

Dynamic star



SOLLECITAZIONI DINAMICHE
19kHz
DYNAMIC STRESSES

ACCURATEZZA
≤ ±0.0025%
ACCURACY

Risoluzione STANDARD
±200000 div
STANDARD Resolution

CE RoHS

Alta Affidabilità
High Reliability

USB 2.0

- For Measurement of:
- ✓ **Weight**
 - ✓ **Force**
 - ✓ **Torque**
 - ✓ **Angular**
 - ✓ **Velocity**
 - ✓ **Power**
 - ✓ **Pressure**
 - ✓ **Displacement**

FAST ACQUISITION PROFESSIONAL HANDHELD INDICATOR

USER GUIDE

MO.DYNAMIC STAR.R3.EN



AEP

transducers

www.aep.it

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AEP transducers holds the right to make any change when necessary, without notice.

The data contained in this manual are just indicative and the manufacturer declines any responsibility for errors or discrepancies with respect to this manual



1. DECLARATION OF CONFORMITY

Manufacturer: **AEP transducers s.r.l**

Address: **Via Bottego 33/A 41126 Cognento MODENA (Italia)**

DECLARES THAT THE FOLLOWING PRODUCT

Product Name: **DYNAMIC STAR**

Type: **FAST ACQUISITION PROFESSIONAL HANDHELD INDICATOR**

Year of Construction: **2015**

Options: this declaration covers all the options specified in the manual.

CONFORMS TO THE FOLLOWING DIRECTIVES:

2014/30/EU - 2014/35/EU - 2011/65/EU(RoHS) and following amendments - 2012/19/EU (RAEE/WEEE)

CONFORMS TO THE FOLLOWING NORMS:

EN 61010-1(2013) EN 61326-1 (2013)

CONFORMS TO THE REGULATION

n° 1907/2006 (REACH)

The product has been tested in the typical installation configuration, as described in the instruction manual. Above described product meets the requirements of mentioned Norms, basing on both test results and considerations listed in the technical file.

I declare that the product defined above meets the requirements of the Directives, of the Norms and Regulation above mentioned.

41126 Cognento Modena (Italia)

Date: 01/10/2020


Lioi Giovanni
Direttore Tecnico

2. IDENTIFICATION

On the rear panel of the instrument are marked in indelible mode all the informations for the identification, the main configuration data, the symbols of conformity and waste disposal, the production date and the serial number.

3. UNAUTHORIZED USES



Environments with explosive atmosphere.

Environments with inflammable or corrosive gas.

4. DISPOSAL



The instrument is a professional apparatus compliant to the Directives 2011/65/EU (RoHS) and 2011/19/EU (WEEE), then it must be disposed separately as electric and electronic waste.

In different countries of European Community, it must be disposed as waste electric and electronic in accord to the laws of the country where the device is commercialized.

Before to remove the instrument, you disconnect first the power supply and after the cables.

5. TRANSPORTATION



The instrument is made by electronic parts.

In the case of transportation please pack the instrument with care.

Beware of strong shocks and moisture

6. INTRODUCTION

DYNAMIC STAR is an professional indicator, ergonomic, extremely versatile and simple to use for measures FORCE, WEIGHT, PRESSURE, TORQUE, DISPLACEMENT, SPEED and POWER. It is equipped with an input for strain gauge transducers and an input for incremental encoder (optional). **DYNAMIC STAR** is particularly suitable for applications where it is requested high capture rate (up to 19,2kHz) that a high resolution ($\pm 200,000$ divisions to 2mV/V for static measurement). **DYNAMIC STAR** can be connected with up to 7 different strain gauge transducers. After being configured the instrument automatically recognizes the strain gauge sensor connected and self-configures the dedicated parameters (Unit, filter, resolution).

Internally, the microcontroller processes the signal from the strain gauge sensor through an 32bit analog to digital converter at a conversion frequency variable from 2.5Hz to 19,200kHz making **DYNAMIC STAR** adaptable to any application that may require both high resolution (in static applications) that high sampling rate (dynamic applications).

The incremental encoder input can manage quadrature signal type line driver RS422 (A +, A-, B +, B-), open collector or 5V TTL (A, B). **DYNAMIC STAR** allows to manage both rotary and linear incremental encoders, determining position and speed informations in different units.

In combination, the informations of force and speed, allow you to determine the Power Mechanics (Force*Speed for linear and Torque*Revolutions per second for rotary systems) that can be displayed in different units.

The display is via a large LCD graphic display with backlight.

DYNAMIC STAR can detect PEAKS, lock the display with HOLD function and via the internal data logger can record up to 266,000 measurements at programmed intervals or manually by the REC.

DYNAMIC STAR can store acquisition points at maximum speed 19,200kHz for a time of about 13s. The storage can be affected by a trigger HW or SW to better define the time interval of the test. The measurements are stored in non-volatile memory, which retains data even when the power down.

Measurements can then be downloaded via the powerful software **Winstar** for creating graphs, export to Excel, report printing etc. The USB output allows the real-time communication of data acquired through a simple communication protocol. **DYNAMIC STAR** is seen by a PC as a virtual COM port.

To reduce battery consumption, **DYNAMIC STAR** can be programmed to turn off after a set time (from 1 to 99 minutes).

The backlight of the LCD display has three levels of intensity to adapt to all lighting conditions outside.

Moreover **DYNAMIC STAR** can be configured to display the LCD normally or upside down.

The instrument is powered by a rechargeable Li-Ion battery of high reliability that is recharged directly from the USB port.

The main features are:

- HIGH RESOLUTION DISPLAY graphic LCD with 3 levels of backlight and display upside down
- AUTOMATIC SELECTION OF UP TO 7 EXTERNAL strain gauge transducers of force, pressure, torque, displacement.
- Incremental Encoder input for measuring position and speed (option)
- CALCULATION OF MECHANICAL POWER
- HIGH FREQUENCY ACQUISITION up to 19,200kHz
- UP to +/- 200,000 divisions for static measurements (at 2 mV/V)
- SELECTION BETWEEN DIFFERENT UNIT
- DATALOGGER FUNCTION can store acquisition points at maximum speed (or 19,200kHz every 52 μ s)
- TRIGGER hardware or software to manage the storage interval of a cycle of data logger
- HOLD FUNCTION
- PROGRAMMABLE RESOLUTION
- PROGRAMMABLE DECIMAL POINT POSITION
- PROGRAMMABLE DIGITAL FILTER
- ZERO FUNCTION
- PEAK FUNCTION (positive and negative)
- AUTO POWER OFF FUNCTION
- CLOCK / CALENDAR
- USB COMMUNICATION PORT

7. AVAILABLE FITTINGS



FORCE and **WEIGHT** measurements using load cells or force transducers in compression and tension in the range from 10N (1kg) to 500t (5000kN).

Second channel with INCREMENTAL ENCODER input (rotary or linear) used for measures of **DISPLACEMENT, LENGTH** or **SPEED**.



PRESSURE or **DEPRESSION** (vacuum) measurements using pressure transducers (type TP16 or TP1) with normalized ranges up to 2000bar (29000psi).

Used for application in gases and liquids.



TORQUE, ANGLE, SPEED and **POWER** measurements using torsionmeter type uTOR or RT2 with internal incremental ENCODER.

Normalized rangers from 0.5 to 5000 Nm.



TORQUE measurements using **STATIC** torsionmeters (type TRA, TRX and TRF) in the range from 0.5 to 5000 Nm. Ability to record continuous **PEAKS** clockwise or anticlockwise at high speed (up to 19,2kHz).



DISPLACEMENT and **LENGTH** measurements using linear strain gauge transducers type LDT with normalized ranges from 5 to 200 mm.



DISPLACEMENT, LENGTH and **SPEED** measurements using rotating incremental encoder



DISPLACEMENT, LENGTH and **SPEED** measurements using linear incremental encoder

8. PURCHASE CODES

DSTAR	indicator with standard 2mV/V input (CH1)
--------------	---

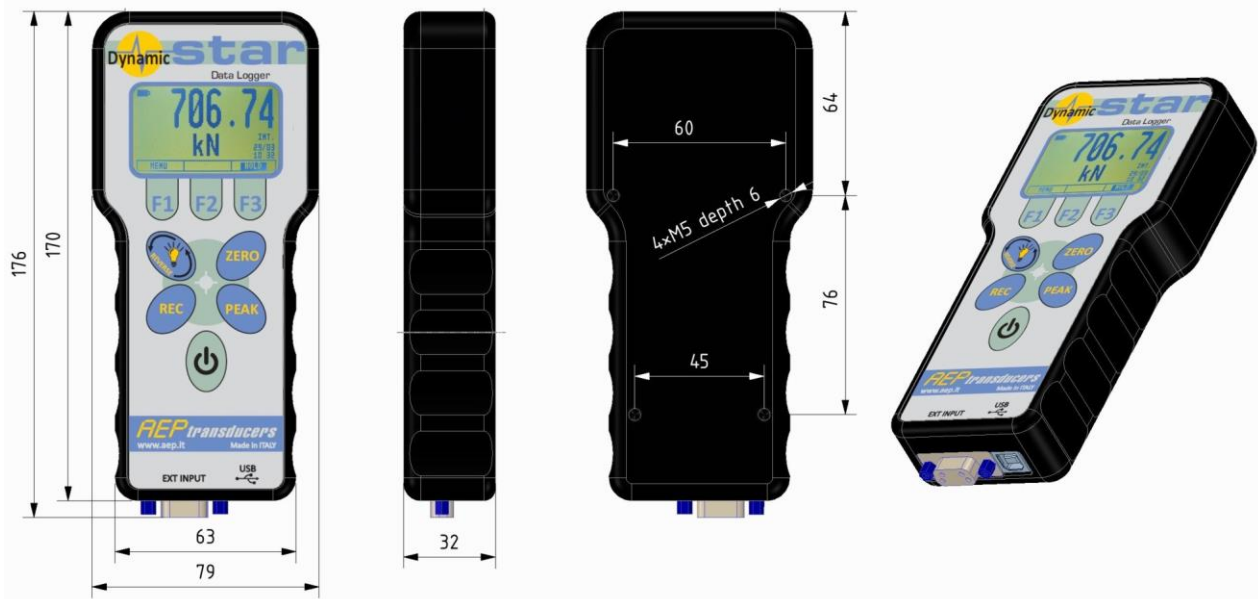
DSTARE	indicator with standard 2mV/V input (CH1) + ENCODER input (CH2)
---------------	--

9. TECHNICAL DATA

<p>STRAIN GAUGE INPUT STANDARD MEASUREMENT INPUT RESOLUTION (@± 2mV/V - Filter 0) 2.5 Hz 5 Hz 10 Hz 16 Hz 20 Hz 50 Hz 60 Hz 100 Hz 400 Hz 1200 Hz 2400 Hz 4800 Hz 7200 Hz 14400 Hz 19200 Hz INTERNAL DIVISIONS STRAIN GAUGE TRANSDUCERS CONNECTABLE EXCITATION VOLTAGE INPUT RESISTANCE PRECISION CLASS LINEARITY ERROR TEMPERATURE EFFECTS on the measurements 10°C a) on zero b) on full scale CONVERSIONS PER SECOND PROGRAMMABLE MEASUREMENTS UNIT FORCE TRANSDUCERS PRESSURE TRANSDUCERS TORQUE TRANSDUCERS DISPLACEMENT TRANSDUCERS POWER</p>	<p>±2 mV/V ± 200.000 div ± 150.000 div ± 100.000 div ± 80.000 div ± 65.000 div ± 50.000 div ± 50.000 div ± 40.000 div ±20.000 div ± 15.000 div ± 10.000 div ± 8.000 div ± 6.000 div ± 4.000 div ± 2.500 div 32 bit 2 @350 Ω / 4 @700 Ω - 4 wires 5V_{dc} ± 3% 100 MΩ ±0.0025% ±0.0015% ±0.005% ±0.005% 2.5-5-10-16-20-50-60-100-400-1200-2400-4800-7200-14400-19200 Kg-N-daN-lb-kN-MN-klb-t bar-mbar-psi-MPa-kPa-Pa-mH₂O-inH₂O-kg/cm₂ mmHg-cmHg-inHg-atm Nm-Nmm-kgm-kNm-in.lbf-ft.lbf-gcm-kgmm mm-m-foot-inch-cm-dm-um Watt-kWatt-lb*ft/s</p>
<p>INCREMENTAL ENCODER INPUT Type of signals: ENCODERS TYPE PULSE COUNTING MAX FREQUENCY POWER SUPPLY UNITA' DI MISURA PROGRAMMABILE ROTATING ENCODER LINEAR ENCODER</p>	<p>line driver RS422 (A+,A-,B+,B-) open collector 5Vdc TTL Linear and angulars x4 20MHz External 5Vdc degrees-rpm-Hz mm-m-foot-inch-cm-dm-um mm/min-m/min-ft/min-in/min-mm/s-m/s-ft/s-in/s</p>
<p>ZERO FUNCTION PROGRAMMABLE RESOLUTION PROGRAMMABLE DIGITAL FILTER HOLD FUNCTION PEAK FUNCTION</p>	<p>100% 1 – 2 - 5 – 10 – 20 – 50 - 100 0 ... 5 YES POSITIVE and NEGATIVE</p>
<p>Internal DATALOG • Max storing points • Max speed • Max DURATION 19200 Hz</p>	<p>266.000 (133.000 with encoder enabled) 19200 readings per sec. without encoder with Encoder 13.8s -----</p>

14400 Hz	18.5s	-----
7200 Hz	37s	18.5s
4800 Hz	55s	27.5s
2400 Hz	110s	55s
1200 Hz	220s	110s
400 Hz	10min	5min
100 Hz	45min	22.5min
60 Hz	1h e 13min	36min
50 Hz	1h e 30min	45min
20 Hz	3h e 40min	1h e 50min
16 Hz	About 4h	about 2h
10 Hz	about 7h and 30min	about 3h and 45min
5 Hz	about 15 h	about 7h and 30min
2.5 Hz	about 30h	about 15h
<p>Note 1: the maximum acquisition frequency with the encoder enabled is 7200Hz</p> <p>Note 2: it is possible to set lower acquisition interval (up to 1 point every 30min)</p> <p>Note 3: for long measurement cycles it is necessary to keep the instrument external powered using the USB port</p>		
NOMINAL WORKING TEMPERATURE	+23°C	
MAX WORKING TEMPERATURE	10/+50°C	
STORAGE TEMPERATURE	-10/+60°C	
INTERNAL BATTERY	3.7V 1100mAh Li-Ion size 523450	
AUTONOMY	8 hours	
DISPLAY grafico	LCD 128x64 dots	
PROTECTION CLASS (EN 60529)	IP40	
CONTAINER	ALUMINUM	
DIMENSIONS (HxLxD) mm	176 × 79 × 32 mm	
WEIGHT	0.7kg	

10. Dimensions(mm)



11. SOFTWARE APPLICATIONS (purchased separately)



To complete the system of measurement **AEP transducers** has developed several software applications that interface directly to the instrument **DYNAMIC STAR** and support the user in the various functions of calibration, testing, analysis, data storage, transfer of measures on Microsoft Excel etc. ...

WINSTAR is a software dedicated to **DYNAMIC STAR**. Through this software you can download the data logger and operate directly on **DYNAMIC STAR** to change parameters and create graphics test.

Quick Analyzer is a general purpose acquisition software where **DYNAMIC STAR** can be associated to other **AEP instruments**.

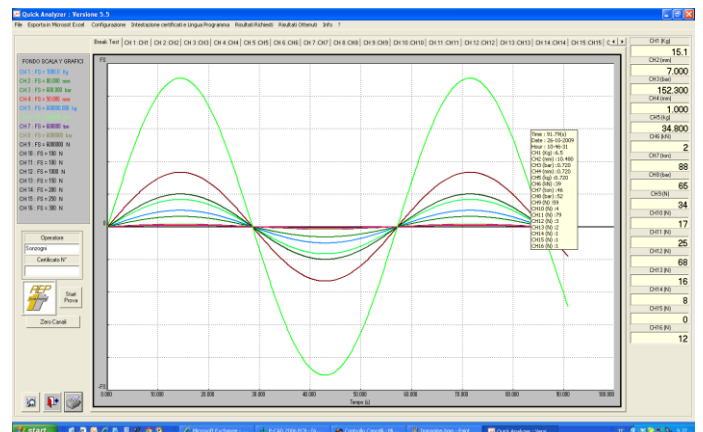
For more information download the manuals of the software on the site:

www.aeptransducers.com

www.aep.it

Quick Analyzer (Option)

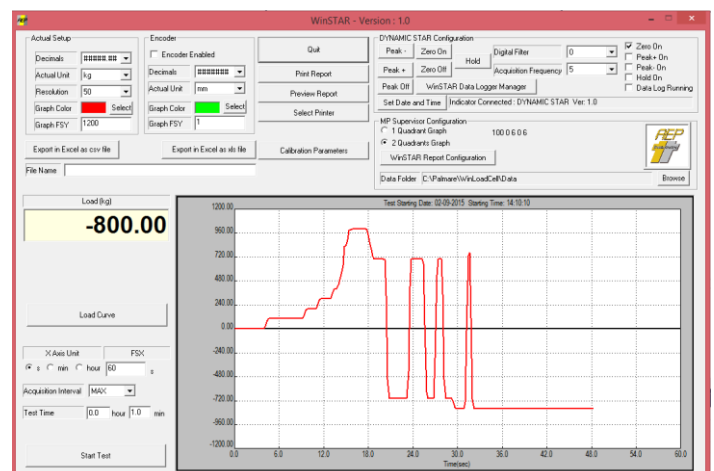
Dedicated to recording and graphical analysis of up to 16 different **AEP transducers** instruments to measure: force, weight, pressure, torque and displacement.



WINSTAR (Option)

A dedicated program that allows an immediate interfacing through the USB port with the **DYNAMIC STAR** and allows you to view graphs, export data to Microsoft Excel directly from the PC and set all configuration parameters.


The program also allows you to download a Data Logger carried out using the internal memory and display the respective curves of acquisition.



12. MAINTENANCE

The instrument does not require periodic maintenance; in case of malfunctions contact the supplier. Occasionally clean the front panel with a nonabrasive cloth of non-corrosive substances. Maintenance should be done by trained personnel.

13. BATTERY REPLACEMENT and BATTERY RECHARGE

DYNAMIC STAR is equipped with rechargeable Li-Ion long life battery so normally it does not need to be replaced. If it should become necessary to replace the battery, please contact your supplier. In case the instrument is not used for long periods, it is recommended to recharge at least every 2 months to avoid a complete discharge of the batteries. To recharge the battery connect the USB cable to the instrument. Keep the instrument under recharge until the dedicated display icon shows the battery is full recharged  (fix icon indication). Recharge time about 8 hours.



14. INSTALLATION

Installation should be done by trained personnel.

15. POWER ON

To power on the instrument keep the power on key pressed for about 2 seconds. After power on the instrument shows the presentation page with the indication of the software release for some seconds. After that **DYNAMIC STAR** enter in the operative page showing the measurement read from the sensor connected.

16. FUNCTIONAL KEYS

DYNAMIC STAR is equipped with 8 keys: 5 have a dedicated function while 3 (F1, F2, F3) have a function consistent with the page displayed at that time, and whose function is described on the display.



On/Off Key

To turn off **DYNAMIC STAR** you must keep pressed the button for about 4 seconds. To avoid that there may be inadvertent shutdowns of the instrument during a Data Logger cycle the button is disabled when a datalog is active. Therefore in case should be necessary to turn off **DYNAMIC STAR** during a data logger cycle you must first stop the Data Logger (hold **REC** button for 4 seconds).



Other keys with dedicated function are enabled only in the Home.

ZERO KEY



Keep pressed for 2 seconds, resets the display values. The display shows **ZERO**. In peak mode resets the peak value displayed. Pressed for about 4 seconds off zero.

PEAK KEY




Select the PEAK mode. Keeping the key pressed you can change one the following operative modes:

Normal Mode : on the display is shown the real time value of the transducer.

PEAK+ **PEAK+ mode**: it is shown the maximum positive value detected

PEAK- **PEAK- mode** : it is shown the maximum negative value detected

REC KEY

Pressed for about 4 seconds run the **start / stop** a cycle of data logger.
The proper acceptance of the button may be controlled through the appearance of the icon  on the display.

If the manual acquisition mode has been selected, each short press of the key stores a measurement point.

BACKLIGHT and REVERSE KEY

This key has a double functionality.



Pressed for less than 1 second toggles the backlight intensity on 3 levels.
Pressed for about 4 seconds switches the display type of the display from normal to reverse.

In reverse mode, the display of the main page will appear as shown below.

**17. POWER MEASUREMENT**

DYNAMIC STAR can measure at the same time the force and the speed through an incremental encoder. So it is suitable for the measurement of mechanical power for both linear and rotary systems.

In the case of linear systems, the power in watts is defined as force*speed where the force is expressed in Newtons and the the speed in m/s.

For rotary systems the power in Watt is defined as 2π *Torque*speed where torque is presented in Newton*m and the speed in Hz.

DYNAMIC STAR displays the mechanical power as an alternative to the measurement of force or torque.

The units are: Watt, kWatt and lb*ft/s.

In order that **DYNAMIC STAR** can properly measure the mechanical power it is necessary to follow the following recommendations:



For the power measurement it is necessary that the option incremental encoder input is present and that this is enabled in the **Main Menu -> Setup STAR**.



In the **Setup Page** of the current channel (see chapter dedicated to calibration of a channel strain gauge) **Power** should be selected as channel type (as an alternative to the options: Force-Pressure-Torque-Displacement).



The calibration of the force transducer or torque (respectively for linear or rotary) must be performed (see chapter on the calibration of one channel strain gauge):

- In Newton for transducers Force
- In Newton*m for torque transducers



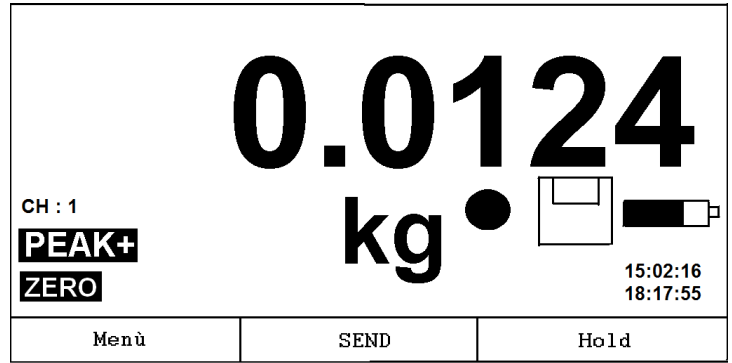
Speed measurement (relative to the incremental encoder) must be set in m/s for linear encoders and Hz for rotary encoders **Main Menu -> Unit**.

DYNAMIC STAR then performs the necessary calculations to calculate the mechanical power and to perform the necessary conversions units of the Power.

18. MAIN PAGE

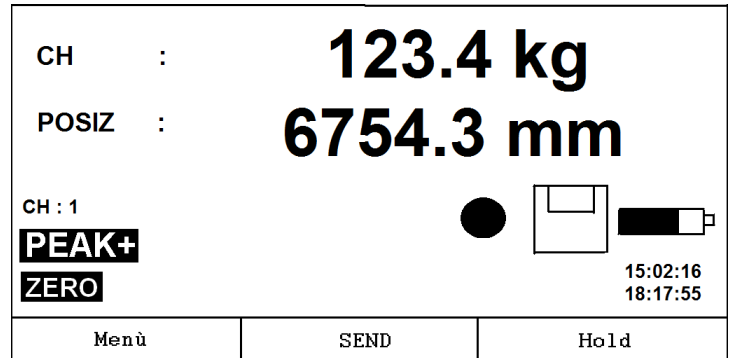
The main page shows the value of the measure according to the settings made in the calibration pages of the transducer.

In the event that it is enabled only the strain gauge channel the main page looks like in the figure. The writing CH: X (X ranges from 1 to 7) indicates which transducer is currently connected and recognized.



In case **DYNAMIC STAR** was equipped with the option of an encoder channel and this is enabled the main page looks like in the figure on the right.

It displays also the value of the encoder channel in the selected unit.



The values are displayed on a field of up to 8 digits including the sign and decimal point.

If the number to be displayed in some situations is greater than 8 digits (including the sign and decimal point), the value is automatically scaled to one decimal place.

Examples :

	Value	Display
1.	+100.0000	100.0000
2.	-100.0000	-100.0000
3.	+100000000	HHHHHHHH

Example 1. The value to be displayed is +100.0000.

Because the + sign is not displayed the value is within the allowable digits.

Example 2. The value to be displayed is -100.0000. The value consists of 9 digits counting the point and the sign.

It is scaled by a decimal point position to be represented number

Example 3. The value to be displayed consists of 9 digits. The value cannot be displayed.

It is given the error message HHHHHHHH.

Depending on the configuration on the main page **DYNAMIC STAR** may appear several icons that describe the functional status of the instrument.

It indicates the state of charge of the battery on 3 levels. The state of battery when it is recharged is indicated by the classical indication with the battery status rolling.

It indicates that a cycle of data logger is in progress. Whenever a point is stored the icon for 1 second icon

ZERO This icon when present indicates the ZERO function is active

USB This icon when present indicates the USB communication is active

PEAK+ When present this icon the PEAK mode is active (PEAK+ or PEAK-). In standard mode no indication will be displayed

RESET This icon (in PEAK mode) shows that the AUTO RESET of the PEAK function is active

15:02:16 This area of the display is dedicated to the date (day, month, year) and time (hour minutes, seconds).

18:24:05

To set the date and time see the **MAIN PAGE-> Date and Time**.

Functional Keys : F1-F2-F3

F1 Key : Menu

This key give access to the Main Menu.

This key is disabled:

Questo tasto è disabilitato nei seguenti casi:

1. When the USB port communication is active
2. A Data Logger cycle is running



F2 KEY : SEND

SEND This key is enabled only when a **Manual USB Communication** is enabled. (see Main Menu-> Setup STAR). It allows to transmit a measurement manually each time the F2 key is pressed.



F3 KEY : HOLD

Hold In **HOLD** mode the measurement is freezed to allow the operator to take note of the value. If the **HOLD** mode is active it is displayed in reverse.



WARNINGS

If **DYNAMIC STAR** is not able to display a value it is shown : **HHHHHHHH**

This can happen when some unit conversioni s performed or the decimal point position is not prpperly set.

In case an overload condition is detected (30% greater then the FULL Scale set) the message **OVERLOAD** is displayed.


A LOW BATTERY condition of the battery is shown as below:

WARNING
LOW BATTERY

If this message appear please recharge the battery immediately.

If this condition persist for more than 2 minutes **DYNAMIC STAR** will be automatically turned off.

19. ZERO FUNCTION

The **ZERO** funcion is activated by the dedicated key **ZERO** and it is used to clear the indication of  the strain gauge and the encoder channels.

The function acts on all the measuring range (100%).

The **ZERO** is stored and will conserved also upon a new power on of the instrument.

When the function is active the icon **ZERO** is displayed.

Each time the **ZERO** key is pressed a new ZERO is performed.

To remove the actual **ZERO**, keep pressed for 4-5 seconds the ZERO key. The icon **ZERO** will be cleared.

In **PEAK** mode (when the AUTORESET function is disabled) the **ZERO** key clears the peak value and allow to start a new **PEAK** test.

20. PEAK FUNCTION

The **PEAK** function is used to display the maximum (PEAK+) or minimum (PEAK-) of a dynamic measurement.

DYNAMIC STAR allows to select the function **PEAK+** or **PEAK-**. The icon **PEAK+** or **PEAK-** on the display shows which PEAK is active.

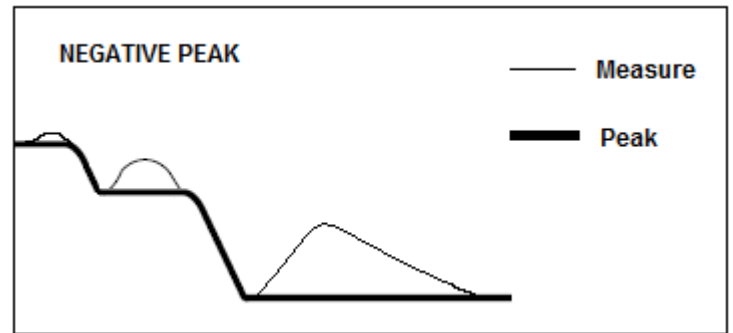
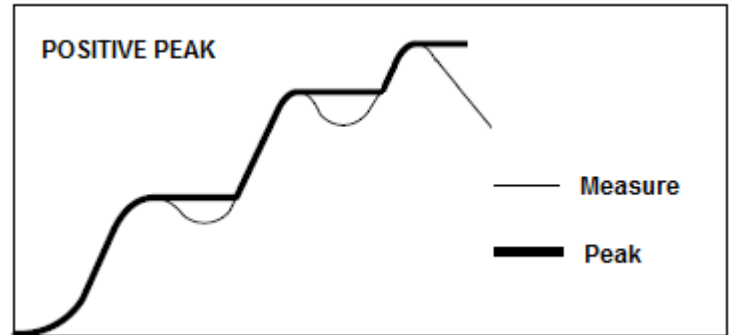
See the picture aside to verify how the PEAK+ (POSITIVE) and PEAK+- (NEGATIVE) works.

The **PEAK** function is activated with the dedicated button.



Entering the main menu or turning the power off function is automatically disabled.

PEAK values can be reset manually using the **ZERO** key or alternatively automatically, activating in the **Menu Parameters** page the function **AUTO RESET**. When the function **AUTO RESET** is active the display shows the message **RESET**.



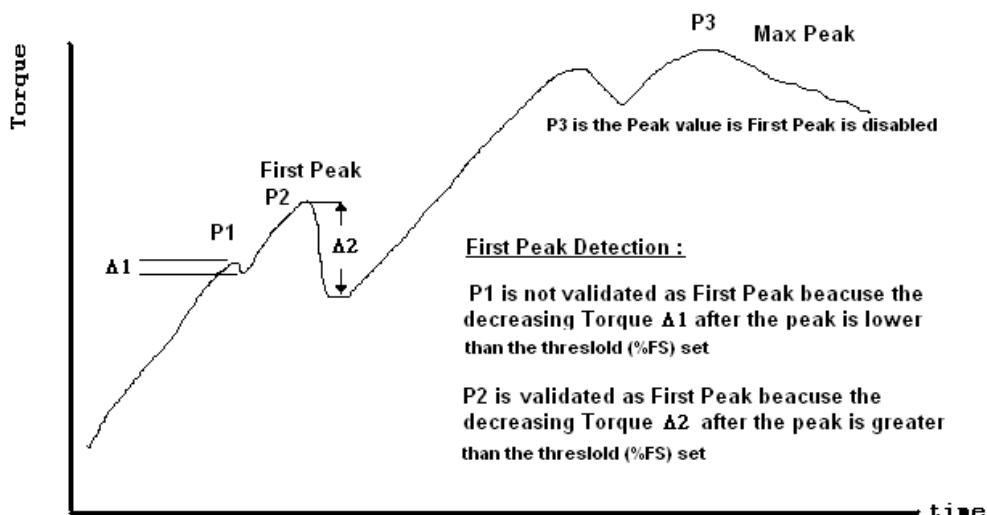
The automatic **RESET** of the PEAK is activated when, after detecting a peak, the measure returns to its initial value.

The icon **RESET** will start to flash and once the time is elapsed, set in the **Menu Parameters**, the peak value will be reset allowing the beginning of a new test.

Always in the **Menu Parameters** you can enable the detection of the **First Peak**.

In this mode, it is identified as valid only the first peak detected (maximum value followed by a fall of the load). A **PEAK THRESHOLD** parameter (expressed as a percentage of the full scale currently-used) allows to discriminate a falling load valid by other (lower value) that may be due to noise or other.

The figure below allows you to better appreciate how the peak detections work with the First Peak activated.



First Peak Detection

When the detection of the first peak is disabled the PEAK value is the highest value measured during the test.

21. DATA LOGGER FUNCTION

For the setting of the datalog parameters see the dedicated chapter **Main Menu -> Data Logger**.

Pressing **REC** for 4-5 seconds the a datalog cycle start and the icon will appear. 



Each time a acquisition point is stored the icon ■ appear for 1 second.

The start of a cycle can be conditioned by a HW trigger (through a line of the input external connector) or by a software Trigger. The trigger software allows you to start actually recording when the measurement on the strain gauge channel exceeds a certain value setting in **Main Menu -> Data Logger** page . The value is considered as an absolute value.

The trigger type is selected in the active page **Main Menu -> Data Logger**.
In case of trigger disable the storage start as soon as you activate the function.

The storage can be **MANUAL** or at precise time intervals (automatic).

In the case of automatic, a measurement point it is stored to the frequency MAX, set by the parameter acquisition frequency of the strain gauge channel ranging from 2.5 points per second to 19200 points per second, or at a timed rate that can vary from one point each 0.1s to 1 point every 30 minutes.

The internal memory of **DYNAMIC STAR** allows you to store up to 266,000 measurement points if you only use the channel strain gauge or up to 133,000 measurement points if you also use the encoder channel.

This memory allows, at the maximum storage rate of 19,200 points per second, to store data for up to 13.8 seconds. Using lower acquisition frequency allows you to increase this time.

Using the trigger (hardware or software) the time interval of interest can be centered optimally.

The table below summarizes better the maximum duration of a cycle of data logger at various frequencies acquisition channel strain gauge when it is selected as a MAX storage rate.

MAX TIME	Without Encoder	With encoder
19200 Hz	13.8s	-----
14400 Hz	18.5s	-----
7200 Hz	37s	18.5s
4800 Hz	55s	27.5s
2400 Hz	110s	55s
1200 Hz	220s	110s
400 Hz	10min	5min
100 Hz	45min	22.5min
60 Hz	1h e 13min	36min
50 Hz	1h e 30min	45min
20 Hz	3h e 40min	1h e 50min
16 Hz	About 4h	about 2h
10 Hz	about 7h e 30min	about 3h e 45min
5 Hz	about 15 h	about 7h e 30min
2.5 Hz	about 30h	about 15h

In case you have not selected MAX but a recording interval from 0.1s to 30 minutes, due to the large internal memory dedicated to data log, you can create cycles of very long duration.

In this case, particular attention must be paid to supply the instrument that has limited autonomy in about 8 hours.

For very long DATALOG cycles you need to keep powered the instrument through the USB cable connected to a PC or an external power supply.

As an alternative to storage at precise time intervals there is the **MANUAL** storage.

In the case of **MANUAL** storage a point is stored with each press of the button.



In this mode and if the PEAK mode is active, it is stored the PEAK value detected instead of the current real time measure.

In this way it is possible to archive all the measurements obtained as a result of a PEAK test.

If you did not select **MANUAL** mode, in PEAK mode you can not run a cycle DATALOG to prevent from starting a cycle with no significant recordings.

During a cycle of **DATALOG** you can not access the **Main Menu** or turn off the instrument.

If necessary manually stop the DATALOG cycle with the REC button pressed for at least 4.5 seconds.



It is possible to analyze a cycle performed in the Data Log page **Menu-> View Log**.

On this page you can analyze point by point all the measurements stored.

Alternatively you can use the software **WinSTAR** (option).

Through this software you can download the whole cycle, display it as a graph, export it to Microsoft Excel, print reports, etc.

22. MAIN MENU

In the Main Menu there are different parameter pages

1. **CHANNEL SETUP** : allow
 - To set the unit for the strain gauge and encoder (if present) channels
 - To set the decimal point position for the strain gauge and encoder (if present) channels
2. **DISPLAY** : allow
 - To set the time for the AUTO POWER OFF
 - To set the time for disable the display backlight
 - To adjust the LCD contrast
3. **SET UP STAR** : allow
 - To set the USB communication mode
 - To set the instrument language
 - To enable/disable the encoder channel (if present the option)
4. **DATA LOGGER** : allow to set all the datalog parameters
5. **FILTER** : allow to set some parameters relative to the strain gauge channel
 - Digital filter
 - Acquisition Frequency
 - Resolution
6. **PEAK PARAMETERS** : allow to set all the parameters dedicated to the PEAK mode
7. **DATE and TIME** : allow to adjust the date and time
8. **VIEW LOG** : allow to view all the points acquired during the last DATALOG cycle
9. **SERVICE** : this is a password protected page
Allow to set some calibration parameters.
10. **QUIT** : Allow to return to the main page.
Inside the menu it is possible to the return to he main page faster directly pressing the keys
 - ZERO
 - PEAK
 - REC

It is possible to enter in the **Main Menu** from the main page by pressing the MENU functional key.

With the keys **↑** and **↓** select the active choice displayed in **reverse**.

Confirm with **ENTER** to access to the desired page.

Inside a menu page select the choice **QUIT** and press **ENTER** .

Inside a menu page the active parameter will be displayed in **reverse**.

Confirm with **Enter** or modify the active parameter with **↑** and **↓**.

There are 2 types of paratemeters. The **value** fields and the **choice** fields.

The **value fields** are parameters where you have to enter the value using the keys **↑** and **↓** that allow to increase/decrease the value.

The **choice field** are parameters where the valid values are proposed directly by **DYNAMIC STAR**. Scroll the proposed values with **↑** and **↓** until you find the desired value.

Confirm the parameter value with **Enter**, the cursor will be positioned on the next parameter.

To exit from the page select **QUIT** and confirm with **Enter**.

With the cursor positioned on the **QUIT** and pressing **↑** or **↓** the cursor will be positioned on the first parameter of the page.

23. CHANNEL SETUP

This page allows the configuration of the channel strain gauge connected (and if enabled also for the channel encoder) with regard to the selected measurement unit and the position of the decimal point.

```

CHANNEL SETUP
CH :
UNIT      : kg
POINT POS : #####.###

ENCODER :
UNIT      : degree
PONIT POS : #####.###

QUIT
  
```

The Strain Gauge parameters are those below the header CH while those relative to the ENCODER channel are below the header ENCODER.

UNIT

For the channel strain gauge depending on the type of transducer configured (FORCE, PRESSURE, TORQUE, DISPLACEMENT, POWER) you will see one of the following menu selection unit. In the case of transducer encoder the selection of the measurement unit defines whether a position or a speed will be measured.

FORCE transducer		PRESSURE transducer		TORQUE transducer		DISPLACEMENT transducer		POWER		ENCODER		
⁽¹⁾ Code	Unit	⁽¹⁾ Code	Unit	⁽¹⁾ Code	Unità	⁽¹⁾ Code	Unit	⁽¹⁾ Code	Unit	⁽¹⁾ Code	⁽³⁾ Linear	⁽³⁾ Angular
00	kg	00	bar	00	Nm	00	mm	00	Watt	00	mm	° (gradi)
01	N	01	mbar	01	Nmm	01	m	01	kWatt	01	m	rpm
02	daN	02	psi	02	Kgm	02	foot	02	lbft/s	02	foot	Hz
03	lb	03	MPa	03	kNm	03	inch			03	inch	
04	kN	04	kPa	04	ft.lbf	04	cm			04	cm	
05	MN	05	Pa	05	in.lbf	05	dm			05	dm	
06	klb	06	mH ₂ O	06	gcm	06	µm			06	mm	
07	t	07	inH ₂ O	07	kgmm	07	mV/V ⁽²⁾			07	µm	
08	mV/V ⁽²⁾	08	kg/cm ²	08	mV/V ⁽²⁾					08	mm/min	
		09	mmHg							09	m/min	
		10	cmHg							10	ft/min	
		11	inHg							11	in/min	
		12	atm							12	mm/s	
		13	mV/V ⁽²⁾							13	m/s	
										14	ft/s	
										15	in/s	

TABLE 1

(1) In the USB communication instead to send the unit as a string will be sent the relative numeric code.

(2) mV/V uniti is useful to check the transducer output in a not engineering unit to verify the real electric signal in input

(3) The selection of the unit select if DYNAMIC STAR will compute a position value o a speed value.

POINT POSITION

For channel strain gauge and possibly for the channel encoder to select the appropriate decimal point position to be adopted.

Modify the value with the keys **↑** and **↓**. Confirm with **Enter** for the next parameter.

To quit from the page select **QUIT** and confirm with **ENTER**.

24. DISPLAY

This page allows you to set the AUTO POWER OFF time, the deactivation time of the backlight and contrast of the display.



DYNAMIC STAR has got two parameters to save the battery charge.

POWER OFF makes it possible to set a AUTO POWER OFF time from 1 to 99 minutes. **DYNAMIC STAR** will go off at the set time if no button is pressed during this period.

RETRO OFF gives the ability to set a time ranging from 1 to 99 minutes to disables the backlight of the LCD display. In this mode, all functions are active but **DYNAMIC STAR** consumes less.



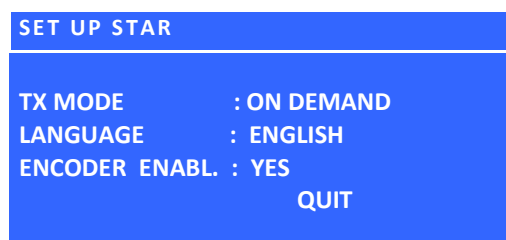
It is possible to disable each of these two functions by setting the value to 0.

By changing the value of **CONTRAST** instead you change the contrast of the display if it is not optimal. Changing the value automatically changes the contrast so you can immediately assess the effect of the modification.

Modify the value with the keys **↑** and **↓**. Confirm with **Enter** for the next parameter. To quit from the page select **QUIT** and confirm with **ENTER**.

25. SET UP STAR

This page allows to modify the communication mode of the USB port and language of the instrument and the enable state for the encoder channel (only if the option is active).



TX Mode : choice field : **ON DEMAND** – **Continuos** – **Manual**

Selecting **ON DEMAND** to request the current value is necessary to send a command (see chapter on the USB communication protocol).

In **continuous** mode instead **DYNAMIC STAR** continuously transmits (up to 500 values per second in the case where only the channel strain gauge is enabled or 250 values per second with also the channel encoder) the present value.

The **continuous** mode of transmission is interrupted by **DYNAMIC STAR** when any character is received from the USB line.

In this case the instrument automatically activate the communication protocol for **ON DEMAND**. If for 10 seconds do not come any data from the line USB tool automatically returns to the continuous mode.

This is useful when, under the control of a program, you want to change some operating parameters of the instrument.

In **Manual** mode on the main page of **DYNAMIC STAR** the **F2 key: SEND** will be enabled. Each time you press the **F2 key: SEND** the present value will be sent on the USB line.

The string transmitted in **Continuos** mode or in **Manual** mode is the same.

\$XXXXXXXXX<cr> without the encoder enabled

\$XXXXXXXX;YYYYYYY<cr> with the encoder enabled

where:

\$ = 1 character = start of message

XXXXXXXX : 8 characters : real time value of the strain gauge channel (sign and point position are included)

YYYYYYY : 8 characters : real time value of the encoder channel (sign and point position are included)

<cr> = 1 character : end of message : carriage return : decimal value 13 : hex value 0xD

LANGUAGE : choice field : **ITALIAN – ENGLISH**

ENCODER EBALEB. : choice field : **YES – NO (only with encoder option activated)**

It defines if you want to use the encoder channel. In case of mechanical power (force*speed) it is necessary to keep the encoder channel eabled.

Modify the value with the keys **↑** and **↓** . Confirm with **Enter** for the next parameter.

To quit from the page select **QUIT** and confirm with **ENTER**.

26. DATA LOGGER

This page allow to set all the parameter dedicated to the DATALOG.

DATA LOGGER	
ACQUISITION TIME :	MAX
TOTAL TIME :	DD HH MM SS
	00 00 01 00
TRIGGER :	HW
TRIGGER THRESH. :	100.00
	QUIT

ACQUISITION TIME : choice field : it defines the time interval between to acquisition point

Man. (this coice set the MANUAL mode)

MAX - 100ms – 500ms - 1s - 2s - 3s - 5s - 10s - 20s -30s- 45s- 1min - 2min -3min - 5min - 10min - 20min - 30min

TOTAL TIME: Set the DATALOG duration.

The Datalog cycle will be stopped automatically when the Total time is elapsed or when the internal memory is full (see the discussion in the dedicated paragraph).

Set the field days (**DD**) , hours (**HH**) , Minutes (**MM**) and seconds (**SS**) to define the Total Time for the datalog.

TRIGGER : choice field : **NO – HW – SW**

NO -> Trigger is disabled. The datalog cycle start immediatly

HW-> Trigger HW enabled. After you have activated the datalog cycle (key REC pressed for at least 4 seconds) the acquisition start when the hw trigger is detected. (tansion from high to low of the trigger signal)

SW-> TRIGGER SW enabled. After you have activated the datalog cycle (key REC pressed for at least 4 seconds) the acquisition start when a load (in absolute value) is detected on the strain gauge channel.

SOGLIA TRIGGER : This parameter is considered only if the SW TRIGGER is enabled.

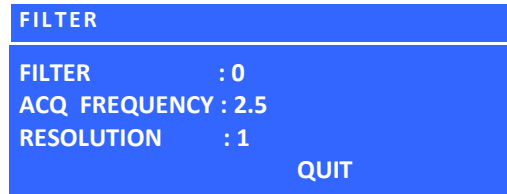
This value it is in the current unit. No automatic unit conversioni is done changing the measurment unit of the strain gauge channel.

Modify the value with the keys **↑** and **↓** . Confirm with **Enter** for the next parameter.

To quit from the page select **QUIT** and confirm with **ENTER**.

27. FILTER

This page allows you to change the parameters that condition the digital filter, the acquisition frequency and the resolution for the strain gauge channel. These parameters influence how DYNAMIC STAR analyzes and shows the measurements.



In the page FILTER it is possible to set the following parameters:

- **FILTER** : 0 - 1 - 3 - 4 - 5
- **ACQUISITION FREQUENCY** (number of samples for second):
2.5 – 5 - 10 – 16 - 20 - 50 – 60 - 100 – 400 – 1200 – 2400 – 4800 – 7200 – 14400 - 19200
- **RESOLUTION** : 1, 2, 5, 10, 20, 50, 100.

This way it is possible to increase the stability of the measurements in dynamic applications at the expense of the divisions.

Modify the value with the keys **↑** and **↓**. Confirm with **Enter** for the next parameter.

To quit from the page select **QUIT** and confirm with **ENTER**.

The parameters FILTER and ACQUISITION FREQUENCY condition both the stability of the measure and the speed with which the measurement follows the transducer signal.

The RESOLUTION allows to set the minimum increment in the measurement from 1 to 100.

The transducer signal is sampled with a programmable frequency from 2.5 to 19200 samples for second.



In case the encoder is enabled the maximum acquisition frequency is 7200Hz.

Depending on the set acquisition frequency the accuracy on the sampled signal changes according to the table below.

The divisions are relative to the standard signal of 2mV/V.

Acquisition Frequency	Divisions with Filter 0 (no digital filter is applied)
2.5Hz	± 200.000 div
5Hz	± 150.000 div
10Hz	± 100.000 div
16Hz	± 80.000 div
20Hz	± 65.000 div
50Hz	± 50.000 div
60Hz	± 50.000 div
100Hz	± 40.000 div
400Hz	± 20.000 div
1200Hz	± 15.000 div
2400Hz	± 10.000 div
4800Hz	± 8.000 div
7200Hz	± 6.000 div
14400Hz	± 4.000 div
19200Hz	± 2.500 div



The values reported on the table above refer to the single acquisition (FILTER 0). If you apply a digital filter (parameter FILTER greater than 0) it is possible to obtain better accuracy at the expense of the settling time (see the table below relative to the answer to a normalized signal step).

After having acquired a value to the set acquisition frequency **DYNAMIC STAR** applies a digital filter (type moving average). The number of samples used is determined by the parameter FILTER.

The relation between FILTER and number of samples is described in the table below:

- Filtro 0:** NO Filter (max speed)
- Filtro 1:** 2 samples
- Filtro 2:** 4 samples
- Filtro 3:** 8 samples
- Filtro 4:** 16 samples
- Filtro 5:** 32 samples

To compute the cutoff frequency (at -3dB) of the digital filter it is necessary to keep in count both the acquisition frequency and the number of samples used.

A very easy formula can be used to determine the cutoff frequency (with a good approximation)

$$f_t = \frac{0.35}{\text{settling time to a step}}$$

In the table below the settling time in all conditions are reported.

Settling Time for a signal step in function of the Acquisition Frequency and the Filter

Acquisition Frequency	Filter 0	Filter 1	Filter 2	Filter 3	Filter 4	Filter 5
2.5	0.4s	0.8	1.6s	3.2s	6.4s	12.8s
5	0.2s	0.4s	0.8s	1.6s	3.2s	6.4s
10	0.1s	0.2s	0.4s	0.8s	1.6s	3.2s
16	62.5ms	0.125s	0.250s	0.5s	1s	2s
20	50ms	0.1s	0.2s	0.4s	0.8s	1.6s
50	20ms	40ms	80ms	160ms	320ms	640ms
60	16ms	33ms	66ms	133ms	266ms	533ms
100	10ms	20ms	40ms	80ms	160ms	320ms
400	2.5ms	5ms	10ms	20ms	40ms	80ms
1200	0.8ms	1.6ms	3.2ms	6.4ms	12.8ms	25.6ms
2400	0.4ms	0.8ms	1.6ms	3.2ms	6.4ms	12.8ms
4800	0.2ms	0.4ms	0.8ms	1.6ms	3.2ms	6.4ms
7200	0.14ms	0.28ms	0.56ms	1.1ms	2.2ms	4.4ms
14400	70µs	140µs	280µs	560µs	1120µs	2240µs
19200	52µs	104µs	210µs	420µs	840µs	1680µs

In the figure 1 below it is possible to see how different acquisition frequency influence the measurement. The load curve is reconstructed better when you use a higher acquisition frequency (so it is indicated for fast transient) but there will be a higher noise.

In figure 2 below it is possible to see the effect on the filter on the measurement (at the same acquisition frequency). The time to reach the real load variation is higher when you use a higher filter but the measure is more stable than using a lower filter (a little noise remains on the measurement)

So the decision on which filter and acquisition frequency it is better to use depends on the application. If you have low changing loads and want a greater accuracy use high filter and low acquisition frequency. On the other hand for applications where the load changes fast it is better to use high acquisition frequency and low filter

Fig 1 : Effect on the measure due to different Acquisition Frequency

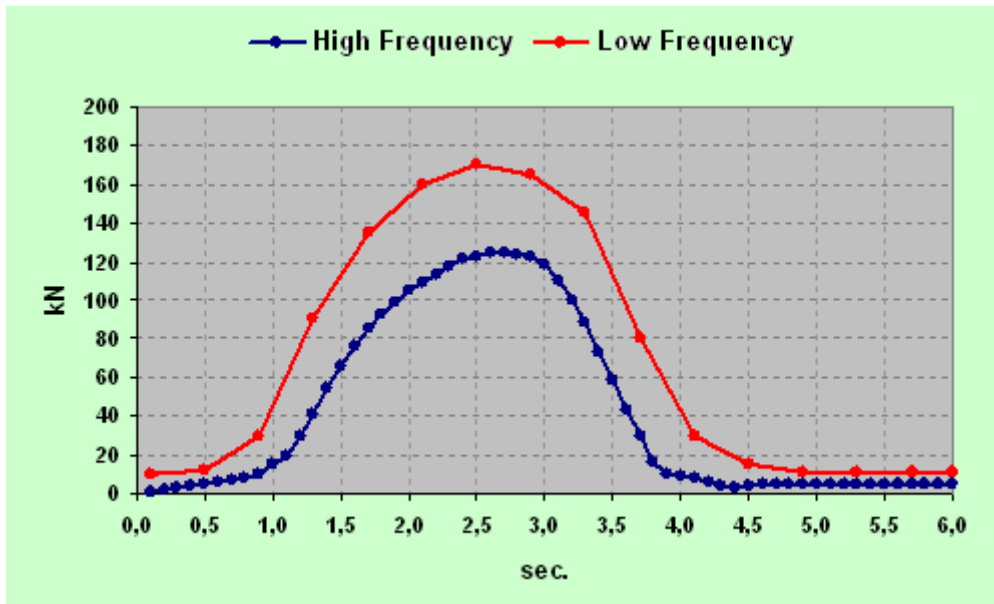
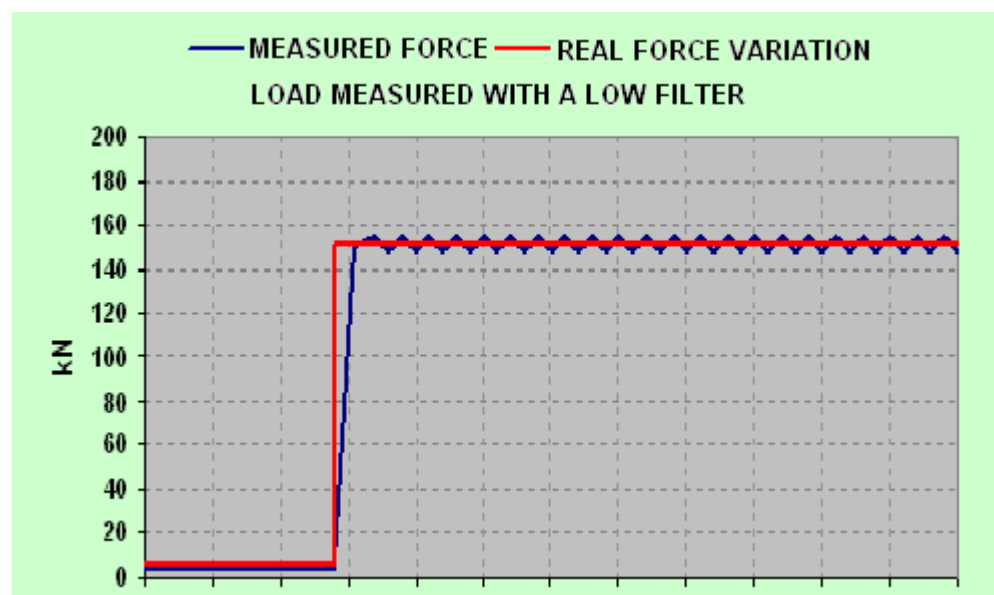
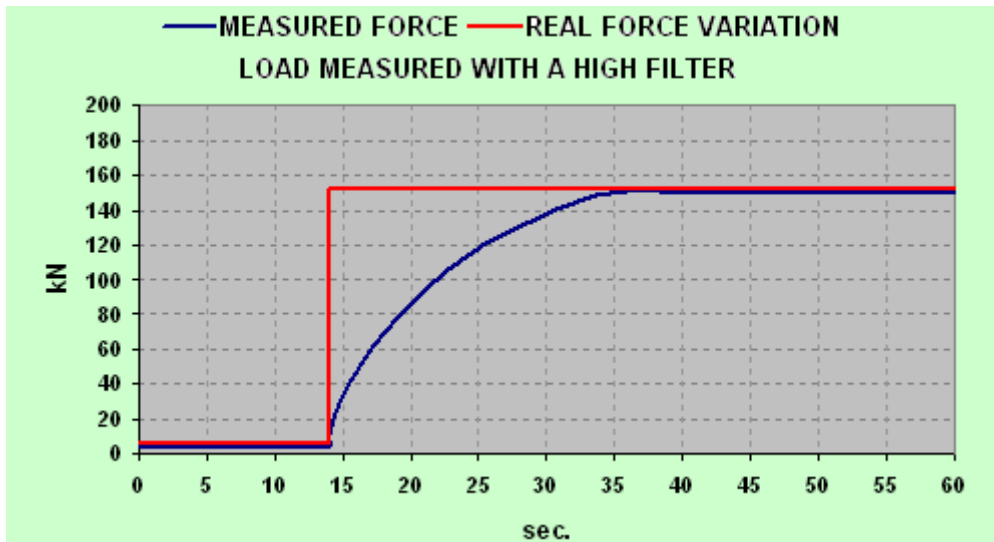


Figura 2 : Effect on the measure due to different filter



ADJUSTMENT OF FILTERS IN TORQUE WRENCH AND SCREWDRIVER SETTINGS

For calibration in screwdrivers and handheld torque tools mode, it is recommended to use one of the available digital filters, corresponding to different acquisition frequencies.

The filters are used to exclude unwanted peaks that may adversely affect the measurements.

- **Torque wrenches and torque wrenches with presetting (snap-on):** Recommended FILTER 0 and FREQUENDA DI ACQUISITION 4800 Hz.
Alternatively, depending on the test requirements, a PURCHASE FREQUENCY from 4800 Hz to 1200 Hz can be used.
- **Wrenches and torque screwdrivers:** Recommended FILTER 0 and PURCHASE FREQUENCY 2400 Hz.
Alternatively, depending on the requirements of the test, a PURCHASE FREQUENCY from 2400 to 7200 Hz can be used.
- **Screwdrivers:** Recommended FILTER 4 and PURCHASE FREQUENCY 7200 Hz, which corresponds to a cutting frequency of approximately 500 Hz as required by ISO 5393.
Alternatively, depending on the requirements of the test, one of the FILTER 3 and FREQUENDA DI ACQUISITION 4800 Hz filters can be used.
For the calibration of the screwdrivers it is necessary to use a coupling simulator which must be chosen according to the torque value to be measured.
Disable the FIRST PEAK function.
- **Impact wrenches:** Recommended FILTER 0 and PURCHASE FREQUENCY 4800 Hz.
Alternatively, depending on the test requirements, FILTER 1 and PURCHASE FREQUENCY 7200 Hz or higher acquisition frequency can be used.
For the calibration of impact wrenches it is necessary to use a coupling simulator which must be chosen according to the torque value to be measured.
Disable the FIRST PEAK function.

28. PEAK PARAMETERS

PEAK PARAMETER	
FIRST PEAK ENABLE	: NO
PEAK THRESH (%FS)	: 02
AUTO RESET	: SI
AUTO RESET TIME	: 05
QUIT	

In the chapter dedicated to the description of the function PEAK has been discussed on the meaning of these parameters and how they must be used.

FIRST PEAK ENABLE : choice field :YES-NO

Selecting YES the FIRST PEAK DETECTION is enabled otherwise it is disabled.

PEAK THRESHOLD (%FS) : it must be inserted as % of the Full SCALE of the strain gauge channel. This parameter is meaningful only if the FIRST PEAK DETECTION is enabled.

AUTO RESET : choice field :YES-NO

AUTO RESET TIME : in seconds

Selecting YES the AUTO RESET of the PEAK is enabled at the AUTO RESET TIME set.

Modify the value with the keys **↑** and **↓**. Confirm with **Enter** for the next parameter.

To quit from the page select **QUIT** and confirm with **ENTER**.

29. DATE AND TIME

This page allowsto change the Date and Time of the internal clock calendar.

DATE - TIME	
DATE	: DD MM YY
	15 02 15
TIME	: HH MM SS
	17 16 00
QUIT	

When you enter in this page the cursor is positioned on QUIT and the internal clock is running.

To set Date and Time position the cursor with the keys **↑** and **↓** on the date and time parameters and confirm with **ENTER** until reach the parameter to modify. During your modification the internal clock is stopped.

To return to the main menu position the cursor on **QUIT** and confirm with **ENTER**.

30. VIEW LOG

Allow to view the last log cycle point by point

VIEW LOG	
CH :	15.75 kg
ENC. :	88.56 mm
START :	15:07:16 21:05:34
POINT :	1
TIME :	0000:00:00:0000

The field **START** shows the Date and Time of the start datalog cycle.

The field **POINT** identifies the sequential acquisition point

The field **TIME** identifies the time elapsed from the start of the cycle in the following format:

HHHH:MM:SS:XXXX

HHHH = hours

MM = minutes

SS = seconds

XXXX = milliseconds with the resolution of .1 ms

Scroll the points using the keys **▲** and **▼**.

Keep a key pressed to to increase decrease the point increment.

To return to the main menu press **ENTER**.

31. SERVICE

The selection **SERVICE** within the programming menu allows you to access password-protected pages dedicated to **AEP transducers** or calibration pages of channels whose passwords are provided in this manual.

Enter the security password to access the selected page, and press **ENTER**.

To return to the main menu press **ENTER**.

32. USB COMMUNICATION PROTOCOL

Although communication takes place via the USB port the application software sees **DYNAMIC STAR** as a serial port set in the following manner

Baud Rate: any valid value is allowed

Parity: NO

Data Bits: 8

Stop bits: 1

The **DYNAMIC STAR** USB driver is present on the installation disk (CD Manual).

The communication commands are composed of 15 ASCII characters in the following format:

<STX> ZYXXXXXXXXXXXX <cr>

<STX>: 1 character ASCII = '\$': start command

Z: 1 ASCII character: defines the type of command

Y: 1 ASCII character: it defines the required function within the command defined by the Z field

XXXXXXXXXXXX: 11 ASCII characters: contain any parameter associated with the command

<cr>: carriage return: command terminator = 13 = 0xD

DYNAMIC STAR on receipt of a valid command responds with a message that is different from time to time for content and format.

The response of **DYNAMIC STAR** is in binary format and variable length depending on the type of the command.

The first byte of the response always begins with the most significant bit B7 set to 1.

The other response byte will have the most significant bit B7 set to 0.

Furthermore, the four bits B7 .. B4 of the first byte of response define the code SYNC which determines the number of bytes that make up the response to the command.

The following will describe in detail all the communication commands

Format of **DYNAMIC STAR** answer to a valid command (N = number of bytes of response for a given command in function of the code SYNC)

BYTE N.	B7	B6	B5	B4	B3	B2	B1	B0	Comment
1	SYNC				X	X	X	X	B7.. B4 identify the SYNC code . B7 is always set to 1 B7 in the next bytes are always set to 0
2	0	X	X	X	X	X	X		
..	0	X	X	X	X	X	X		
N	0	X	X	X	X	X	X		

Answer Format SYNC = 8

The command that provide an answer with SYNC = 8 have 6 bytes or 11 bytes (according if the incremental encoder channel is enabled or not) of response and it is used to transmit real time floating point values for the channels (4 bytes according to IEEE754).

In addition, some status bits identify whether certain functions are active or not.

The reconstruction of the float contained in the response packet takes into account the size of the data packet described below

ENCODER DISABLED

BYTE N.	BIT 7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Comment
1	1	0	0	0	B7 Byte 3	B7 Byte 2	B7 Byte 1	B7 Byte 0	SYNC = 8
2	0	BIT 6..BIT0 of Byte 0 float value							First 7 bits of byte 0 of the float value
3	0	BIT 6..BIT0 of Byte 1 float value							First 7 bits of byte 1 of the float value
4	0	BIT 6..BIT0 of Byte 2 float value							First 7 bits of byte 2 of the float value
5	0	BIT 6..BIT0 of Byte 3 float value							First 7 bits of byte 3 of the float value
6	0	T	R	D	P+	P	H	Z	Z=1 ZERO is active H=1: HOLD is active P= 1: PEAK is active P+= 1 = PEAK+ is active P+= 0 = PEAK- is active D=1: Datalog is active R= 1: Datalogging running R = 0:Datalog waiting trigger T = 1: trigger Hw active T= 0: trigger Hw not active

ENCODER ENABLED

BYTE N.	BIT 7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Commento
1	1	0	0	0	B7 Byte 3	B7 Byte 2	B7 Byte 1	B7 Byte 0	SYNC = 8
2	0	BIT 6..BIT0 of Byte 0 float value							First 7 bits of byte 0 of the float value
3	0	BIT 6..BIT0 of Byte 1 float value							First 7 bits of byte 1 of the float value
4	0	BIT 6..BIT0 of Byte 2 float value							First 7 bits of byte 2 of the float value
5	0	BIT 6..BIT0 of Byte 3 float value							First 7 bits of byte 3 of the float value
6	0	0	0	0	B7 Byte 3	B7 Byte 2	B7 Byte 1	B7 Byte 0	Encoder Channel
7	0	BIT 6..BIT0 of Byte 0 float value							First 7 bits of byte 0 of the float value
8	0	BIT 6..BIT0 of Byte 1 float value							First 7 bits of byte 1 of the float value
9	0	BIT 6..BIT0 of Byte 2 float value							First 7 bits of byte 2 of the float value
10	0	BIT 6..BIT0 of Byte 3 float value							First 7 bits of byte 3 of the float value
11	0	T	R	D	P+	P	H	Z	Z=1 ZERO is active H=1: HOLD is active P= 1: PEAK is active P+= 1 = PEAK+ is active P+= 0 = PEAK- is active D=1: Datalog is active R= 1: Datalogging running R = 0:Datalog waiting trigger T = 1: trigger Hw active T= 0: trigger Hw not active

Alternatively it is used to request a specific data related to a channel (eg FULL SCALE).
In this case the number of bytes in the response is 6.

BYTE N.	BIT 7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Commento
1	1	0	0	0	B7 Byte 3	B7 Byte 2	B7 Byte 1	B7 Byte 0	SYNC = 8
2	0	BIT 6..BIT0 of Byte 0 float value							First 7 bits of byte 0 of the float value
3	0	BIT 6..BIT0 of Byte 1 float value							First 7 bits of byte 1 of the float value
4	0	BIT 6..BIT0 of Byte 2 float value							First 7 bits of byte 2 of the float value
5	0	BIT 6..BIT0 of Byte 3 float value							First 7 bits of byte 3 of the float value
6	0	0	0	0	0	0	0	0	Not used

So the value in floating point (4 byte according to IEEE754) is reconstructed taking into account the table below.

Float	B7	B6	B5	B4	B3	B2	B1	B0
0	Bit 0 –Byte 1	BIT 6 .. BIT 0 byte 2 of the answer						
1	Bit 1 –Byte 1	BIT 6 .. BIT 0 byte 3 of the answer						
2	Bit 2 –Byte 1	BIT 6 .. BIT 0 byte 4 of the answer						
3	Bit 3 –Byte 1	BIT 6 .. BIT 0 byte 5 of the answer						

33. SOFTWARE EXAMPLES

The following C and Visual Basic code explain how to decode the data packet

Example in C

RxBuffer is the incoming serial buffer. Indice is the index of RxBuffer array that contains the SYNC code

```
float GetFloat(int Indice)
{
union{
unsigned char Byte[4];
float F;
}L;
    L.Byte[0]=RxBuffer[Indice+1] & 0x7f;
    L.Byte[1]=RxBuffer[Indice+2] & 0x7f;
    L.Byte[2]=RxBuffer[Indice+3] & 0x7f;
    L.Byte[3]=RxBuffer[Indice+4] & 0x7f;
    if (RxBuffer[Indice+0] & 0x01) L.Byte[0] |=0x80;
    if (RxBuffer[Indice+0] & 0x02) L.Byte[1] |=0x80;
    if (RxBuffer[Indice+0] & 0x04) L.Byte[2] |=0x80;
    if (RxBuffer[Indice+0] & 0x08) L.Byte[3] |=0x80;
    return L.F;
}
```

Example in Visual Basic

`Imports System.Runtime.InteropServices`

`<StructLayout(LayoutKind.Explicit)> Public Structure FloatStruct`

`<FieldOffset(0)> Public MyFloat As Single`

`<FieldOffset(0)> Public MyByte1 As Byte`

`<FieldOffset(1)> Public MyByte2 As Byte`

`<FieldOffset(2)> Public MyByte3 As Byte`

`<FieldOffset(3)> Public MyByte4 As Byte`

`End Structure`

`Dim MioRect As FloatStruct`

`Public MyBuffInt(10000) As Byte`

`If MsComm1.BytesToRead >= 6 Then`

`MsComm1.Read(MyBuffInt, 0, MsComm1.BytesToRead)`

`For Indice=0 to MsComm1.BytesToRead`

`If (MyBuffInt(Indice) and &HF0) = &H80 then`

`MioRect.MyByte1 = MyBuffInt(Indice+1) and &h7f`

`MioRect.MyByte2 = MyBuffInt(Indice+2) and &h7f`

`MioRect.MyByte3 = MyBuffInt(Indice+3) and &h7f`

`MioRect.MyByte4 = MyBuffInt(Indice+4) and &h7f`

`if (MyBuffInt(Indice+0) and &h01) then`

`MioRect.MyByte1 = MioRect.MyByte1 or &h80`

`End if`

`if (MyBuffInt(Indice+0) and &h02) then`

`MioRect.MyByte2 = MioRect.MyByte2 or &h80`

`End if`

`if (MyBuffInt(Indice+0) and &h04) then`

`MioRect.MyByte3 = MioRect.MyByte3 or &h80`

`End if`

`if (MyBuffInt(Indice+0) and &h08) then`

`MioRect.MyByte4 = MioRect.MyByte4 or &h80`

`End if`

.....
MioRect.MyFloat contains the float value required

ANSWER FORMAT SYNC = 9

The commands that provide an answer with SYNC = 9 have 15 bytes of response.

The contents of these bytes depends only on the command and will be described in detail in the section

Byte 2 of the response is the Z field of the command

Byte 3 of the response is the Y field of the command

BYTE N.	BIT 7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Comment
1	1	0	0	1	0	0	0	0	SYNC = 9
2	Command								field Z of the command
3	Function of the command								Field Y of the command
4								The content of this field depend on the command
....								
....								
....								
15								

34. READ COMMANDS

READ COMMAND: Read actual values

Command : **\$C000000000000<cr>**

Answer from **DYNAMIC STAR**: 11 byte with encoder enabled : 6 bytes with encoder disabled : SYNC = 8

The real time values of the strain gauge and encoder channels are transmitted

The unit associated to the values can be read using the command READ ACTUAL SETTING

See the description for SYNC=8 commands

READ COMMAND: Read Positive PEAK

Command : **\$CD00000000000<cr>**

Answer from **DYNAMIC STAR**: 11 byte with encoder enabled : 6 bytes with encoder disabled : SYNC = 8

The positive peak values are transmitted

The unit associated to the values can be read using the command READ ACTUAL SETTING.

This command can be used only if **DYNAMIC STAR** is in PEAK mode

READ COMMAND: Picco Negativo.

Command : **\$CE00000000000<cr>**

Answer da **DYNAMIC STAR**: 11 byte con encoder abilitato : 6 bytes senza encoder abilitato : SYNC = 8

The negative peak values are transmitted

The unit associated to the values can be read using the command READ ACTUAL SETTING.

This command can be used only if **DYNAMIC STAR** is in PEAK mode.

READ COMMAND: READ ACTUAL SETTING

Command : **\$C100000000000<cr>**

Answer da **DYNAMIC STAR**: 15 bytes : SYNC = 9

Transmit the Actual Setting of the instrument.

Byte 0 : 0x90

Byte 1 : 'C'

Byte 2 : '1'

Byte 3 : 0

Byte 4 : Point position for the strain gauge channel : binary value 0..5

Byte 5 : Point position for the encoder channel : binary value 0..5

Byte 6 : Active Unit for the strain gauge channel : binary value: see table 1

Byte 7 : Active Unit for the encoder channel: binary value: see table 1

Byte 8 : Active Resolution : binary value: see table 2

Byte 9 : Point Posizione for the channel FULL SCALE (FS) : binary value 0..5

Byte 10: Calibration unit for the encoder channel

Byte 11: Strain Gauge Sign : binary value 0-1 : 0 = STANDARD - 1 = INVERTED

Byte 12: Strain Gauge Type : binary value 0..3 0 : FORCE : 1=PRESSURE : 2=TORQUE : 3=DISPLACEMENT 4: POWER

Byte13: FULL SCALE Calibration Unit : see table 1

Byte 14: encoder Type : 1 rotative – 0 Linear

COMANDI di LETTURA: READ INSTRUMENT TYPECommand: **\$C4000000000000<cr>**

Answer: 15 bytes: SYNC = 9

The following string will be transmitted : <0x90>C40DYNAMICSTAR

READ COMMAND: READ FULL SCALECommand : **\$C5000000000000<cr>**

Answer: 6 bytes : SYNC = 8

The FULL SCALE value will be transmitted

The unit associated to the values can be read using the command READ ACTUAL SETTING.

READ COMMAND: READ SOFTWARE VERSION.Command: **\$CF000000000000<cr>**

Answer: 15 bytes: SYNC = 9

Transmit the software version of the instrument and other instrument setting

Byte 0 : 0x90

Byte 1 : 'C'

Byte 2 : 'F'

Byte 3 : 1 byte binary : Acquisition frequency: see table 4

Byte 4 : 1 byte binary : Filter (0..5)

Byte 5 : 1 byte binary : 1 Incremental encoder option is active

Byte 6 : 1 byte binary : 1 Incremental encoder channel is enabled

Byte 7 .. 14 : 8 ASCII characters with the software version. Example: 'Ver: 1.0'

35. WRITE COMMANDS

Write commands allow you to modify the **DYNAMIC STAR** parameters

They typically have an answer according to SYNC 10 with the indication of whether the command was correctly accepted.

ANSWER FORMAT SYNC=10

The commands that provide an answer with SYNC = 10 have 4-byte response.

The answer to these commands is typically a confirmation or not of the execution of the command.

Byte 2 of the response replicates the Z field of the command string

Byte 3 of the response replicates the Y field of the command string

BYTE N.	BIT 7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0	Comment
1	1	0	1	0	0	0	0	0	SYNC = 10
2	Command								field Z of the command
3	Command function								field Y of the command
4	0	0	0	0	0	0	0	R	R=1 the command has been executed

WRITE COMMAND: Set the decimal point position for the strain gauge channelCommand: **\$L00000000000X<cr>**

Answer: 4 bytes : SYNC = 10

'X' = 1 ASCII character : decimal point position '0'..'5' : see table 2

WRITE COMMAND: Set Acquisition FrequencyCommand: **\$L10000000000XX<cr>**

Answer: 4 bytes : SYNC = 10

'XX' : 2 ASCII characters : see table 4 for codes

WRITE COMMAND: Set Digital Filter

Command: \$L2000000000X<cr>

Answer: 4 bytes : SYNC = 10

'X' = 1 ASCII character: Digital Filter value '0'..'5'

WRITE COMMAND: Set Unit for the Strain Gauge Channel

Command: \$L3000000000X<cr>

Answer: 4 bytes : SYNC = 10

'XX' = 2 ASCII characters: see table 1 for codes .

WRITE COMMAND: Set Strain Gauge Channel Resolution

Command: \$L4000000000X<cr>

Answer: 4 bytes : SYNC = 10

'X' = 1 ASCII character : see table 3 for codes

WRITE COMMAND: Set ZERO ON / ZERO OFF .

Command: \$A000000000X<cr>

Answer: 4 bytes: SYNC = 10

'X' : 1 ASCII character X = '1' : ZERO ON X= '0' : ZERO OFF .

WRITE COMMAND: Set PEAK MODE

Command: \$A1000000000X<cr>

Answer: 4 bytes: SYNC = 10

'X' : 1 ASCII character ASCII

X= '0': PEAK OFF X = '1': PEAK+ ON X = '1' : PEAK-ON

WRITE COMMAND: Set HOLD ON /HOLD OFF .

Command: \$A2000000000X<cr>

Answer: 4 bytes: SYNC = 10

'X' : 1 ASCII character

X = '1': HOLD ON X= '0' : HOLD OFF

Table 2: Decimal Point Position

Code	Decimal point position
0	#####
1	#####.
2	#####.
3	####.###
4	###.####
5	##.#####
6	#.#####

Table 3: Resolution

Code	Resolution
0	1
1	2
2	5
3	10
4	20
5	50
6	100

Table 4: Acquisition Frequency

Code	Acquisition Frequency
0	2.5
1	5
2	10
3	16
4	20
5	50
6	60
5	100
6	400
7	1200
8	2400
9	4800
10	7200
11	14400
12	19200

36. COMMUNICATION CONTINUOUS MODE

The communication protocol described so far is expected to get a measure from **DYNAMIC STAR** as an answer to the command `$C00000000000<cr>`.

This type of protocol is obviously slow.

DYNAMIC STAR is capable of transmitting values in continuous mode (ie without the need to send a transmission command) up to the acquisition frequency of 1200 Hz

This mode is useful when you want to capture all values from **DYNAMIC STAR**.

This mode is useful when you want to record a program for managing all the values acquired by the instrument in dynamic applications, for example when you want to record the progress of peak torque wrench generated by a snap or a body in free fall.

This mode is enabled when is sent the command: `'$A30000000000X'<cr>`

Where 'X' is a ASCII character with the following meaning

'X' = '0' : Start continuous mode

'X' = '1' : Polling

'X' = '2' : Stop continuous mode

Answer: 4 bytes : SYNC = 10

Note : With 'X'='1' **DYNAMIC STAR** does not transmit any answer

With 'X' = '0' starts the continuous transmission mode.

DYNAMIC STAR confirms the command with the response with SYNC = 10 and starts transmitting the values according to the protocol SYNC 8 (identical to the one received with the command `$C00000000000<cr>`).

To keep alive this mode the host must send, at least every 1-2 seconds, the polling command to confirm it wants to continue this mode.

DYNAMIC STAR returns to normal communication mode or by sending the command Stop Continuous Mode or when **DYNAMIC STAR** does not receive data for at least 5 seconds.

37. COMMAND FOR DATA LOGGER

READ COMMAND: READ DATALOGGER SETTING

Command: **\$D000000000000**<cr>

Answer: 15 bytes : SYNC = 9

Byte 0 : 0x90

Byte 1 : 'D'

Byte 2 : '0'

Byte 3 : 0

Byte 4: binary value : acquisition interval

0=> Manuale	1 = MAX	2=0.1s	3=>0.5s	4=>1sec	5=>2sec	6=>3sec	7=>5sec
8=>10sec	9=>15sec	10=>20sec	11=>30sec	12=>45sec	13=>1min	14=>2min	15=>3min
16=>5min	17=>10min	18=>15min	19=>30min				

Byte5: binary value : Total Time : days (0..99)

Byte6: binary value : Total Time: hours (0..24)

Byte 7: binary value : Total Time: minutes (0..60)

Byte 8: binary value : Total Time: seconds (0..60)

Byte 9 : 0

Byte 10-11-12-13: binary value 32 bit in floating point : Software trigger Threshold (IEEE754)

Byte 14: binary value : Type of Trigger : 0 : no trigger 1 = Hw 2 : Sw

READ COMMAND: READ LAST DATALOG SETTING 1

Command: **\$D100000000000**<cr>

Answer: 15 bytes : SYNC = 9

Byte 0 : 0x90

Byte 1 : 'D'

Byte 2 : '1'

Byte 3-4-5-6 : binary value 32 bit integer : number of points stored

Byte 7: year : 00=> 2000

Byte 8: month : 1..12

Byte 9: day : 1..31

Byte 10: hour : 0..23

Byte 11: minutes : 0..59

Byte 12: seconds : 0..59

Byte 13: 0

Byte 14: 0

Note :

if the field : number of points stored = 0 then no datalog is stored and the other parameters have no meaning

WRITE COMMAND: READ LAST DATALOG SETTING 2

Command: **\$D400000000000**<cr>

Answer: 4 bytes : SYNC = 10

Byte 0 = '\$'

Byte 1 = 'D'

Byte 2 = '4'

Byte 3 = 0

Byte 4 : binary value acquisition interval

0=> Manuale	1 = MAX	2=0.1s	3=>0.5s	4=>1sec	5=>2sec	6=>3sec	7=>5sec
8=>10sec	9=>15sec	10=>20sec	11=>30sec	12=>45sec	13=>1min	14=>2min	15=>3min
16=>5min	17=>10min	18=>15min	19=>30min				

Byte 5: binary value : Type of Trigger : 0 : no trigger 1 = Hw 2 : Sw

Byte 6: binary value : days : 0..99
 Byte 7: binary value : Hours : 0..24
 Byte 8: binary value : Minutes : 0..60
 Byte 9: binary value : seconds : 0..60
 Byte 10-11-12-13: floating point (IEEE754) value. Software trigger Threshold (IEEE754)

Command Start DataLog Cycle

Command: **\$D500000000001**<cr>
 Answer: 4 bytes : SYNC = 10

Command Stop DataLog Cycle

Command: **\$D600000000000**<cr>
 Answer: 4 bytes : SYNC = 10

Command to download a Datalog Cycle

In this section we analyze how to download a cycle of Datalog.

You can not run a download with a datalog cycle in progress.

This condition can be monitored with the command Read Actual Value

A download cycle begins with a command of **StartDownload** and ends with a command **AbortDownload** or when **DYNAMIC STAR** has no more data to send .

Each frame of received data is composed by some storing points (packet) and is transmitted with SYNC = 13.

The frame structure is :

1 SYNC : 1 byte = 0xD0 SYNC =13

Some data packet for each acquisition point. The number of packet is variable according to the datalog setting

Counter : 4 byte long : is the index inside the datalog of the first packet transmitted. It increments for each frame received by the number of packet received.

- You must synchronize on the character SYNC (0xD0)
- Decode the data packet
- Check the counter is correct

The number of data packet depends on:

- The encoder channel is enabled/disabled
- The datalog cycle has been created with manual or automatic time interval.

Encoder disabled and manual acquisition

Number of bytes transmitted for frame : $61 = 1(\text{SYNC}) + 7 \cdot 8 (\text{data packet}) + 4 (\text{counter})$

Number of data packet : 7

Each data packet is composed by 8 bytes and contains the measure and the acquisition time in floating point

Encoder disabled and automatic acquisition

Number of bytes transmitted for frame : $61 = 1(\text{SYNC}) + 14 \cdot 4 (\text{data packet}) + 4 (\text{counter})$

Number of data packet : 14

Each data packet is composed by 4 bytes and contains the measure in floating point

Encoder Enabled and manual acquisition

numero byte trasmessi per frame : $41 = 1(\text{SYNC}) + 3 \cdot 12(\text{data packet}) + 4$ (counter)

Number of data packet : 3

Each data packet is composed by 12 bytes and contains the measure for the strain gauge channel – encoder and the acquisition time in floating point

Encoder Enabled and automatic acquisition

numero byte trasmessi per frame : $61 = 1(\text{SYNC}) + 7 \cdot 8(\text{data packet}) + 4$ (counter)

Number of data packet : 7

Each data packet is composed by 8 bytes and contains the measure for the strain gauge channel – encoder in floating point .

In the case of acquisition at regular intervals (automatic) time can be computed taking in account the storage itself is made from **DYNAMIC STAR** at regular intervals.

In the case of storage rate MAX the time interval between two points is established by the frequency of acquisition set. For example, if the acquisition frequency is 1200Hz the time between two points is $1/1200$.

In other cases, be taken into account the time set: as storage interval.

In the case of manual acquisizioni time it is included in the data packet

Start Download Command.

Command: **\$D70000000000**<cr>

Answer: 45 bytes : SYNC = 13

DYNAMIC STAR answer with SYNC 13.

Abort Download Command.

Command: **\$D80000000000**<cr>

Answer 4 bytes : SYNC = 10

Abort the current download

38. STRAIN GAUGE CHANNEL CALIBRATION for the active channel

For calibration purpose channel strain gauge can be either: FORCE, PRESSURE, TORQUE or DISPLACEMENT.

Once connected and recognized the transducer must be calibrated so as to be able to provide the information load properly. Based on the coding on the connector **DYNAMIC STAR** recognizes the connected transducer and loads the correct configuration parameters.

The calibration process of the strain gauge transducer is made of 2 programming pages within the **Main Menu -> Service**. These pages are password protected.

On the first page (**PASSWORD: 1675**) will define:

- the transducer type: among FORCE-PRESSURE-TORQUE-DISPLACEMENT-POWER. Select the type of transducer connected and press ENTER. To select POWER consult the dedicated chapter
- the sign: between STANDARD - INVERTED
The output of the transducer may not meet the required standards. For example for a force transducer the output can be positive in compression while negative in traction. If the actual output would be contrary to our expectations, it is necessary to invert the selection in this field.
- the unit of measurement of Calibration: according to the type of selected transducer are proposed the units of measurement possible. Used to define the unit of measurement of the full scale of the transducer that will be placed on the next page. Nle case of POWER this field is disabled.

In the second (**PASSWORD 6502**) will define

- full scale of the transducer. The unit of this field has been defined previously
- The decimal point position adopted in this calibration page
- two sensitivity parameters (one positive and one negative) for precise calibration of the output of the transducer.

The OUTPUT value allows an immediate check of the output value when the transducer is loaded with a note value.

The ZERO key is active to clear any offset of the initial measure.

The values of sensitivity allow to calibrate the output value (**OUTPUT**) with that expected in both the positive and negative field of work.

For example, if the displayed value should be greater than the expected value of the sensitivity it must be increased (proportional to the error).

Remember though before making measurements under load to do the ZERO.

In some cases the value of sensibility is known from external calibrations or as given as factory value of the transducer.

In this case, simply enter the sensitivity value known directly.

39. INCREMENTAL ENCODER CALIBRATION

It is possible to have access to the Incremental encoder calibration page from the MAIN MENU->SERVICE using **PASSWORD 4487**.

In the incremental encoder page you must define the encoder type (linear or angular) and the sensibility of each step.

Linear encoder : sensibility is the step resolution and its unit (mm-m-foot-inch-cm-dm-um)

Angular encoder : sensibility is the number of step for revolution.



In both cases it must be taken in count that **DYNAMIC STAR** perform a x4 multiply of the pulses.

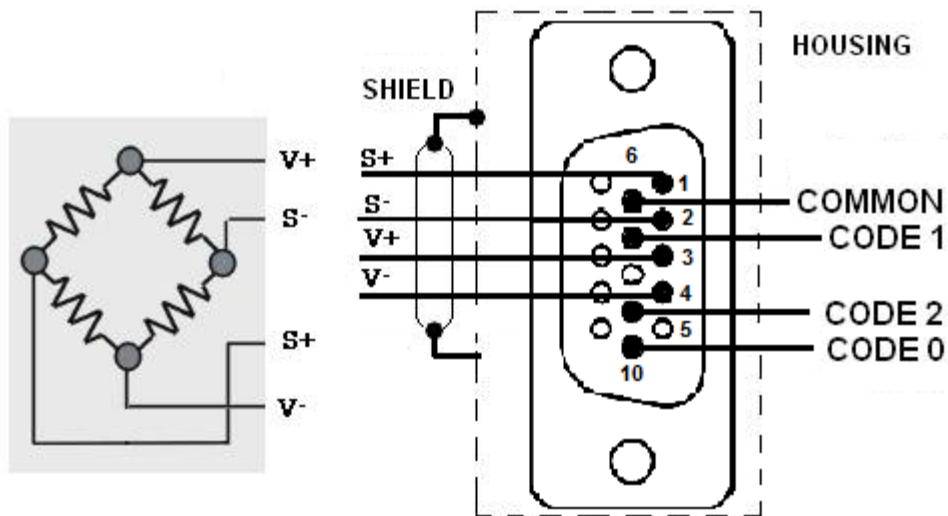
40. CONNECTION OF EXTERNAL TRANSDUCERS

DYNAMIC STAR, for the connections of external transducers (strain gauge and incremental encoder) has a SUB-D 15 poles HIGH DENSITY male connector

The strain gauge transducers must be connected as in the figure below where is shown the matched female connector from the soldering side.

- Pin 1 : S+
- Pin 2 : S-
- Pin 3 : V+
- Pin 4 : V-

15 POLES FEMALE DB-15 HIGH DENSITY CONNECTOR
VIEW SOLDERING SIDE



For the automatic identification of different transducers it is necessary to make a code on the connector using the lines **CODE 0**, **CODE 1**, **CODE 2** and **COMMON** according to the **Table 5**.

In case of just one transducers it is not necessary to make any cabling code. DYNAMIC STAR in this case set the external transducer 1.

- Pin 6 : COMMON
- Pin 7 : CODE 1
- PIN 9 : CODE 2
- PIN10: CODE 0

External transducer	join PINS
EXT. 1	6 – 10
EXT. 2	6 – 7
EXT. 3	6 – 7 – 10
EXT. 4	6 – 9
EXT. 5	6 – 9 - 10
EXT. 6	6 – 7 – 9
EXT. 7	6 – 7 – 9 - 10

