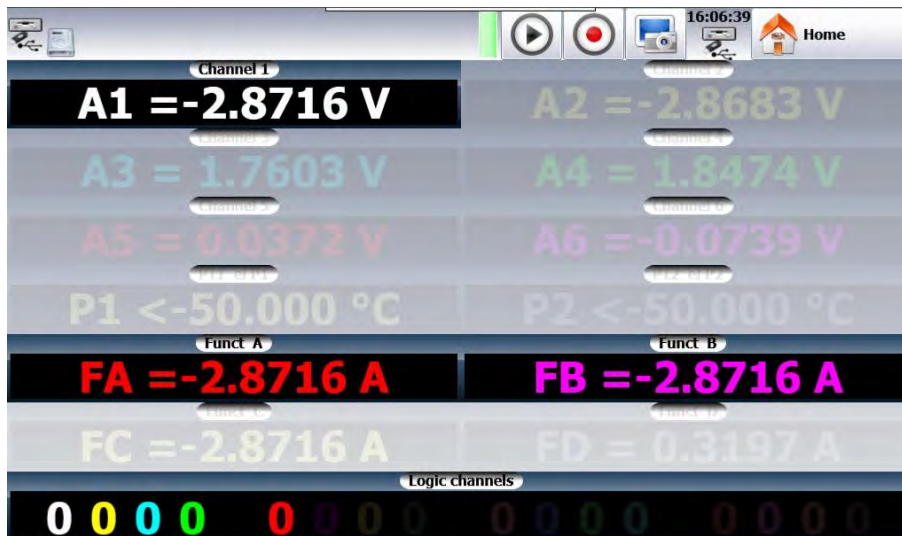


Figure 4.8

## 4.5 Trigger menu

Programming the start and stop conditions for the paper print in Direct mode, and the data acquisition conditions for the channels in Memory, File and Template modes.

Selection of the actions after data acquisition or plot and validation of the save in real time.



Figure 4.9

The program of triggers is different according to the pending mode (Direct, Memory, File or Template). See the chapter of the pending mode for more details.

## 4.6 Memory output key



Display on screen of the data acquisitions available from the internal memory or from files of the internal memory or an USB stick.

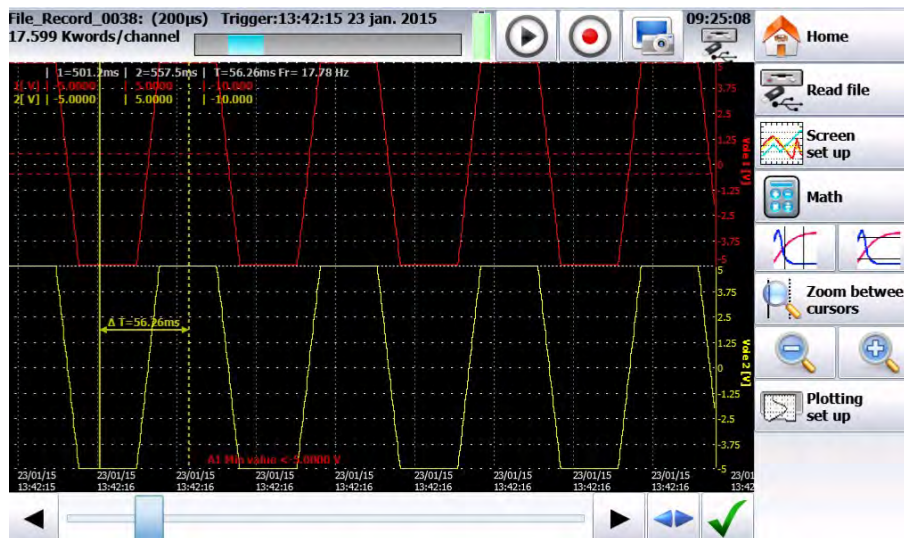


Figure 4.10

This function includes the same commands as the « **Direct display** » function.

The « **Read block or file** » command allows you to select the memory block (zone inside the internal memory) or the file to display.

When pressing this key, the following window pops up:



Figure 4.11

- Block number: number of the memory block to display
- Read file: selection of the file to display
- Write data to file: save the current display into a file



When the size of the data acquisition to display is big, it may take time to recover and display the dots.

The display is made in 2 phases:

- A quick phase to display the frame of the data acquisition: some dots may not appear
- A slower phase where all data acquisition dots are displayed: the advancement percentage is displayed at the bottom of the screen.

## 4.7 Record key



This key has various effects according to the current mode of the device.

**Direct** mode: launches the paper printing if the trigger is in manual **Start**; else, the device waits for the start condition.

**Memory** mode: launches the data acquisition into internal memory; the device waits for the start condition

**Template** mode: launches the data acquisition into internal memory; the device waits for the start condition

**File** mode: launches the data acquisition into file; the device waits for the start condition

**Network analysis** mode: real time data acquisition directly into the internal memory (there is no trigger)

In all cases, to force the record to start or stop when the conditions registered in the recorder are not met, you only have

to press  (to force the record) and  (to force it to stop).



In **Memory**, **Template** or **File** mode, the device switches automatically to display of the current data acquisition.



shows up at the top of the screen, with:

- the pending block number, if relevant
- the current sampling rate
- the status of the data acquisition (stand-by, pending xx%, ...)
- the opening of a save file, if relevant
- a bargraph specifying the percentage of data acquisition achieved and the percentage of data acquisition displayed

## 4.8 Screen copy

You can create a file copying the content of the LCD screen:

You only have to press  at the top right of the screen.

The file will be created either onto the USB stick, if there is one, or into the internal memory.

The name of the file will be bmpxxxxx.bmp (incremental name).

In the internal memory, files are saved in the « FolderBMP» directory.

You can either copy this directory into an USB stick, or delete it.

You can also use a ftp link to recover these files.

# FILE MANAGEMENT

## General

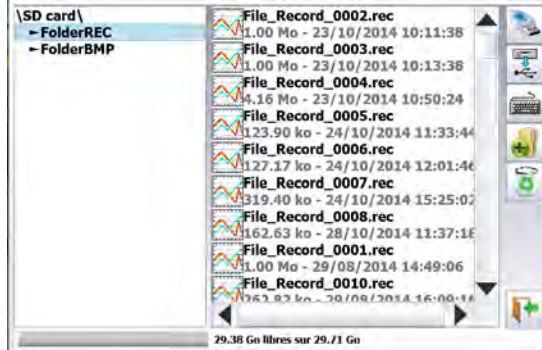
For all possible files, the device has an internal flash disk available and may accept an USB stick, which makes it possible:

- to save and load the total configuration of the recorder
- to save or restore a data acquisition.

The names of the setup files have a "cnf" ex-voltage.

The names of the data acquisition files have a "rec" ex-voltage.

You can create directories and save the files into them.



**HD / USB stick** : read/write into the internal flash disk or an USB stick (if it was connected at the start of the device)

**Copy of a file to USB** : copy the selected file or directory to an USB peripheral

**Type the name of a new file**

**Create directory** : creation of a new directory; you can type its name with the alphanumerical keyboard displayed on screen

**Erase** erases the selected directory or file

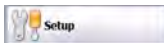
**Close the window**

**Directory Selection** : Allows you to select the directory to work with **8- Selection of the file window:** Allows you to select the file to work with



It is highly advisable to work in a directory and not at the root of the flash disk When erasing a directory, all files in this directory will be erased too.

## Management of the configuration files

The configuration file management page is linked to the  key. There name bear the "cnf" exvoltage.



**Reset** : sets up the device in standard configuration

**Load from disk** : loads a configuration from a file in the internal flash disk or an USB stick

**Save to disk** : saves a configuration into a file in the internal flash disk or an USB stick

**Save ASCII file to disk** : saves a configuration into ASCII file in the internal flash disk or an USB stick

## 1 Save setup files

Press **Save to disk**

You can type the name of the file with the alphanumerical keyboard displayed on screen.



Advice: Do not save files to the root of the disk; create directories for a more efficient management.

## 2 Load setup files

Press **Load from disk**

Select the directory and then the file to load, and click **Load**.

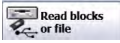


Attention: you will lose the pending configuration.

## 3 Save data acquisitions

There are 2 ways to save data acquisitions into the device: - in **Manual** mode after a data acquisition - in **Real Time** during a data acquisition.

**Manual:**

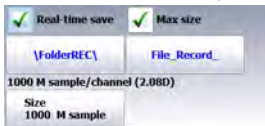
Available under every mode; you can access it from the  function after stopping



1. Read block: lire un bloc mémoire
2. Selection of the block to read
3. Read a recorded file
4. Write data into a file: Record the data displayed on screen into another file.
5. Close the window

- **Real time:**

Available in **Direct**, **Memory** and **Template** modes after validation of **Real Time Save** in the triggers page:



As soon as the record is launched, the device saves the samples into the file. The file closes when the data acquisition is done.



If the data acquisition is waiting for a start trigger, the device records into the file all points before this trigger. When the data acquisition stops, the file will include more points than the memory block that was used for the data acquisition.

In both cases – Manual or Real Time record – the date of the file is the date when the file was closed.

**Name of the files:** the name of each file is made of 12 characters plus one 4-cipher number. The device will automatically increase this number at each record.

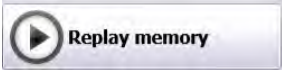
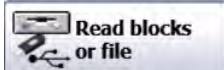
Only the validated channels (i.e. in **ON** position; see chapter **Use**) will be recorded into the file.

Before writing into the file, a pop-up reminds you the saved channels and the number of points per channel.

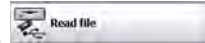
The file is made of:

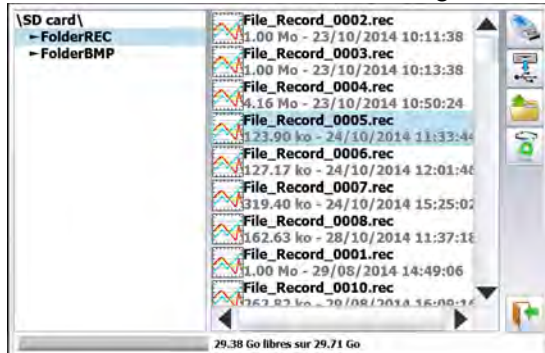
- a header, including the information later required to recover the file (the setup of each channel, the sampling rate, etc.).
- the N samples (1 sample = 2 bytes per channel).

## 4 Recovery of the data acquisition files

Press  from the main menu, then  .  
The following window pops up:



Select  . The following window pops up:



Select the place and the name of the file to load and display on screen, then press .

### Operating software

Data acquisition files may be transferred to a PC computer.

The SeframViewer software is provided on a CD-ROM with the device. It makes it possible to display the recorded files or convert them as xls or txt files.

It works under WINDOWS XP, 2000, Vista, Seven, 8 with Framework 2.0

Transfer of files from the recorder to the PC:

o USB peripheral o Thanks to the FTP protocol.

## 5 Transfer via FTP

- Using SeframPilot:

The ftp transfer is made directly by SeframPilot: if the IP address is for DAS60, validate with



- Using Windows Explorer:

You can create a favorite icon:

- Go to Tools → Connect to a network driver
- Click Open a storage session or a network server
- Under Internet network address , type ftp:// and the IP address of the recorder.

You can give a name to this link that will always be active among network favorites .

You get a direct access to the directories of your recorder, which contain the data acquisition files: main directory on the internal flash disk of your device.

Once selected the directory where you record your data acquisitions, you can rename, move, copy and delete them.

**Note:** You cannot read a file in real time while recording it.



You cannot delete a file while the recorder reads it.

Transfer your files to your computer to use them with the SeframViewer or FLEXPPO software.

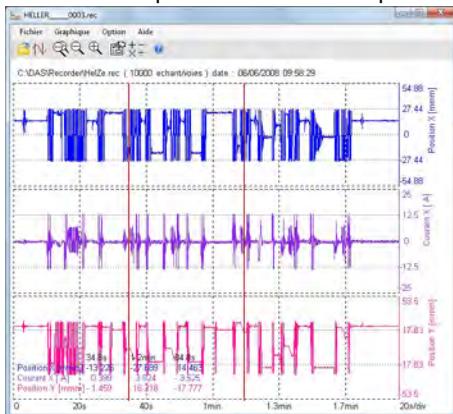
## 6 Display under SeframViewer

Launch SeframViewer (or double-click on a file) Open a.REC file.

You can select:

- the channels to display
- the display mode  $f(t)$  or  $xy$
- the autocalibration of the channels.

Your data acquisition file shows up on screen. SeframViewer functions are available.



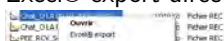
Refer to the user's manual included in the software to discover all functions of SeframViewer by clicking the last icon:

**Help .**

You can also directly create a result file (text or Excel file) by launching the following line in the Windows® command mode: (see Menu, sub-menu Help Options) Example:

C:\SeframViewer monfichier.rec /x : direct creation of an Excel file C:\SeframViewer monfichier.rec /t : direct creation of a text file.

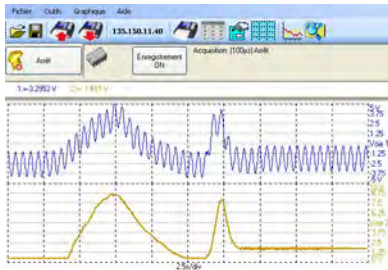
Excel® export directly launches Excel in the explorer.



## 7 Managing with SeframPilot

You can manage the recorder directly from SeframPilot. This software allows you to:

- Manage setups (creation and change setup files)
- Start and stop records
- Load data blocks
- Load files thanks to Windows Explorer through FTP
- Launch SeframViewer
- Real time display of data in F(t) format



# Direct Mode

This chapter describes the **Direct mode** of the recorder, designed to print out the measurements made on the channels in real time on heat-sensitive paper.



This mode does not exist on models without integrated printer.

You can start and stop the print out under various conditions.

You can activate a simultaneous save of the measurements on file.

## 6.1 Launching the printing

Press .

Programming the start and stop conditions of the print.

Selection of the actions after print and validation of the save in real time.



Figure 6.1

- F(t): printing a graph as a function of time
  - Digital: printing digital values of the measurements as a table
2. **Paper speed:** printing speed

You can change it from 10mm/min to 20mm/h.

2. Print configuration: see chapter 4.2
3. Start: start condition of the print

- Manual: with the  key
- Trigger: with a channel, with a combination of analog and logic channels (see chapter 5)
- Stand-by: after a delay or at a precise date and time

4. Stop: stop condition of the print

- Manual: with the  key
- Trigger: with a channel, with a combination of analog and logic channels (see chapter 5)
- Stand-by: after a delay or at a precise date and time
- Paper length: after printing a programmed length of paper

5. After acquisition: action after the end of the print; only possible if the start and stop triggers are not Manual

- Stop: no action
- Relaunch: waiting for the trigger Start
- Save to file: saving or not of the data acquisition into a file

6. Save: simultaneous record of the measurements into a file

- Simultaneous save: saving or not the simultaneous save
- File: record to a file o Name of the file: directory and name of the saving file o Acquisition period: sampling rate of the channels o Length of the max file.



See chapter **File mode** to know the restrictions of the recording on file.

If an initial scroll speed has been programmed, the paper will scroll at that speed while waiting for a trigger.



The operator can force a trigger any time by pressing  when waiting a start trigger.

When printing, pressing  will stop the printer.

## 6.2 Configuration of print

In the “Direct Mode” configuration screen, press  to open the “Plotting Setup” screen. See [Figure 6.2](#)



Figure 6.2 Print Setup

Definition of the specific characteristics of the paper printing:

**Reticule** : setup of the reticule on paper

- none, all 5mm, 10mm or per integer number of divisions
- fine or wide, which means with or without subdivisions
- access to the « Modification of diagrams » to setup the display of channels on paper (see chapter **Diagrams**)

**Name of the plot** setup of a title (80 characters max.) for printing. It will appear on top of the paper.

**Boundaries** possibility to note the boundaries of each channel (same as on screen) at the end of the print.

**Notes** possibility to write notes while printing without, at the beginning of the printing, on alarm, on a length of paper

### 6.2.1 Relaunching the printing

In relaunch mode, as soon as stop conditions happen, the device waits for new start conditions for the print out.

To terminate the cycle, you only have to force the interruption of the print by pressing  during the print.

### 6.2.2 Writing information

At the beginning of each printing, the date and time and the programmed title appear at the top of the paper.  
The number of each channel appears on the plot.

# Memory Mode

This chapter describes the **Memory mode** designed to record in real time the measurement data made on the channels into the internal memory.

You can start and stop the data acquisition under various conditions. You can simultaneously save measurements on file.

## 7.1 Setup and start of the data acquisition

Setup of the data acquisition into internal memory. Press  to open the setup screen, see **Figure 7.1**.



**Figure 7.1** Memory Mode Setup

1. Blocks: parting of the internal memory in blocks
  - 1, 2, 4, 8, 16, 32, 64 or 128
  - Erase blocks: erasing of all blocks: the current block is #1
2. Acquisition period: sampling rate of the channels
  - internally paced from 1 $\mu$ s to 10min
  - externally paced by the logic channel 16
3. Start: start condition of the data acquisition
  - Manual: with the  key
  - Trigger: with a channel, with a combination of analog and logic channels
  - (see chapter 5)
  - Stand-by: after a delay or at a precise date and time
  - Automatic: imimageste; automatic stop when the block is full

4. Stop: stop condition of the data acquisition
  - Automatic: when the block is full
  - Trigger: with a channel, with a combination of analog and logic channels (see chapter 5)
  - Trigger mode: Double Trigger; see the following chapter.
5. Real time save: simultaneous record of the data acquisition into a file
  - directory and name of the saving file
  - maximum length of the file
6. After acquisition: action after the end of the print; only possible if the start and stop triggers are not Manual
  - Stop: no action
  - Relaunch: waiting for the start trigger
  - Save to a file: Saving or not the data acquisition into a file
7. View of the active channels, of the recording time, of the pre-trigger...

**Pre-trigger** definition of the position of the Start trigger in the data acquisition - data acquisition before and after trigger (before or after Start), and disabling of the trigger.



« **Impossible** » shows up when there is not enough place for saving data: you should reduce the sampling rate or the number of channels



See chapter **File mode** to know the restrictions of the recording on file.

## 7.2 Sampling period

When the frequency of the input signals is too high to record them in Direct mode, you must record the measurement signals into memory at high sampling rate: it is the **Memory mode**.

Sampling consists in recording the instant value of a signal at regular intervals and storing each of these values into a memory.

To get adequate acquisition of a periodic signal, you need to choose a sampling period compatible with the frequency of the signals present at the input terminals of the recorder.



A 10-dot per signal period definition is minimal for a satisfactory plot.

## 7.3 Internal memory, blocks

The available memory in the recorder can be shared into blocks that will be filled one after the other at each data acquisition.

The acquisition depth is worth  $N / (B * V)$

N= total memory amount

B = number of blocks

V = number of channels to scan

Example: memory 32 Mwords, 16 blocks and 3 channels 'ON', we shall have:  $N = 32\,554\,432 / (16 * 3) = 699\,050$  words/channel.

Any new data acquisition goes automatically into the first free block (in increasing order).

When all blocks are full, any new data acquisition will shift the previous blocks from the N position into the N-1 position; the 1<sup>st</sup> block will be lost.

The new data acquisition will take the place of the last block.

## 7.4 Trigger position

The data acquisition into a memory block relies on the concept of « circular buffer »:

- the buffer is filled from the starting condition on
- the buffer is filled as long as the stop condition is not valid; when the buffer is full, it fills from the initial position of the buffer zone (block)

Thus, the memory block always contains the last N samples.

The operator can select when the samples in buffer will be frozen; to do so, you will select a delay between the trigger start and the beginning of the effective buffering.

This delay may be positive or negative: thus, buffered samples may be before, after or on both sides of the start moment. You can also not inhibit the trigger: you will be able to test the trigger during the pre-trigger phase, in case the trigger should happen before the end of this phase. In case of repetitive signals, the trigger should be inhibited.

Delay to memory input: -50% Delay to memory input: +50% from the 1<sup>st</sup> position of buffer from the 1<sup>st</sup> position of buffer

## 7.5 Double Trigger mode

In this mode, you will use a start trigger and a stop trigger.

Measurements between these two triggers shall be registered.

Data acquisition will stop automatically: - when the stop condition is valid, or - when the memory block is full.

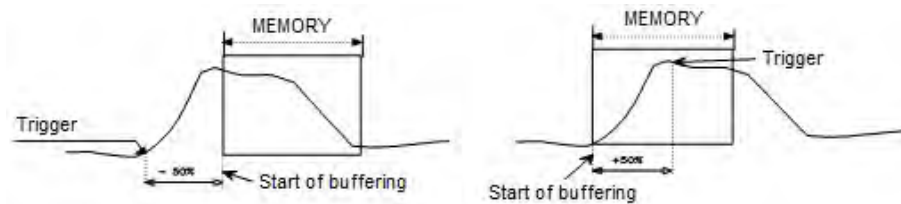


Figure 7.2

## 7.6 Recording



Start data acquisition by pressing  after pressing .

At the top left of the screen appear:

- the number of the pending block, if required
- the current sampling rate
- the status of data acquisition (waiting for trigger, filling xx%...)
- the opening of a save file, if required
- a bargraph showing the percentage of data acquisition made and the percentage of data acquisition displayed

Pressing  stops the pending data acquisition process.



If the acquisition time of the record is less than 2 minutes, you will see the whole data acquisition.

Then, you won't be able to leave this page: only when the acquisition stops can you change of menu.

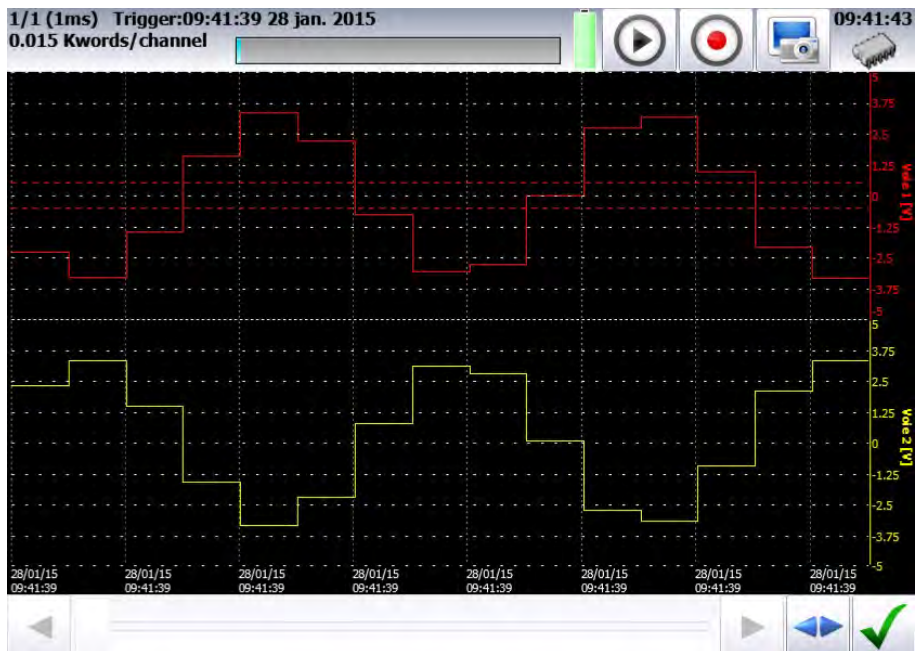


Figure 7.3



For longer acquisition time, you can zoom onto a part of the data or change of page.

When changing of menu page, you can return to data acquisition by pressing

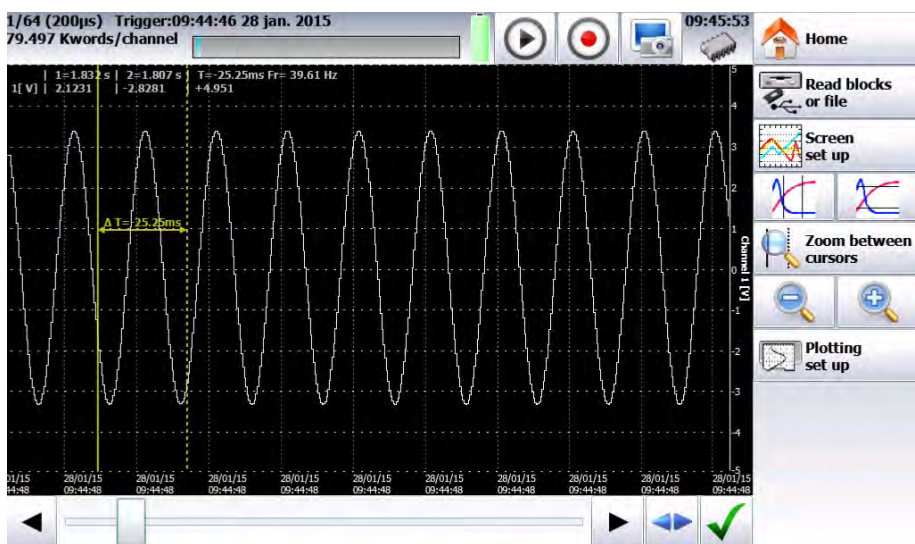


Figure 7.4

Additional menu keys: Display:

-  Total : the whole memory is displayed and refreshed during the data acquisition.

- Partial : only a part of the memory is displayed; the screen is frozen; only the bargraph and the filling rate show the status of data acquisition; you have access to time cursors and zooms.



You cannot visualize a block else than the current one, draw a plot or save the data acquisition into a file as long as the current data acquisition is not finished.

## 7.7 Memory output



You can access the « memory output » mode by pressing

Display of the data acquisitions available in the internal memory or in files. Possibility to start the paper printing of the data acquisitions.

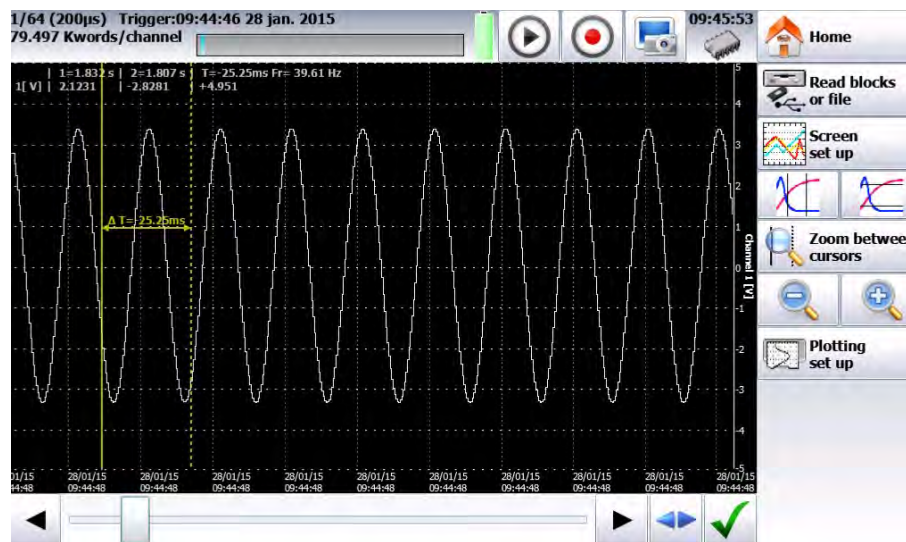


Figure 7.5

1. Read blocks or file: selection of the memory block or of the file to display; if there is no valid block, the only menu key available will be « Load file »
2. Screen setup: type of display, diagrams; see chapter Use
3. Time cursors: vertical cursors, zoom
4. Voltage cursors: horizontal cursors
5. Zoom between cursors: allows a zoom between the positioned cursors
6. Zoom + & Zoom -: allow zooming or not onto a part of the data acquisition
7. Plotting setup: configuration of the data acquisition drawing; « Launch plot » key
8. Total display of the data acquisition
9. Validation of the buffered channels to display 10- Cursor for scrolling along the data acquisition.

The upper window displays:

- the number of the displayed block
- the sampling rate of the block

- the date of trigger
- the number of points per channel in the block
- a bargraph showing the filling level of the block and the position of the trigger

# File Mode

This chapter describes the **File Mode** designed to record in real time the measures made on the channels. The start and stop of the plot can be triggered under various conditions.

## 1 Setup and triggering of the data acquisition

Press .

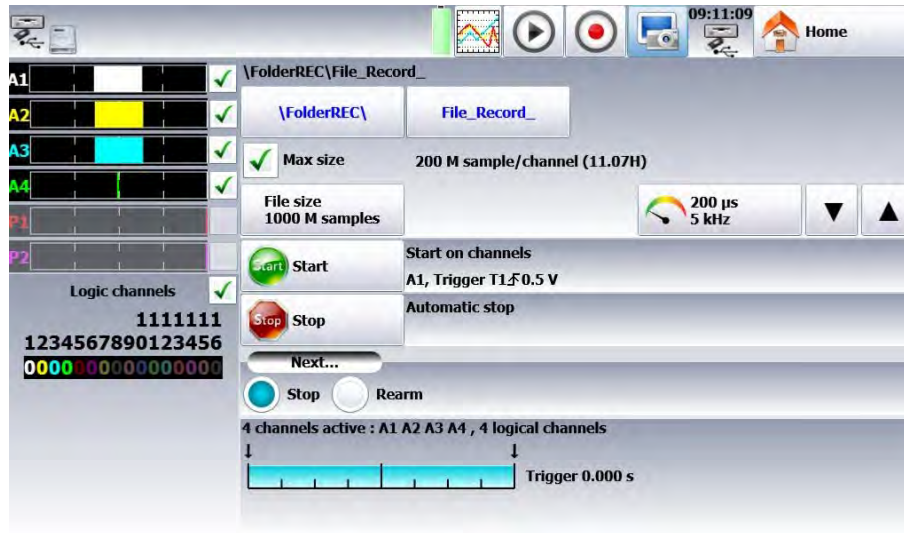


Figure 8.1

1- File name: directory and name of the data acquisition file

- Directory of the data acquisition file
- Name of the data acquisition file

2- Acquisition period: sampling speed of the channels

- internally paced from 1 $\mu$ s to 20min
- externally paced by the logic channel 16

3- Start: start condition of the data acquisition

- Manual: with the  key
- Trigger: with a channel, with a combination of analog and logic channels (see chapter 5)
- Stand-by: after a delay or at a precise date and time

10.2

File Mode

- Automatic

4- Stop: stop condition of the data acquisition

**Automatic** when the disk is full

**Trigger** with a channel, with a combination of analog and logic channels (see chapter 5)

Trigger mode **Double Trigger**; see chapter **Memory mode**.

---

## 8.1 Restrictions

---

Real time data acquisitions to a file are limited by the transfer rate between the inputs and the saving means of the internal memory or USB sticks.

It is advisable not to create too big files, because reading them may be very long. It takes ca. 3 minutes to read a 200MB file.

The minimum transfer rate to the flash disk is 100 Kwords/s (10 $\mu$ s)

To know the number of channels you can record at a given acquisition period, calculate:

number of channels = 100 000  $\times$  acquisition period example: at 20 $\mu$ s, the number of channels is max. 2.

# Go/No Go Mode

This chapter describes the “Go/No Go” designed to record in real time the measurement data made on the channels into the internal memory.

You can start the data acquisition under various conditions. It **stops** when the measurement values go out of a range defined by a previous data acquisition called **Template**.

A simultaneous save of the measurements onto a file can be activated.

## 9.1 Setup and launching of the data acquisition

Press 

Setup of the data acquisition as a template into internal memory.

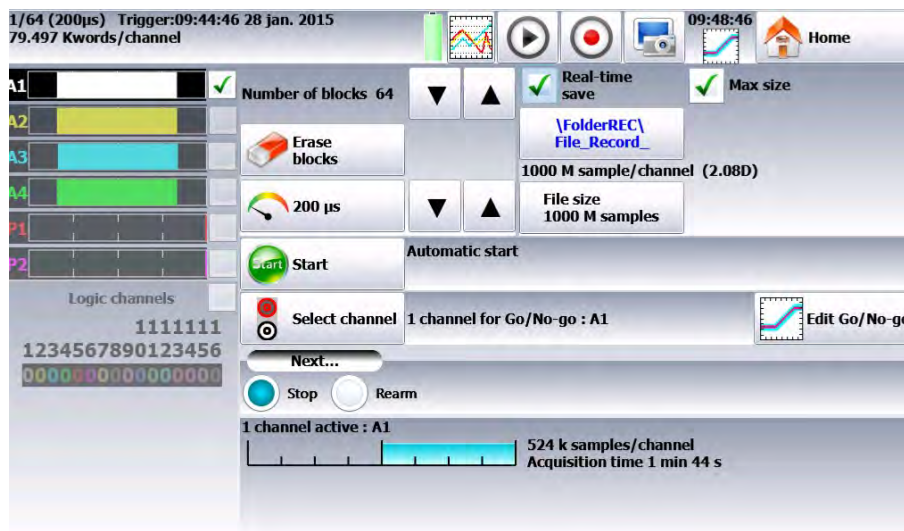


Figure 9.1

## 9.2 Blocks: parting of the internal memory in blocks

- 1, 2, 4, 8, 16, 32, 64 or 128
- Erase blocks: erasing of all blocks: the current block is #1 1- Acquisition period: sampling speed of the channels
- internally paced from 1µs to 20min
- externally paced by the logic channel 16

## 9.3 Real time save: simultaneous record of the data acquisition into a file

- directory and name of the saving file
- maximum length of the file

## 9.4 Start: start condition of the data acquisition

- Manual: with the  key.
- Trigger: with a channel, with a combination of analog and logic channels (see chapter 5)
- Stand-by: after a delay or at a precise date and time

## 9.5 Automatic: automatic stop when the block is full

1. Template channels: channels to compare with the template; access to the setup of the template
2. After acquisition: action after the end of the print
  - Save file: save the data acquisition into a file if the Real Time save has not been validated (or is impossible)
  - Draw: plotting the data acquisition
  - Stop: no other action
  - Relaunch: waiting for the Start trigger
  - Change setup: loading a configuration and waiting for the Start trigger



« **Impossible** » shows up when there is not enough place for saving data: you should reduce the sampling rate or the number of channels



See chapter **File mode** to know the restrictions of the recording on file.

### 9.5.1 Creation of the template

Make a data acquisition into memory.



Press , then select .

The device displays the current template. It is marked as 2 curves (a min. curve and a max. curve) around the channel selected as a reference for the template.

The 2 curves are saved in internal ROM.

1. Channel: allows the selection of the reference channel
2. DX & DY: allow you to build the min. and max. curves
3. Begin & End: limits of the memory extent where the trigger test shall be made
4. Save Go/NoGo: as soon as the template is correct, you can save it into the internal ROM.



You cannot save a template on a **file**. To save a template on a file, save the block and the channel in order to recreate the template for reuse.



Figure 9.2

## 9.6 Use of the template

The comparison with the template is the stop criterion of the data acquisition. This comparison shall be made with the « **Template Channels** » selected in the  page.

The information window at the bottom of the page  sums up the general configuration of the data acquisition:

- channels and functions between validated channels for data acquisition
- channels and functions between channels compared to the template
- number of points per channel (as a function of the number of blocks)
- total data acquisition time (as a function of the acquisition speed)
- position of the trigger (as a function of pre-trigger phase)

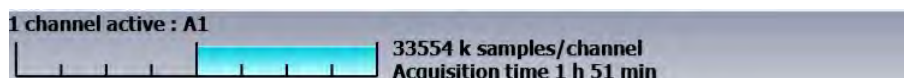


Figure 9.3



The comparison to the template is only possible when the channels are validated for data acquisition. An error message shows up if you have selected « **Template Channels** » that have not been validated.

The data acquisition is made as above (see chapter **Memory Mode**).

When the memory block is full, the device checks that all measured points on the template channels are between the 2 min. and max. reference curves constituting the template.

If all points are between the curves, the data acquisition restarts (in the same block). If not, the data acquisition stops.

# Power Analysis Mode

The recorder also includes a network analysis function. It allows power and harmonics measurements. Measured values can be viewed in real time or delayed. You can also record the available logic channels and channels.

You can access the network analysis menu with the  key.

## 10.1 Power Analysis

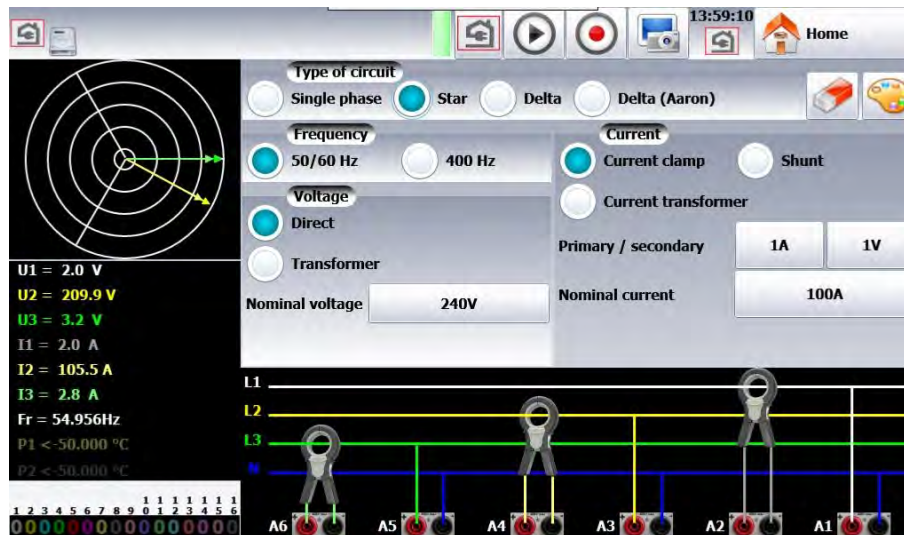


Figure 10.1

1. Setup of the network analysis
2. Changing the color of the various measurements (voltage, current, power...)
1. Measurement mode of the current (clamp, shunt, transformer)
2. Parameters of the current measurement (conversion from the measured value and the value sent to the recorder)
3. Nominal current in the phase conductor
4. Wiring scheme
5. Logic channels (validation and parameter setting)
6. Display of the measured values
7. Phase diagram
8. Type of network
9. Parameters of voltage
10. Value of the nominal voltage
11. Frequency of the network to analyze

The setup page shows up. It lets you access various parameters:

- Description of network and wiring



Figure 10.2

- Selection of the type of analysis and of the desired values

You can also access other menus:

- Visualization (Oscilloscope, Digital, Harmonics):  key.
- Acquisition:  key.



**Attention:** The connections of the inputs on the installation to test shall be made by a duly authorized personal.

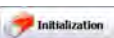


In network analysis the DAS60 should be strictly connected to its external power supply and connected to the socket : this for security reasons ensuring earthing.

## 10.2 Network setup

In the main menu, change of mode by pressing . You directly access the setup page.  
Select the basis configuration of the network:

- single-phase
- three-phase mode Aaron: Only 2U and 2I are used. The 3<sup>rd</sup> phase is re-calculated (method of the double-wattmeters).
- three-phase mode Star/ Delta

The  key allows you to set up the channels in a basis configuration:

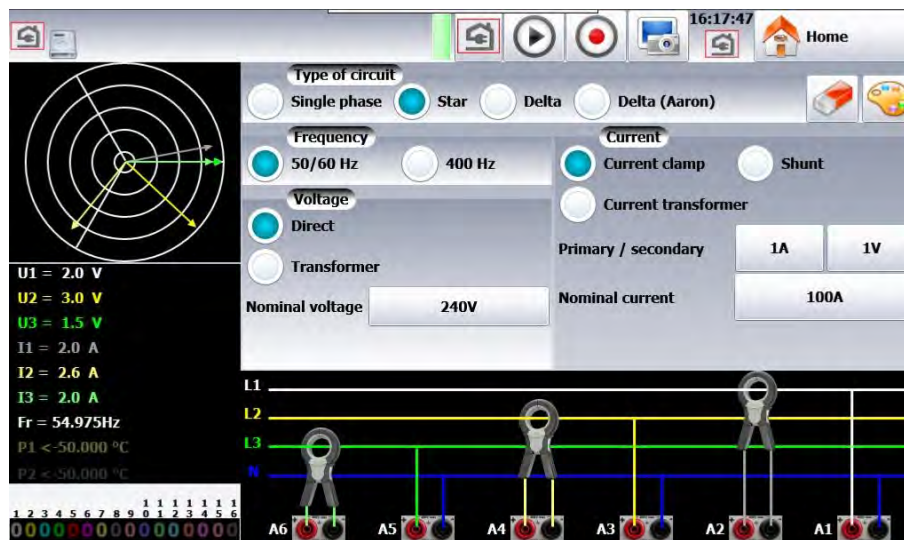


Figure 10.3

- Voltage measurement: « Direct » or « Transformer ». If the network voltage is measured through a transformer, select this setup and enter the transformation ratio
- The device automatically selects the right caliber; you only have to specify the nominal voltage of the networks. Beware: if this value is too different from the real voltage, this may lead to uncertainty and measurements over the caliber
- Current measurement: The same is worth as for voltage measurement; you select the current type of input (clamp, shunt, transformer). In each configuration, you have to enter the associated parameters.
- For "clamp": primary current, secondary voltage (these are current / voltage clamps)
- For "transformer" (transformer + shunt): primary and secondary currents and value of the shunt
- For "shunt": value of the shunt, in ohms
- You also have to set the nominal current and voltage
- Data acquisitions are synchronized with the calculation of frequency of channel 1.

### 10.3 Wiring and check

Direct display of the network wiring. Any wrong wiring may lead to wrong results. The colors of the channels match the colors of the respective inputs.

The voltage inputs U1, U2 and U3 are connected to the terminals 1, 3 and 5. The current inputs I1, I2 and I3 are connected to the terminals 2, 4 and 6.

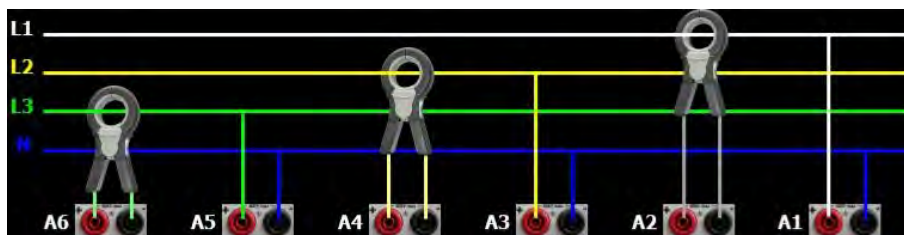


Figure 10.4

## 10.4 Fresnel diagram

You can also check if the wiring is right by displaying the Fresnel diagram. The length of the arrows is not proportional to the efficient value of the currents: the user will have to check that what he sees is coherent.

The position of the voltage arrows is calculated with reference to the voltage V1.

Attention: the angles are those of the voltages/currents representative either of the shape factor or of the fundamental values.

You can check whether the connection is direct or reverse. Intensity vectors are calculated in reference to the corresponding voltages.



**Attention:** even if nothing abnormal appears, there may be mistakes. In any case, the wirings must be made with caution by a qualified personal.

## 10.5 Warning messages

Messages may appear in red any time at the top of the screen:

- Impossible to synchronize the signal: the frequency is wrong, the signal is too weak or too noisy
- Caliber exceeded: The voltage or the current are too high for the theoretical nominal value: you must change this value or use another probe.

## 10.6 Recording additional channels

You can record additional channels by checking channels to record in the setup of your network analysis. The number of channels will change as a function of the network (single phase: more additional channels, three phases: less additional channels):

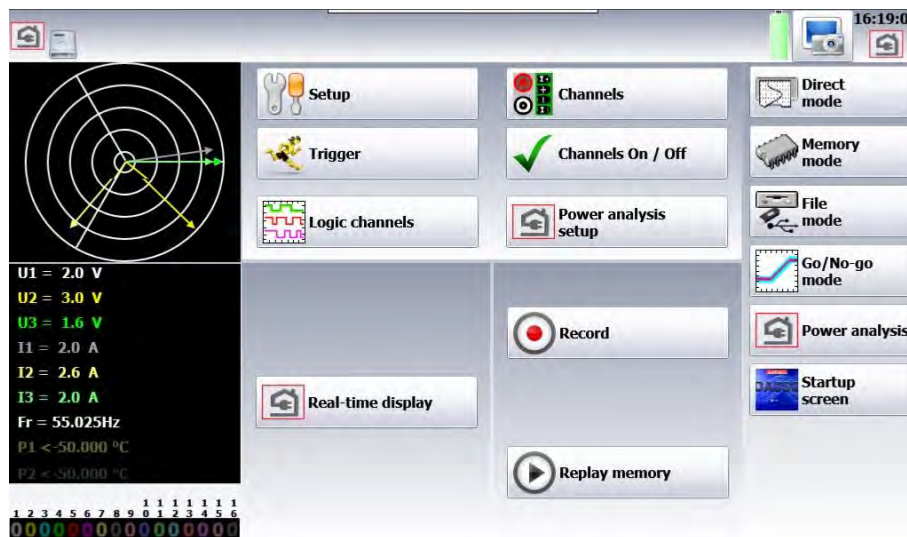


Figure 10.5

## 10.7 Real time display of the signals

By pressing , you have access to the following windows. You have access to this page even during data acquisition.

Each of these windows can be invalidated by pressing .

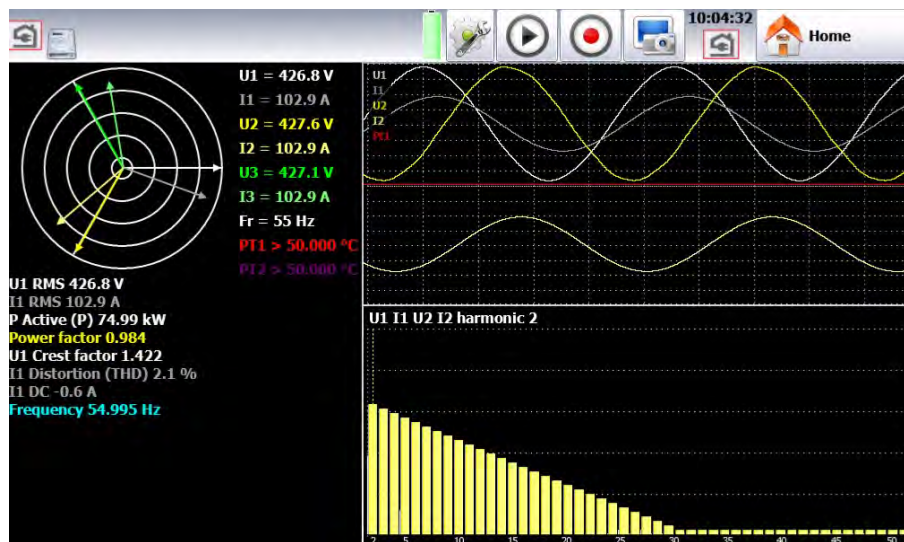


Figure 10.6



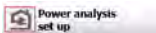
Figure 10.7

- Fresnel diagram: display of the signal and of the RMS values of the inputs and of the frequency.
- Oscilloscope: This mode allows you to know the true shape of the signals; hence, it will help you detect wiring mistakes.
- The time basis depends on the frequency of the signal (at least one alternation)
- You can change the reticules and the position of the displayed channels.
- Harmonic display: This window is updated ca. once a second.

- Selection of the channels: you select either all the voltage channels (U1, U2, U3) or all current channels (I1, I2, I3) or all network channels (U1, U2, U3 + I1, I2, I3) or only one channel (these channels are also used to record harmonics).
- Sampling frequency: 200µs
- Number of points: 2048
- A cursor allows you to display the value of the selected harmonic
- Parameters: display of the values of each parameter.

At any moment, you can copy the screen into a bitmap file (on a hard disk or a USB stick) by pressing .

## 10.8 Power analysis setup

Press  to open the setup menu. Once the device is set up, you still have to set the type of measurement to make: you can make a power analysis or an energy analysis.

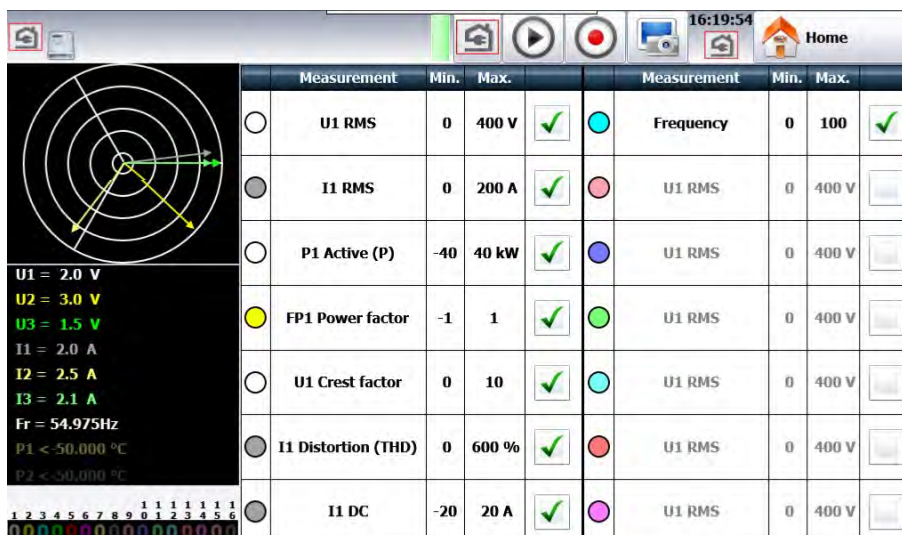


Figure 10.8

## 10.9 Parameter acquisition file

You should first set the sampling period and the directory of the file.

There is no trigger: as soon as the record is launched, the values of the parameters are saved in real time into the file; the data acquisition stops when pressing  in the acquisition page.

## 10.10 Record launch

### 10.10.1 Manual launch

You only have to press the record key to launch the record. You can select a stop condition (recording time or manual stop)

### 10.10.2 Automatic trigger

You only have to press the record key to launch the record, but no stop condition is possible unless manually.

### 10.10.3 Parametric trigger

The record is launched according to a TRUE condition of a given parameter, of a value and of a comparison. You will find the list of the parameters you can use at

## 10.11 You can select a stop condition (recording time or manual stop)

| Measurement         | Min. | Max.  |
|---------------------|------|-------|
| U1 RMS              | 0    | 400 V |
| I1 RMS              | 0    | 200 A |
| P Active (P)        | -40  | 40 kW |
| Power factor        | -1   | 1     |
| U1 Crest factor     | 0    | 10    |
| I1 Distortion (THD) | 0    | 600 % |
| I1 DC               | -20  | 20 A  |

Figure 10.9

### 10.11.1 Trigger according to an inrush

You can start the record according to an inrush current and select a stop condition (recording time or manual stop)

Threshold: 0.00 ARMS

Hystérésis : 0.00 %

Threshold H. : 0.00 Threshold L. : 0.00

Figure 10.10

*Threshold*: reference value in Ampere RMS where the record will start. *Hysteresis*: Percentage value of the tolerance for the start according the selected threshold. If you want no tolerance, set the value to 0 %.

You can start the record after starting the motor: the next trigger will be the next overintensity if the evolution of current is under the low threshold ( $\text{threshold} * \text{hysteresis}/100$ ) and reaches the threshold.

### 10.11.2 In version 1.1 of the firmware or later

---

Stop of the inrush record if, after trigger, the current is higher than ( $\text{threshold} * \text{hysteresis}/100$ ) and reaches the threshold.

#### 10.11.2.1 Trigger according to a duration or a date

---

You can set up the record so that it starts after a selected period or at a specified date and select a stop condition (record time or manual stop)

## 10.12 Recordable parameters

---

- Number of observed values: you can select it under "Number of parameters". The possible values range from 1 to 14.
- Selection of values: you can select:

### 10.12.1 Voltage and Current

---

- Efficient RMS : efficient value o Fund fund : efficient value of the fundamental o Average dc : average value (DC offset) o Peak cr : maximum value between the max and min peaks
- Peak factor fcr : ratio between the peak value and the efficient value  
(1,414 for a sinusoidal signal) - Total harmonic distortion THD: ratio of the total presence of harmonics to the fundamental component of the signal
- Distortion factor DF: DF% is the ratio of the total presence of harmonics to the true efficient value of the signal.

### 10.12.2 Power

---

- P : Active o Q : Reactive o S : Apparent
- Energy: cumulative value; you will find an initialization at page « Display »

### 10.12.3 Power Factor

---

- F.P. : power factor
- Cos phi : cosine between the fundamental components of the signals U1 and I1,
- Frequency: the calculation of frequency is made at the input U1.
- Standard data acquisition channel: you can select among the free channels.

For voltage, current and power, you can select each line (ex. U1, P2, I2) or the global value of the network (Ut, It, Pt)  
For each parameter, you can change the following values:

- Validity:  : allows you or not to display a parameter as a graph; the parameters will always be recorded; only the graphic display is changed.
- Color: color of the displayed parameter in the graph; for the additional channels and the logic channels, the colors are as set up for each of them
- Caliber: the caliber is defined by the nominal values of the voltages and currents. For example, for a nominal voltage of 230V, the caliber shall be 400V centered on 200V (hence, between 0 and 400V); the minimum and maximum values may be changed for finer display. For example, you will be able to display the signal U1 between 220V and 240V.

## 10.13 Record

You launch the data acquisition by pressing . There is no trigger: the record is made in real time, directly on the disk.

During the data acquisition, you cannot change the parameters of data acquisition, but you can change the display parameters (zoom, color, display validity...).

You can also display signals in scope mode or display the parameters in digital mode.

To stop the data acquisition, press .

## 10.14 Measurement process

|                                  |                                                                             |
|----------------------------------|-----------------------------------------------------------------------------|
| <b>Efficiency Values</b>         | $X_{rms} = \sqrt{\frac{\sum_{k=1}^N x_k^2}{N}}$                             |
| <b>Average Values</b>            | $X_{mean} = \frac{1}{N} \sum_{k=1}^N x_k$                                   |
| <b>Active Powers</b>             | $P = \frac{1}{N} \sum_{k=1}^N V_k * i_k$                                    |
| <b>Apparent Powers</b>           | $S = U * I$                                                                 |
| <b>Reactive Powers</b>           | $Q = \sqrt{S^2 - P^2}$                                                      |
| <b>Power Factor</b>              | $FP = \frac{P}{S}$                                                          |
| <b>Peak Factor</b>               | $F_c = \frac{X_{peak}}{X_{RMS}}$                                            |
| <b>Total Harmonic Distortion</b> | $THD = \sqrt{\frac{X_t^2 - X_{fund}^2}{X_{fund}^2}}$                        |
| <b>Distortion Factor</b>         | $DF = \sqrt{\frac{X_t^2 - X_{fund}^2}{X_t^2}}$                              |
| <b>Total Active Power</b>        | $P_T = P_1 + P_2 + P_3$                                                     |
| <b>Total Reactive Power</b>      | $Q_T = Q_1 + Q_2 + Q_3$                                                     |
| <b>Total Apparent Power</b>      | $S_T = \sqrt{P_T^2 + Q_T^2}$                                                |
| <b>Total Voltage</b>             | $U_T = \sqrt{\frac{U_1^2 + U_2^2 + U_3^2}{3}}$                              |
| <b>Total Intensity</b>           | $I_T = I_1 + I_2 + I_3$                                                     |
| <b>Power Factor</b>              | $FP_T = \frac{P_t}{S_t}$                                                    |
| <b>Energy</b>                    | cumulative value of power P; this value is reset in the Visualization page. |

**Attention:** the maximum value of energy during the data acquisition is restricted to  $E = P_n * H$ , where  $P_n$  = nominal power  $H = 12$  hours.

# Channel Setup

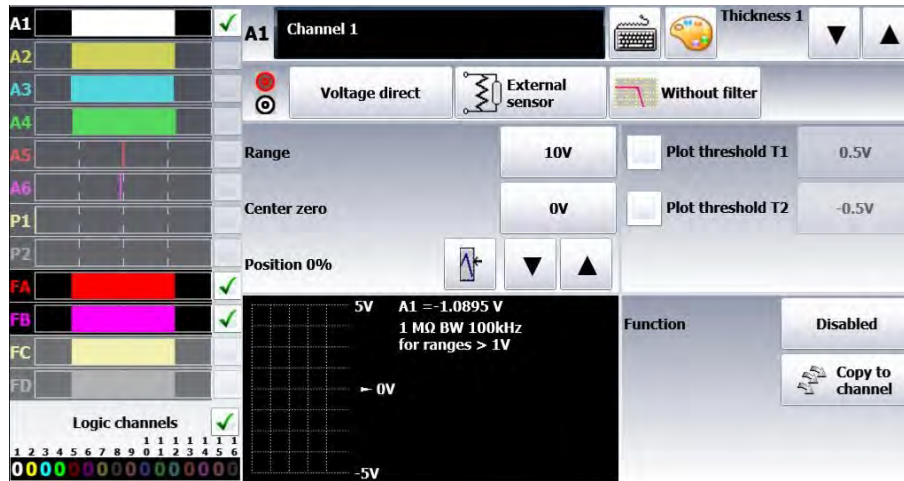


Figure 11.1

Change of the color of the channel (by pressing this button, you can access pre-defined colors or design customary paint mixes:

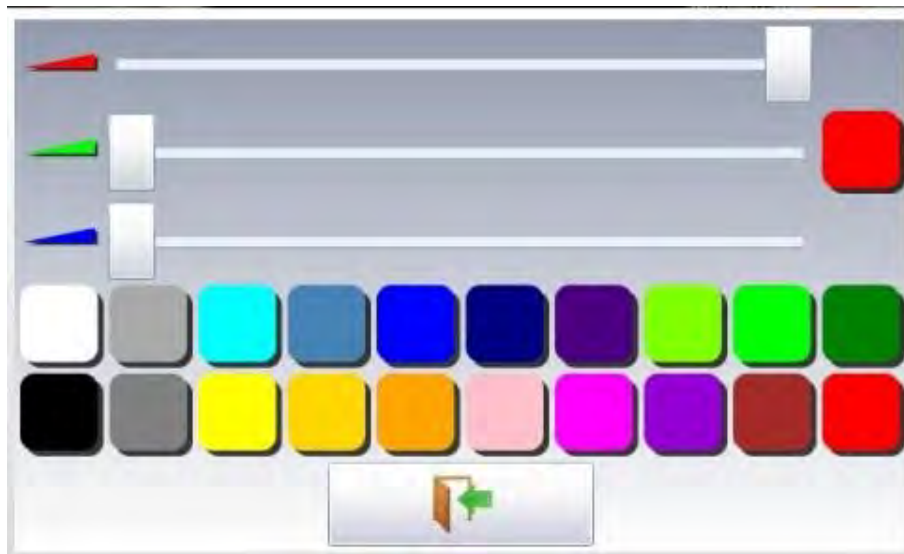


Figure 11.2

Change the thickness of the line for the selected channel. You can also change this thickness with the  (thicker) keys

1. Checkbox to validate a threshold
2. Current threshold value or change of the threshold value
3. Information about the channel (caliber, thresholds, offset...)
4. Logic inputs : real time status of the logic inputs

By pressing the menu « channels », you access the table of all available analog and temperature channels of your recorder.



Figure 11.3

This table gives you a quick insight of the various adjustments of the channels. You can change these adjustments directly in this table by pressing the parameter you want to update.

You can access the setting of parameters channel by channel by pressing the name of the channel at the top of the table (A1, A2...) or by pressing on the bargraph of the channel (right side of the screen).

## 11.1 Analog channels

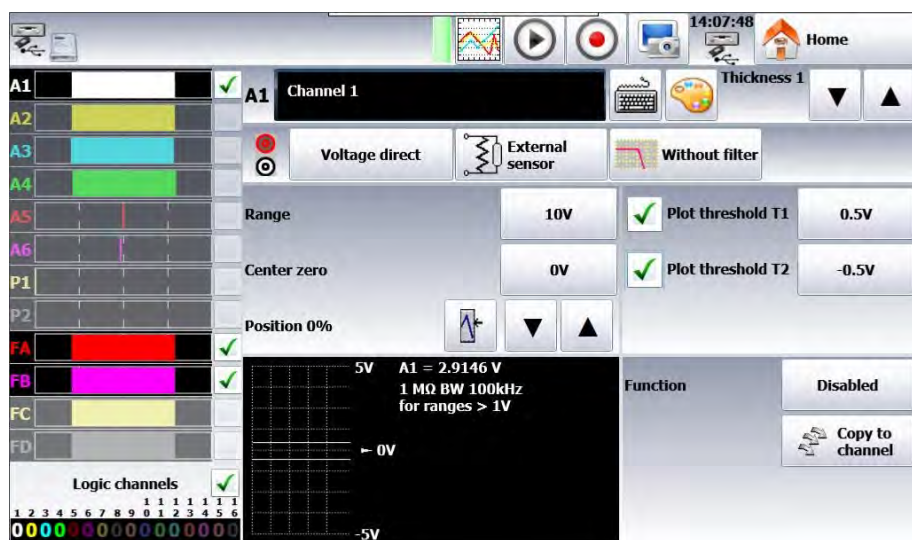


Figure 11.4

1. Number of the channel
2. Name of the channel: give a name to the channel (max. 26 characters)
3. Type: selection of the type of measurement made on the input
  - voltage, current, frequency, thermocouple or counter
  - direct, RMS,  $\Delta V / \Delta t$  or  $\int V dt$
  - value of the shunt for current measure (sensor 4-20mA automatic)
  - selection of the type in thermocouple, compensation, unit

4. Type of external sensor
5. Filter: positioning of a filter on the input
  - 10kHz, 1kHz, 100Hz, 10Hz for analog filters
  - 1Hz, 10s, 100s or 1000s for the digital filters (according to the type of signal)
6. Change of the color of the channel

7. Change of the thickness of the signal with the keys  (decrease) and  (increase)

8. Validation and adjustment of the trigger thresholds 1 and 2

**Note** A warning message pops up when the programmed analog thresholds are out of the measurement range.

9. Function: makes it possible to append a mathematical calculation function to the relevant channel

**None** : no function

**Change of unit** : changes the unit of the measures made on the channel; you can program a couple of dots X1, Y1 and X2, Y2 for scaling

**Calculation** : available mathematical functions, associated parameters and unit

$aX + b$  identical to the change of units, but instead of giving a couple of dots, you give the intercept (b) and the slope (a).

$|X| + b$  absolute value

$aX^2 + b$  square

$a\ln(X) + b$  Napierian logarithm

$a\sqrt{X+c} + b$  square root

$a^{cx} + b$  natural exponential

$a(1/X) + b$  reverse.

10. Copy to channel: makes it possible to copy the adjustment of a given channel onto one or several other channels
11. Display window for the thresholds, caliber, zero offset...
12. Adjustment of the position: position of the zero on screen or on the paper from -100 to 100%: i.e. in RMS mode, it is interesting to have zero at the minimum value (-100%); you will get the max. value = caliber
13. Adjustment of zero: Zero (or center or offset) is the central value of the measurement.

**Note** When using a mathematical function or a scale change, zero is the zero of the requested unit.

14. Adjustment of the caliber: the caliber is the measurement range corresponding to the full width of the screen, where the channel is plotted.

## 11.2 Type of measurement $\Delta V / \Delta t$

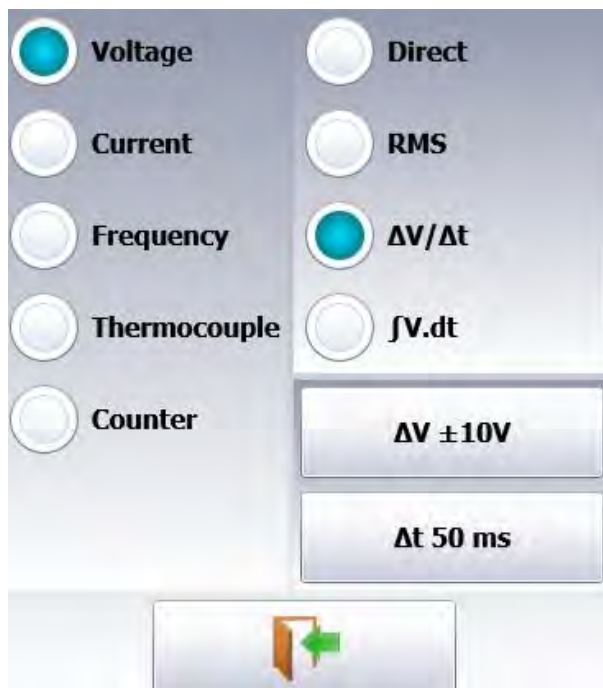


Figure 11.5

- $\Delta V / \Delta t$**  Put on the « derivative » measurement mode.  
Every period  $\Delta t$ , the recorder divide the voltage variation by  $\Delta t$  and get a value in Volt/second.
- $\Delta V$**  Select the measurement range of the input signal from  $\pm 500\mu V$  to  $\pm 500V$ . The range must be larger than the input signal.  
As example for a signal varying from  $-7V$  to  $+7V$  select  $\pm 10V$
- $\Delta t$**  Select the measurement period from  $200\mu s$  to  $10min$ . It's the time between 2 derivative calculations. Take a period compatible with the signal speed: a period too short give a derivative with noise.

### 11.2.1 Example

Channel 1: triangle signal,  $-5V$  to  $+5V$ , period  $5s$   
 Channel 2: use measurement type  $\Delta V / \Delta t$  with the same signal  
 $\Delta V \pm 10V$   
 $\Delta t 50ms$   
 Span  $20V/s$   
 The signal (Channel 1) is varying linearly at  $+4V/s$  and then at  $-4V/s$   
 The derivative (Channel 2) give  $4V/s$  and  $-4V/s$

### 11.2.2 Type of measurement $\int V dt$

**$\int V dt$ :** Put on the measurement type « integral »  
 If  $U$  is the voltage measurement, every period  $dt$  the recorder calculate  $U \cdot dt$  and add this to the previous calculation: this sum or integral is expressed in  $Vs$  (Volt\*second). The integral is reset by the user and/or every start of measurement.

- $\int V$**  Select the measurement range of the input signal from  $\pm 500\mu V$  to  $\pm 500V$ . The range must be larger than the input signal.
- $dt$**  Calculation period from  $200\mu s$  to  $10min$ .

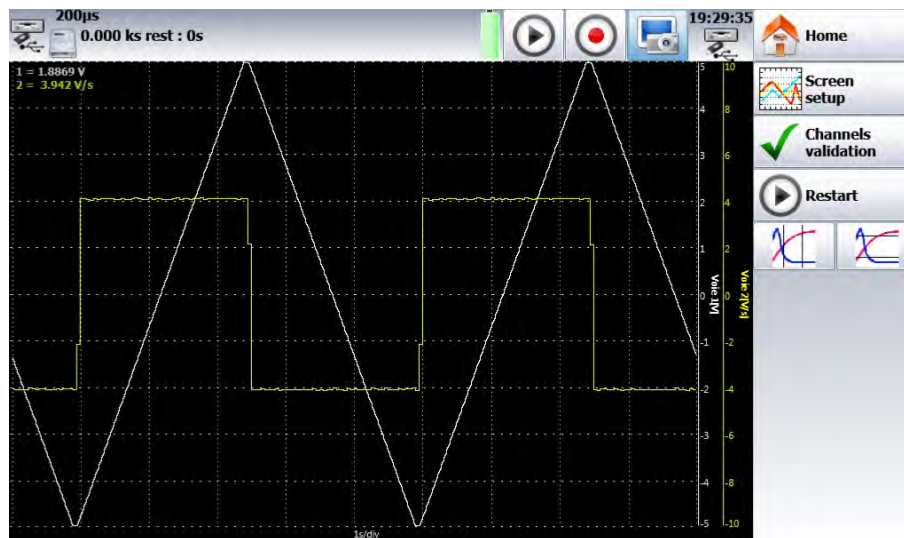


Figure 11.6

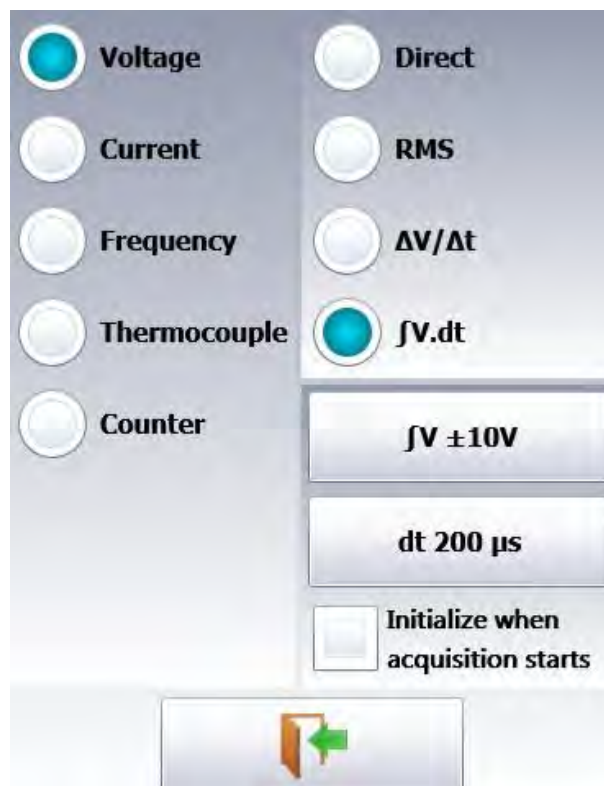


Figure 11.7

### 11.2.3 Example

Channel 1: square signal, period 10s, 2s at 5V, 8s at 0V .

Channel 2: use measurement type V.dt with the same signal V  $\pm 10V$  dt 200  $\mu s$

Span 200Vs

The signal « integral » (channel 2) begin at 0Vs and then increase of 10Vs (integration of 5V during 2s) every signal (Channel 1) period.



Figure 11.8

### 11.3 Additional functions between channels

There are function channels on this device. You can activate up to 4 function channels (FA, FB, FC, FD). These channels make it possible to make calculations between channels or calculations of average values... For example, if you want to calculate a value of power, select the parameters of the A function channel

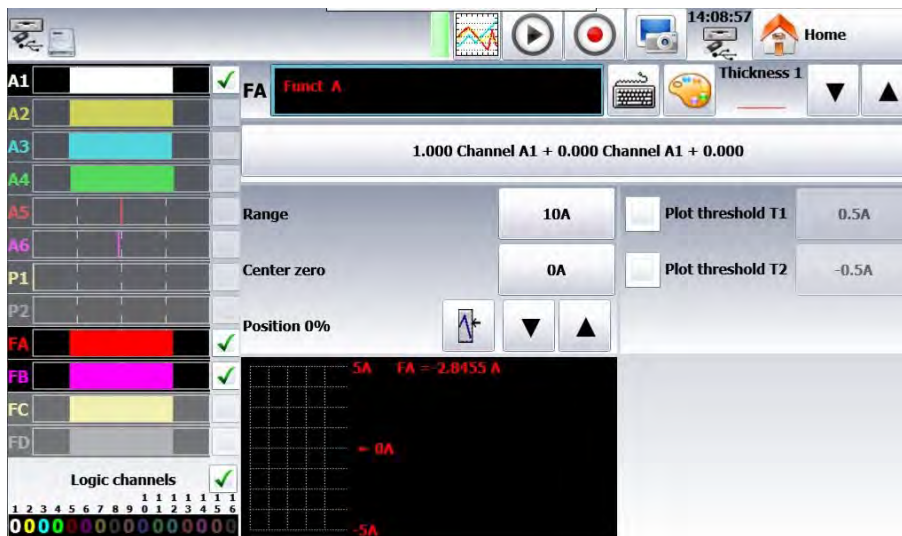


Figure 11.9

You get this page above. Then, you make the calculation you want by pressing the formula bar and create the calculation you want in the following window:

For the calculation of power, you will have:  $a(x*y) + b$  with:

x. = channel A1 operator = \* unit W

y. = channel A2 coefficient a = 1 coefficient b = 0

| Mode                                             | X channel                                   |                                    | Y channel                                   |                       |
|--------------------------------------------------|---------------------------------------------|------------------------------------|---------------------------------------------|-----------------------|
| <input checked="" type="radio"/> $a x + b y + c$ | <input checked="" type="radio"/> Channel A1 | <input checked="" type="radio"/> + | <input checked="" type="radio"/> Channel A1 | a =<br>1              |
| <input type="radio"/> RMS ( x )                  | <input type="radio"/> Channel A2            | <input type="radio"/> -            | <input type="radio"/> Channel A2            | b =<br>0              |
| <input type="radio"/> Frequency( x )             | <input type="radio"/> Channel A3            | <input type="radio"/> X            | <input type="radio"/> Channel A3            | c =<br>0              |
| <input type="radio"/> Filter( x )                | <input type="radio"/> Channel A4            | <input type="radio"/> /            | <input type="radio"/> Channel A4            | Unit<br>A             |
|                                                  | <input type="radio"/> Channel A5            |                                    | <input type="radio"/> Channel A5            | Format<br>1,23 kV ISO |
|                                                  | <input type="radio"/> Channel A6            |                                    | <input type="radio"/> Channel A6            |                       |
|                                                  | <input type="radio"/> Channel P1            |                                    | <input type="radio"/> Channel P1            |                       |
|                                                  | <input type="radio"/> Channel P2            |                                    | <input type="radio"/> Channel P2            |                       |



Figure 11.10

# Triggers

This chapter describes all possible triggers of the device.

They are used by:

- the « configuration » menu, with the A and B alarms
- the « triggers » menu, with the start and stop parameters of the recording.
- **Edge/Level trigger**
  - Edge trigger: you need a change of status o *Example:* Channel A1, rising edge, threshold = 0V: triggers only if the signal status changes from negative to positive
  - Level trigger: no need to pass the threshold o *Example:* Channel A1, high level, threshold = 0V: triggers only if the signal is positive
  - Alarms only have level triggers.
- **Analog / Logic channels:** trigger only from analogic or logic channels
- **Single / Multiple threshold:**
  - triggering from only one threshold, or
  - complex triggering from several channels and several thresholds; see description below.

Such complex triggering is only possible with analogic channels.

You can setup these triggers thanks to the « trigger » menu in the homepage.



Figure 12.1

## 12.1 Analog channel trigger

By pressing Start or Stop, you open the setup window for the trigger of the start or stop of recording.

After selection of the trigger on Analog Channels, the following line on screen allows you to set the trigger condition. It depends on the selection of single or multiple threshold.

### 12.1.1 Single threshold



Figure 12.2

1. Channel: selection of the channel, on which the trigger threshold is applied
2. Threshold 1 / Threshold 2: selection of the threshold to settle; each channel is tested with reference with 2 thresholds, i.e. you can program a start condition on the channel A1 and the threshold 1, and a stop condition on this same channel A1 and the threshold 2.
3. Higher / Lower: trigger when the channel value is more or less than the set threshold.
4. Threshold value: threshold value selected in real value (taking the current unit and scale of the configuration of the selected channel into account)
5. Edge: Selection of the active edge of the channel in reference to the threshold.

### 12.1.2 Multiple thresholds

After selection of a trigger on a set of logic channels, the window allows you to set the trigger under several conditions. Then, by pressing the various thresholds in front of their respective channels, you open the



Figure 12.3

1. One of the thresholds (or): the first achieved condition activates the trigger
2. All thresholds (and): all conditions must be simultaneously achieved to validate the trigger
3. Slope (ou): trigger on the slopes of the signals; the first achieved condition validates the trigger

### 12.1.3 Example

The trigger displayed above is:

Trigger if

Channel 1 decreasing and equal to threshold S1, value 1V

Channel 2 decreasing and equal to threshold S1, value -1V

The same interpretation is valid for the AND trigger (all thresholds).

OR

### 12.1.4 Parasites

You can trigger a parasite with a periodic 50Hz signal: trigger when the shape of the signal radically changes:

- parasite impulsion  $>200\mu\text{s}$
- sudden change of frequency



Figure 12.4

### 12.1.5 Trigger on Logic Channels

After selection of the trigger on Logic Channels, the window allows you to set the trigger condition.

The 16 logic channels can be used in the trigger word:

- either active at status 0 (less than 1.6 volt)
- or active at status 1 (more than 4.0 volts)
- or non used X
- AND / OR: the logic function AND / OR is applied to each channel
- Type: edge or level: the trigger is applied on an edge (change of value) or a level



Figure 12.5

# Math Functions

You can apply mathematical calculations on your data acquisitions. You can access them with the « **Direct display** » function.

## 13.1 Definitions

Press the « **Mathematical calculations** » key.



Figure 13.1

**Add:** add a mathematical calculation

**Remove:** remove one of the displayed mathematical calculations

**Channel:** selection of the channel on which the calculation is applied

**Function:** selection of the calculation function applied in the formula. You can change it by pressing directly on the type, which opens a window with all available calculations.

18 various mathematical formulas are available.

You can display up to **5 simultaneous calculations** on screen.

The display is made in windows above the diagrams, where are specified:

- the number of the channel (with its color)
- the type of calculation
- the value of calculation

Under « **Direct display** », calculations are made in real time and the display is updated every 300ms.

The calculation is made on the 1000 points displayed on screen. Hence, the time resolution is 0.1%.

## 13.2 Types of calculations

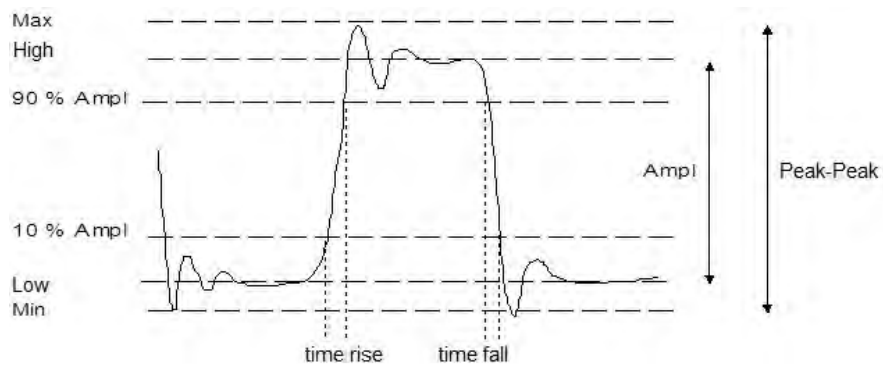
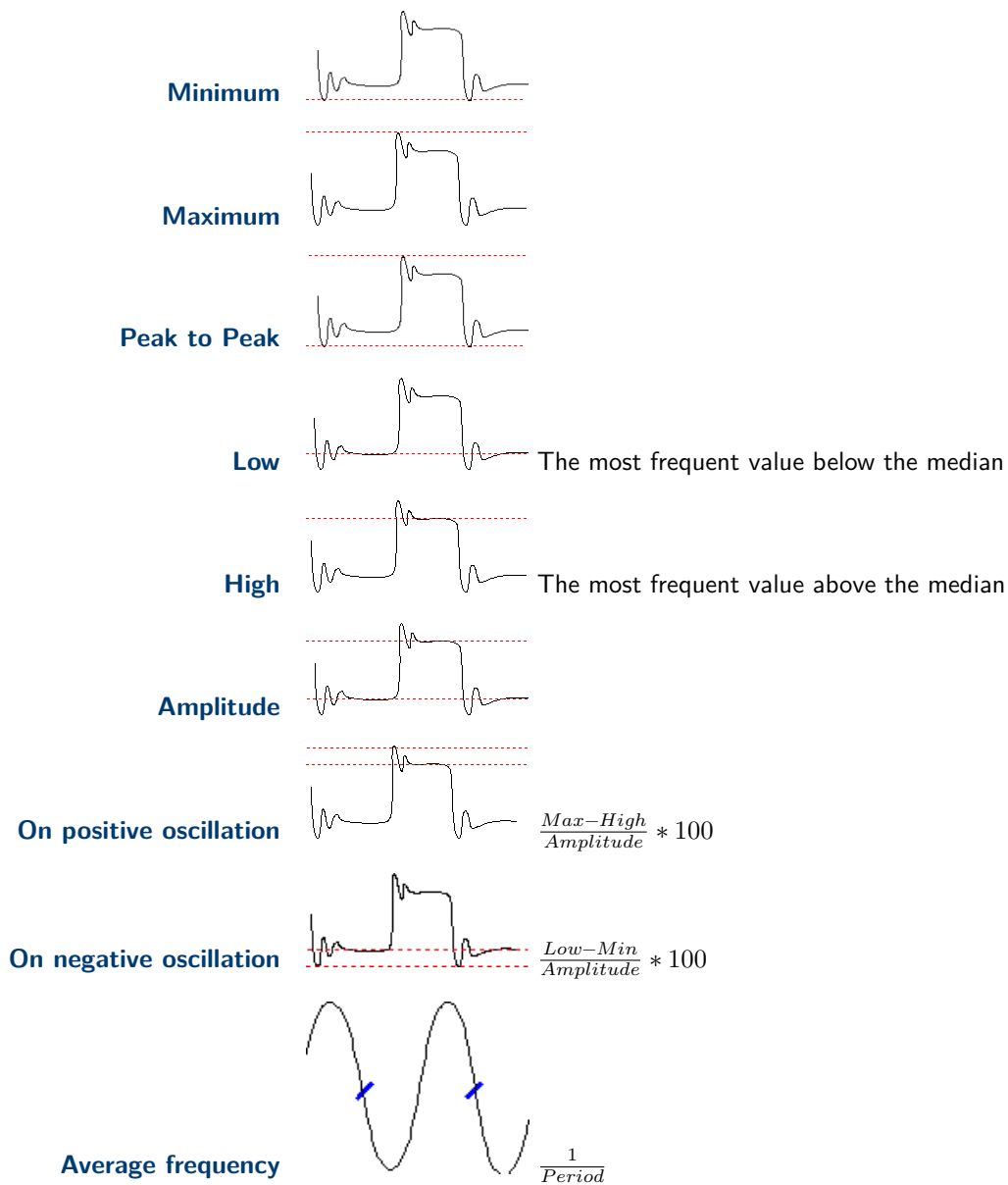


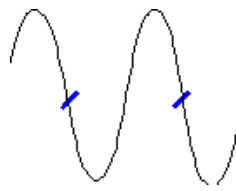
Figure 13.2

### 13.2.1 Math Functions

Math function values may be moved around on the screen. To move the math values, click and drag them to a desired position on screen.

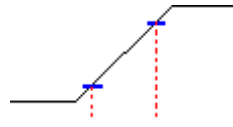


**Cycle average**



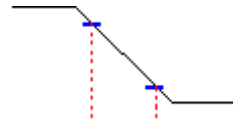
$\frac{\text{Duration of } N \text{ complete periods}}{N}$  Average duration of a complete cycle calculated on as many periods as possible

**Rising edge**



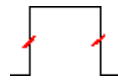
$T1 = 10\% \text{ Amplitude}$   $T2 = 90\% \text{ Amplitude}$   $T_{rise} = T2 - T1$

**Falling edge**



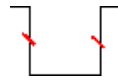
$T1 = 90\% \text{ Amplitude}$   $T2 = 10\% \text{ Amplitude}$   $T_{fall} = T2 - T1$

**Positive pulse width**



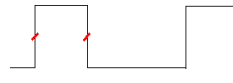
Measurement of the time of 1st positive pulse. It is measured at 50% of amplitude

**Negative pulse width**



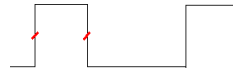
Measurement of the time of 1st negative pulse. It is measured at 50% of amplitude

**Positive duty cycle**



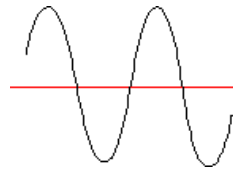
$\frac{\text{positive pulse duration}}{\text{period}}$

**Negative duty cycle**



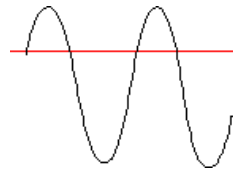
$\frac{\text{negative pulse duration}}{\text{period}}$

**N : total number of dots**



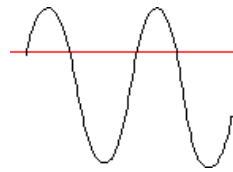
$$\frac{1}{N} \sum_{i=1}^N V_i - \text{Note}^2$$

**RMS**



$$\sqrt{\frac{1}{N} \sum_{i=1}^N (V_i)^2 - \text{Note}^2}$$

**Standard Deviation**



$$\sqrt{\frac{1}{N} \sum_{i=1}^N (V_i - \bar{V})^2 - \text{Note}^2}$$

<sup>2</sup> Calculated using the whole graphic range

# Input - Output

## 14.1 Additional Input/Output Connectors

The connector is at the rear (female SUB-D 25pin).

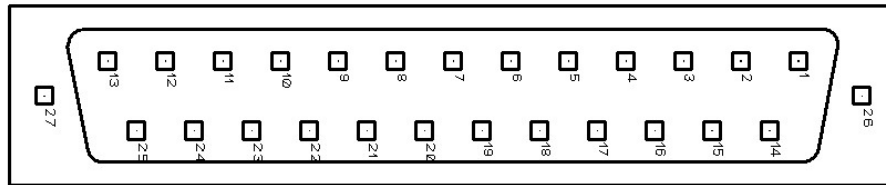


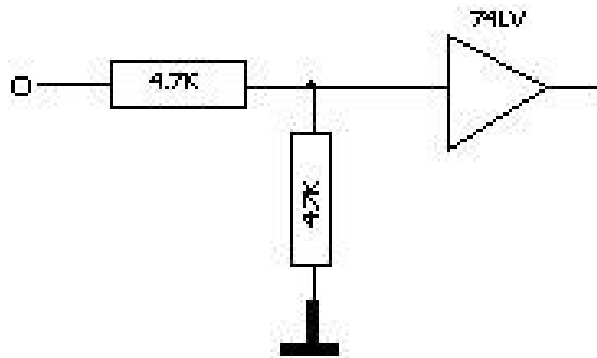
Figure 14.1

| # pin | I/O | Name of the signals |
|-------|-----|---------------------|
| 13    | I   | Logic channel 1     |
| 25    | I   | Logic channel 2     |
| 12    | I   | Logic channel 3     |
| 24    | I   | Logic channel 4     |
| 11    | I   | Logic channel 5     |
| 23    | I   | Logic channel 6     |
| 10    | I   | Logic channel 7     |
| 22    | I   | Logic channel 8     |
| 9     | I   | Logic channel 9     |
| 21    | I   | Logic channel 10    |
| 8     | I   | Logic channel 11    |
| 20    | I   | Logic channel 12    |
| 7     | I   | Logic channel 13    |
| 19    | I   | Logic channel 14    |
| 6     | I   | Logic channel 15    |
| 18    | I   | Logic channel 16    |
| 5     |     | Ground              |
| 17    |     | Ground              |
| 4     |     | Ground              |
| 16    | O   | 9-15V 0.2A power    |
| 3     |     | Ground              |
| 15    |     | Alarm C             |
| 2     |     | Alarm D             |
| 14    | O   | Alarm A             |
| 1     | O   | Alarm B             |

The power supply ground is the mechanical ground of the carter of the SUB-D25 connector.

## 14.2 Logic inputs

Non-connected inputs are according to the following circuit:



**Figure 14.2** Logic Input

Non-connected inputs are 0V potential (level 0).

Number of logic channels: from 1 to 16.

TTL level: 3.3V (protected up to 24V)

To create a rising edge, you only have to place a connection between the power input and output of the connector.

Similarly, to create a falling edge, you only have to remove this connection. You can also use an output signal TTL 3.3V.

### 14.2.1 Use

#### Plotting and display:

These channels are plotted on the right or left side of the paper according to the selected format.

They are displayed at the top or the bottom of the screen according to the selected position.

They are numbered from the right to the left.

Each channel is plotted between two dotted lines that show their limits. The height of reticules is min. 2mm for the plot.

#### External clock:

You can use the logic channel 16 (see figure "connector") as a data acquisition clock for the sampling in memory or file mode. The data acquisition can then be made up to 500kHz.

#### Triggers:

You can use the logic channels to trigger the plotting and the data acquisitions (start and stop).

(AND or OR mode)

See chapter « **Trigger** ».

## 14.3 Alarm outputs

Available contacts and outputs on the rear connector A, B, C and D. All outputs are TTL 5V.

When the device is powered off, A, B, C and D outputs have a 5kΩ impedance

### 14.3.1 Use

Signal for internal events to the outside toward the recorder (triggers on logic or analog channels, status of the printing block...)

See chapter « **Use** ».

## 14.4 Power supply output

There is a power supply output restricted to 0.2A (see figure "connector").

The voltage is the one of the 9-12V battery as a function of the charge and 15V is the charger is connected.

The ground of this power supply is the mechanical ground.

Thus, you can use this output to provide power to a sensor or an electronic circuit in order to manage the logic inputs.



The power supply may disappear in case of overload ( $> 0.2A$ ). In this case, you must turn off the device a few minutes before turning it on again.

## 14.5 External voltage box input/output interface

The external voltage box input/output interface option (code 984405500) makes it possible to:

- Convert an alternating voltage (example 230V 50Hz) into a logic signal 1
- Easy connection of the inputs of the 16 logic channels
- Insulation of the 16 logic inputs ( $250V \sim$  between channels,  $250V \sim$  between channels and ground)
- Easy connection of the alarm outputs by a screw terminal
- Power supply of an external accessory with 3.3V, 5V or 12V by a screw terminal.

**Connection of the logic channels according to the signal voltage:**

- 0 to 250V  $\sim$  red

connection 0 - 250V  $\sim$  logic channel  
black

by insulated pin plug between red and black terminals max. usable voltage: 250V continuous or alternating typical trip threshold (AC or DC): 48V frequency: 45 to 440Hz undetected low threshold (AC or DC): 0 to 10V detected high threshold (AC or DC): 60V to 250V insulation:  $250V \sim$  between channel and ground

1

2

connection 0 - 48V logic channel

1

0 to 48V  $\sim$

by a screw terminal between the points 1 and 3 of the screw terminal box max. usable voltage: 48V (AC or DC) frequency: 45 to 440Hz

typical trip threshold (AC or DC): 9V undetected low threshold (AC or DC): 0 to 2V detected high threshold (AC or DC): 10V to 48V insulation:  $50V \sim$  between channel and ground 0 to 10V  $\sim$

1

2

connection 0 - 10V logic channel 1

by a screw terminal between the points 1 and 2 of the screw terminal box max. usable voltage: 10V continuous or alternating frequency: 45 to 440Hz typical trip threshold (AC or DC): 2.2V undetected low threshold (AC or DC): 0 to 1V detected high threshold (AC or DC): 3V to 10V insulation:  $50V \sim$  between channel and ground

**Response time:**

To detect the alternating current, the signal of the logic channels is rectified and filtered.

Typical delay for a rising signal: 10ms

Typical delay for a falling signal: 50ms

**Use:**

Link the box to the input/output connector of the device with the 25-pin connector provided as an option.

Connect the logic channels to record with respect of the maximum acceptable voltages.

**Power supply / Alarms:**

max current 3.3V: 200mA max current 5V: 200mA max current 12V: 200mA

Alarm A contact 1 & 2: open contact in case of alarm, insulation  $50V_{max}$  / ground

Alarm B: logic output 0V / 5V not isolated

Alarme C: logic output 0V / 5V not isolated

|        |      |    |     |        |         |         |         |         |        |
|--------|------|----|-----|--------|---------|---------|---------|---------|--------|
| Ground | 3.3V | 5V | 12V | Ground | Alarm C | Alarm D | Alarm A | Alarm B | Ground |
| 1      | 2    | 3  | 4   | 5      | 6       | 7       | 8       | 9       | 10     |

Figure 14.3

# Ethernet Interface

## 15.1 General

You can use the recorder remotely via its Ethernet interface with the TCP-IP protocol.

Connect the recorder to your network with a straight-through cable onto the 10/100 BASE-T (RJ45) connector at the rear of the device.

You can use the recorder on an Ethernet network 10 Mbit/s or 100Mbit/s.

In case of a network with BNC cable, you must use an external hub to convert the BNC signal into RJ45 signal (use a straight-through cable).

If your PC has no network, you can also use a crossover cable directly between the PC and the recorder.

### 15.1.1 Crossover cable

| Connector 1 |        | Connector 2 |        |
|-------------|--------|-------------|--------|
| Pin         | Signal | Pin         | Signal |
| 1           | TX+    | 3           | RX+    |
| 2           | TX-    | 6           | RX-    |
| 3           | RX+    | 1           | TX+    |
| 6           | RX-    | 2           | TX-    |

**Table 15.1** Crossover Cable Wiring

The recorder uses the TCP/IP protocol to dialog with the PC. Thus, you can give it an IP address with a subnet mask. Ask your network administrator an IP address and a corresponding mask, then, when you have set

up the recorder with the  key, turn off and on the device, so that the changes are taken into account.

*If you don't have any network administrator:*

Check that the TCP/IP driver is correctly installed on your device.

Case of a PC under Win XP or other:

From Windows Explorer, go to "Work station", "Configuration panel", "network connection", and then go to the properties of the network card.

Check that the TCP/IP protocol has been installed, then check the IP address and the subnet mask.

You have to take great care and define an IP address and a subnet mask that are compatible with the ones of the remote computer.

The port that the recorder uses is **Port #23**.

For example, in I mode, you could have:

| Device   | IP            | Mask          |
|----------|---------------|---------------|
| PC       | 192.135.20.00 | 255.255.255.0 |
| Recorder | 192.135.20.01 | 255.255.255.0 |

Refer to the definition of the classes of IP addresses.

Programmation:

You can create your own software under Visual Basic, Visual C++, etc. by using, for example, the Winsock.dll driver by Microsoft.

Then, you only have to send the commands as per the following paragraphs to the recorder.

## 15.2 WIFI interface

Use only the USB stick provided by SEFRAM.

Turn the device on with the USB stick on a relevant port.  
 In the « **Setup** » menu, press the « **Network** » key.  
 Once the Wi-Fi validated, press the « **Wi-Fi networks** » key.



Figure 15.1

(if you don't see your network, press the Ethernet/Wi-Fi keys several times)  
 When your network appears, select it and validate.  
 The commands are automatically positioned. You only have to type the password. In case of connection problem, contact your network administrator.

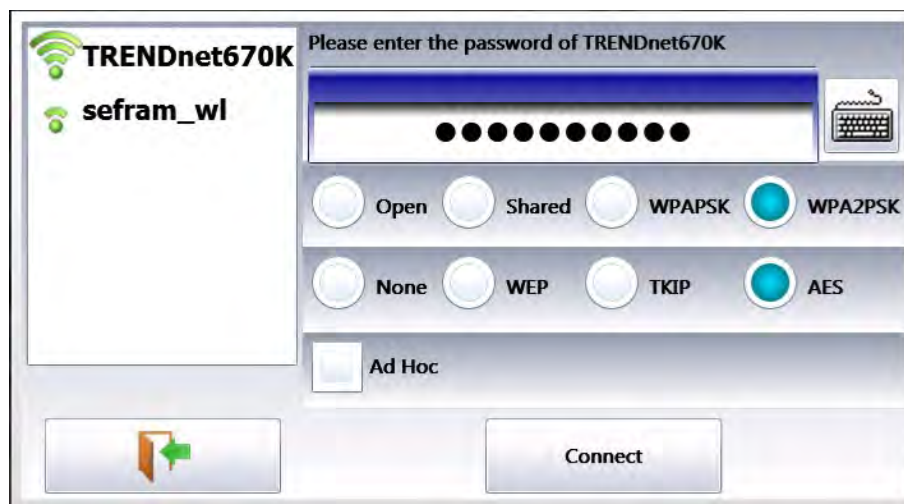


Figure 15.2

In the setup page you will get the IP addresses of the Ethernet and Wi-Fi networks.

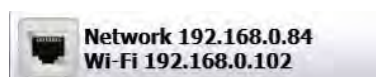


Figure 15.3

### 15.3 FTP transfer

Transfer your files to your computer to save them or view them with the SeframViewer software.

- Using of the Windows file explorer
- Filezilla: freeware (<https://filezilla-project.org/>)
- Using an external browser (Internet Explorer, Mozilla, Opera, Chrome, etc.)

Launch your browser and type the connection address (see § **Setup**): « **Ftp://** » followed by the IP address of your recorder Then, press the Entry key of your computer.

You will get direct access to the directories of your recorder, including the data acquisition files: **HD**: root directory of the internal drive disk of your device.

Once you have selected the folder where you recorded your data acquisitions, you can rename them, move them, copy them or erase them.

Transfer your files to your computer to use them with the provided SeframViewer software or FLEXPLO.



**Note:** You cannot read a file in real time while recording it.

## 15.4 Managing with VNC

This piece of software allows you to manage the recorder remotely.

### 15.4.1 Changing the password

In the « Setup » page, press VNC.

You can then change the password of VNC.

The default password is « **sefram** ».

### 15.4.2 External software VNC Viewer

You are submitted a link to easily download this software:

You only have to follow the instructions on site to install this software properly. At the end of setup, you will have the possibility to select a version for your VNC viewer (you may have to pay for some of them). Select the version you want according to the applications you need.

Just open the « VNC viewer » file where you recorded it.

On the VNC Server line: you must type the IP address of your recorder and the password (the default password is « **sefram** »), then click « Connect »

You will be able to control your recorder from your computer.

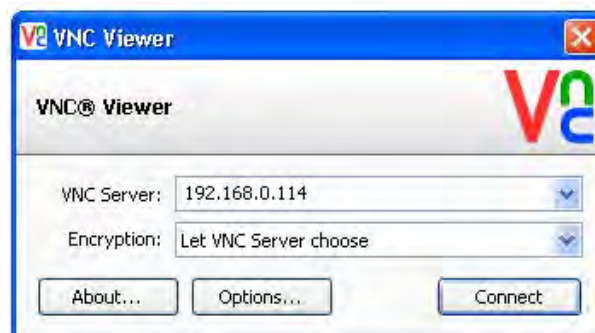


Figure 15.4

# Programming

## 16.1 Message Format



**Note:** In all the following examples, the space character is pictured as a blank space.

Exchanges from a controller to the recorder are made as messages made of a chain of ASCII characters (and possibly of binary bytes) with a message termination at the end.

## 16.2 Response Format

Messages are terminated by a termination character. Messages may include multiple commands. If the message includes several message units, they are separated with a semicolon ";" and possibly preceded and/or followed by one or several "filling" characters in ASCII code (0 to 32, in decimal format except 10 and 13).

### Termination Character LF

The message termination may be preceded with one or several "filling" characters under ASCII code (0 to 32, in decimal format except 10 and 13).

Example of messages made with 3 message units:

```
MESSAGE 1; MESSAGE 2 ; MESSAGE 3 { TERM}
```

```
CHANNEL 1; TYPE:VOLTAGE DC;:CALDEC ? { TERM}
```

## 16.3 Message Syntax

A message (ex. :REAR:SETUP 1) is made of several fields:

### 16.3.1 Header

For the command messages (ex. :REAR:SETUP 1) or query messages (ex. :REAR ?), it is made of a chain of characters (simple header) or several chains separated by ":" (compound header). A chain includes from 1 to 12 alphanumeric characters or "\_" (code ASCII 95 in decimal format). The recommended chain length is 4 characters.

A header chain always starts with an alphabetic character. It may be preceded by a colon ":" (compound header) or end by a question mark "?" (query message).



**Note:** Query messages must be followed by the termination.

### 16.3.2 Header separator

One or several ASCII characters (0 to 32, decimal except 10 and 13).

### 16.3.3 One or several pieces of data

(ex. :SPEED 1,MM\_S), alphanumeric, digital or compound of various characters or binary bytes.

### 16.3.4 Data separator

A comma ",", possibly followed and/or preceded by one or several "filling" characters in ASCII code (0 to 32, decimal except 10 and 13).

### 16.3.5 Data

There are several types of data:

#### 16.3.5.1 Alphanumeric data

1 to 12-character words that can be alphabetic (upper case or lower case), digital or "\_" (95d) coded under ASCII. Words always start with an alphabetic character.  
For example, for a non-digital parameter: S1M.

#### 16.3.5.2 Decimal digital data

Made of a mantissa and possibly of an exponent, and shown as a chain of ASCII characters starting with a cipher or a sign (+ or -). They are of NR1 (integer), NR2 (decimal) or NR3 type (with exponent) or of a combination of these three types.

#### 16.3.5.3 Text

Any chain of ASCII 7-bit characters between brackets (") or apostrophes ('). Example: "Channel 1"

## 16.4 Message Response Format

Exchanges from a recorder to a controller to the recorder are made as messages made of a chain of ASCII characters (and possibly of binary bytes) with a message termination at the end.

The format of emission messages is identical to the reception messages, although with a more rigid structure.

The syntax of a response message is: **Message unit + message termination.**

**Message unit** If the message includes several message units, they shall be separated by a semicolon ";".

**Message termination** LF: Line Feed (10 in decimal format)

### 16.4.1 Syntax

A message unit (ex. TYP:THE J,COMP) is made of several fields:

#### 16.4.1.1 Single Header

(ex. **TYP:THE**) made of only one (simple header) or several (compounds header) chains of 1 to 12 alphanumeric characters (upper scale only or digital or "\_" (code ASCII 95 in decimal format).

A header chain always starts with an alphabetic character.

In a compound header, chains of characters are separated by ":" (ex. TYP:THE).

**Header separator** "space" (32d) only.

**One or several pieces of data** (ex. **J,COMP**) alphanumeric, digital or compounds of any characters or binary bytes.

**Data separator** Comma ",",

### **16.4.2 Data**

---

There are several types of data:

**Alphanumeric data** 1 to 12-character words that can be alphabetic (upper case only), digital or "\_" (95d) coded under ASCII (example: **J**).

**Decimal digital data** Made of a chain of ASCII characters starting with a cipher or a sign (+ or -). They are of NR1 (integer), NR2 (decimal) or NR3 type (with exponent). For example, for a digital character: -25.02.

**Text data** Any chain of ASCII 7-bit characters between brackets (") or apostrophes ('). Example : "A".

**Any chain ASCII characters** ends with the message termination.

# Specifications

Note: All specifications apply to the unit after:

1. A temperature stabilization time of 15 minutes over an ambient temperature range of  $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .
2. Short correction operation performed before making measurement.

Specifications are subject to change without notice.

## Specifications

Note: All specifications apply to the unit after a temperature stabilization time of 30 minutes over an ambient temperature range of 23 °C ± 5 °C.

| Universal Inputs                                           |         |                                                                       |                |
|------------------------------------------------------------|---------|-----------------------------------------------------------------------|----------------|
| Number of Channels                                         | DAS30   | 2                                                                     |                |
|                                                            | DAS50   | 4                                                                     |                |
|                                                            | DAS60   | 6                                                                     |                |
| Voltage                                                    |         |                                                                       |                |
| Maximum Input Voltage                                      |         | ±500 VDC or 424 VRMS                                                  |                |
| Maximum Offset                                             |         | ± 5 ranges (up to ± 500 V)                                            |                |
| Accuracy                                                   |         | 0.1% of the full scale ±10 µV                                         |                |
| True RMS AC/DC Ranges                                      |         | 200 mV to 424 V                                                       |                |
| Response Time                                              |         | 100 ms typical (40 ms to 50 Hz)                                       |                |
| Crest Factor                                               |         | 2.2 and 600 V Max                                                     |                |
| Input Impedance (DC)                                       |         | > 25 MΩ for upper ranges < 1 V, 1 MΩ for upper ranges, 150 pF typical |                |
| Channel Isolation                                          |         | > 100 MΩ at 500 VDC                                                   |                |
| Bandwidth and Filters                                      |         |                                                                       |                |
| Bandwidth (-3 dB)                                          | > 1 V   | 100 kHz                                                               |                |
|                                                            | > 50 mV | 50 kHz                                                                |                |
|                                                            | 5 mV    | 20 kHz                                                                |                |
| True RMS AC/DC Bandwidth                                   |         | 5 Hz to 500 Hz                                                        |                |
| Internal Analog Filters                                    |         | 10 kHz, 1 kHz, 100 Hz, 10 Hz                                          |                |
| Slope                                                      |         | 20 dB/decade                                                          |                |
| Programmable Digital Filters                               |         | 10 Hz, 1 Hz, 0.1 Hz, 0.01 Hz, 0.001 Hz                                |                |
| Sensitivity                                                |         | 100 mV RMS min.                                                       |                |
| Duty Cycle                                                 |         | 10% min.                                                              |                |
| Frequency Range                                            |         | 0.1 Hz to 100 kHz                                                     |                |
| Basic Accuracy                                             |         | 0.02% of full scale                                                   |                |
| Data Acquisition and Trigger                               |         |                                                                       |                |
| Resolution                                                 |         | 14 bit                                                                |                |
| Fastest Sampling Interval (single channel)                 |         | File mode                                                             | Memory mode    |
|                                                            | DAS30   | 5 µs (200 kSa/s)                                                      | 1 µs (1 MSa/s) |
|                                                            | DAS50   |                                                                       |                |
|                                                            | DAS60   | 2 µs (500 kSa/s)                                                      |                |
| Memory Length (memory mode)                                |         | 32 M word segments up to 128 blocks                                   |                |
| Triggering                                                 |         | Positive edge, negative edge, on logic input, delay, go no go         |                |
| Pre-trigger                                                |         | ±100%                                                                 |                |
| Temperature with Thermocouples                             |         |                                                                       |                |
| Sensor Range by Type (cold junction compensation: ±0.5 °C) | J       | 410 °F to 2192 °F (210 °C to 1200 °C)                                 |                |
|                                                            | K       | 482 °F to 2498 °F (250 °C to 1370 °C)                                 |                |
|                                                            | T       | 392 °F to 752 °F (200 °C to 400 °C)                                   |                |
|                                                            | S       | 122 °F to 3200 °F (50 °C to 1760 °C)                                  |                |
|                                                            | B       | 392 °F to 3308 °F (200 °C to 1820 °C)                                 |                |
|                                                            | E       | 482 °F to 1832 °F (250 °C to 1000 °C)                                 |                |
|                                                            | N       | 482 °F to 2372 °F (250 °C to 1300 °C)                                 |                |
|                                                            | C       | 32 °F to 4208 °F (0 °C to 2320 °C)                                    |                |
|                                                            | L       | 392 °F to 1652 °F (200 °C to 900 °C)                                  |                |

| Power Analysis Function                         |                                                                                                                                                                                                                                                                                                                                                    |                       |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Networks                                        | Single phase, 3 phase                                                                                                                                                                                                                                                                                                                              |                       |
| Display                                         | Fresnel diagram, oscilloscope, data                                                                                                                                                                                                                                                                                                                |                       |
| Measurements                                    | Mean value, RMS, peak, crest factor, THD and DF for voltage & current, active, reactive and apparent power, power factor (ø)                                                                                                                                                                                                                       |                       |
| Harmonics                                       | Calculated up to rank 50, with display and record                                                                                                                                                                                                                                                                                                  |                       |
| Logic Input                                     |                                                                                                                                                                                                                                                                                                                                                    |                       |
| Channels                                        | 16                                                                                                                                                                                                                                                                                                                                                 |                       |
| TTL Maximum Voltage                             | 24 V                                                                                                                                                                                                                                                                                                                                               |                       |
| Sampling Interval                               | 1 µs (1 MSa/s) per channel                                                                                                                                                                                                                                                                                                                         |                       |
| Sensor Supply                                   | 9 to 15 VDC                                                                                                                                                                                                                                                                                                                                        |                       |
| Alarms 2                                        | A & B 0 to 5 V output                                                                                                                                                                                                                                                                                                                              |                       |
| Pt100/Pt1000 (factory option for DAS30 & DAS50) |                                                                                                                                                                                                                                                                                                                                                    |                       |
| Number of Channels                              | 2                                                                                                                                                                                                                                                                                                                                                  |                       |
| Current                                         | 1 mA for Pt100, 100 µA for Pt1000                                                                                                                                                                                                                                                                                                                  |                       |
| Resolution                                      | 20 bits                                                                                                                                                                                                                                                                                                                                            |                       |
| Temperature Range                               | -392 °F to 1562 °F (-200 °C to +850 °C)                                                                                                                                                                                                                                                                                                            |                       |
| Measurements                                    | 2, 3, 4 wires                                                                                                                                                                                                                                                                                                                                      |                       |
| Accuracy @ 20 °C                                | ±0.2 °C                                                                                                                                                                                                                                                                                                                                            |                       |
| Printer (factory option for all models)         |                                                                                                                                                                                                                                                                                                                                                    |                       |
| Paper Width                                     | 110 mm                                                                                                                                                                                                                                                                                                                                             |                       |
| Paper Speed                                     | 1 mm/min. to 25 mm/s                                                                                                                                                                                                                                                                                                                               |                       |
| Paper Speed                                     | 10 mm/s max. (memory mode)                                                                                                                                                                                                                                                                                                                         |                       |
| Resolution                                      | Y axis                                                                                                                                                                                                                                                                                                                                             | 8 dots/mm             |
|                                                 | X axis                                                                                                                                                                                                                                                                                                                                             | 16 dots/mm            |
|                                                 | XY mode                                                                                                                                                                                                                                                                                                                                            | 8 dots/mm (both axis) |
| General                                         |                                                                                                                                                                                                                                                                                                                                                    |                       |
| Internal Solid State Memory (file mode)         | 32 GB (DAS30, DAS50)                                                                                                                                                                                                                                                                                                                               |                       |
|                                                 | 64 GB (DAS60)                                                                                                                                                                                                                                                                                                                                      |                       |
| Operating Temperature                           | 0 °C to 40 °C, 80% RH (no condensation)                                                                                                                                                                                                                                                                                                            |                       |
| Storage Temperature                             | -68 °F to 140 °F (-20 °C to 60 °C)                                                                                                                                                                                                                                                                                                                 |                       |
| Display                                         | 10" TFT touchscreen LCD, backlit, 1024 x 600 dots                                                                                                                                                                                                                                                                                                  |                       |
| Power Supply                                    | 15 V / 4 A max with main adapter (100 / 240 VAC)                                                                                                                                                                                                                                                                                                   |                       |
| Interfaces                                      | 2 x USB host, LAN (10/100 base-T with RJ45 socket)                                                                                                                                                                                                                                                                                                 |                       |
| Battery                                         | Non removable, Lithium-ion                                                                                                                                                                                                                                                                                                                         |                       |
| Typical Battery Life                            | 9.5 hours with standby mode, 4 hours without standby mode                                                                                                                                                                                                                                                                                          |                       |
| Safety                                          | IEC 61010 - CAT III 600 V                                                                                                                                                                                                                                                                                                                          |                       |
| Weight                                          | 5.5 lbs (2.5 kg)                                                                                                                                                                                                                                                                                                                                   |                       |
| Dimensions (W x H x D)                          | 8.25" x 11.5" x 4.1" (210 x 295 x 105 mm)                                                                                                                                                                                                                                                                                                          |                       |
| Warranty                                        | Two Years                                                                                                                                                                                                                                                                                                                                          |                       |
| Supplied Accessories                            | AC mains adapter 100 / 240 V, rugged carrying case, CAT III banana test leads <sup>(2)</sup> + alligator clips <sup>(2)</sup> , bare wire to banana adapters <sup>(2)</sup> , 25 pin male connector <sup>(1)</sup> and backshell, soft wipe, stylus, screwdriver, roll of thermal printer paper (-P models), calibration certificate & test report |                       |

(1) User configurable with solder cups.

(2) One cat per channel