



(covering the operations with 600T and 600T EN Pressure Transmitter - Rev. up to 5.4, 652/653S Temperature - Rev. 5.1, Deltapi K Smart Pressure Transmitter - Rev. up to 5.5, KST Temperature - Rev. up to 5.1, Generic HART device - HART 5 Revision, 2600T Pressure Transmitters (models 364, 261, 264, 265, 267, 268, 269), AS 800 Pressure Transmitters, TH02/TH102/TH202 and TTH300/TTF300 Temperature and Dräger Device Polytron IR).



ABB AUTOMATION

The Company

ABB Automation is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Automation's dedication to quality and accuracy.

BS EN ISO 9001



St Neots, U.K. – Cert. No. Q5907
Stonehouse, U.K. – Cert. No. FM 21106

UNI EN 29001 (ISO 9001)



Lenno, Italy – Cert. No. 9/90A



Stonehouse, U.K. – Cert. No. 0255

Use of DANGER, WARNING, CAUTION and NOTE

This Publication includes **DANGER, WARNING, CAUTION** and **NOTE** information where appropriate to point out safety related or other important information.

- DANGER** - Hazards which will result in severe personal injury or death.
WARNING - Hazards which could result in personal injury.
CAUTION - Hazards which could result in equipment or property damage.
NOTE - Alerts user to pertinent facts and conditions.

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore comply fully with all **DANGER, WARNING** and **CAUTION**.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

Section	Page
GENERAL DESCRIPTION	3
REVISION SUMMARY	3
COMMUNICATION PROTOCOL	4
COMMUNICATION APPLICATIONS	5
KEYBOARD AND DISPLAY	7
TRANSMITTER TERMINOLOGY AND GENERAL OPERATIONS	8
GETTING STARTED WITH 691HT HAND TERMINAL	9
PASSWORD PROCEDURE	10
DIRECT CONNECTION	11
BROADCASTING CONNECTION	11
USE OF THE GREEN KEYS - PV - PROCESS VALUE	12
USE OF THE GREEN KEYS - REVIEW	13
USE OF THE GREEN KEYS - CONF KEYS	17
USE OF THE GREEN KEYS - TRIM KEYS	31
USE OF THE GREEN KEYS - SERIAL LINK	43
HART RESPONSE MESSAGES	44
APPENDIX "A1"	50
APPENDIX "A2"	50
APPENDIX "B"	50
APPENDIX "C"	51
APPENDIX "D"	56
TECHNICAL SPECIFICATION	56
FAULT REPORT SHEET	57

REVISION SUMMARY

This is the actual revision of the product: Rev. 3

The actual software version, Rev. 2.11 can be successively updated with the PC Based Program and option LOAD PROG under SERIAL LINK menu, operation that can be performed at the nearest Service Center.

GENERAL DESCRIPTION

The Hand Held **Communicator** provides a smart interface with HART electronic transmitters : it is designed to enable the plant engineer to configure, calibrate and troubleshoot the transmitters either before or after field installation.

The Hand Held Communicator can store in its non-volatile memory up to 32 transmitter configurations.

It can also be used as a Modem between the Personal Computer and the transmitter.

The Communicator employs a four line by twenty dot-matrix characters LCD and a 25 key tactile feedback keyboard : the use of the keyboard is based either on dedicated keys or software defined keys.

The communication between the Communicator and the transmitter is based on standard Bell 202 FSK (Frequency Shift Keying) current modulation superimposed on the 4 to 20 mA analog signal: since the energy balance added to the current loop is virtually equal to zero no disturbance or interference occurs on the analog process signal.

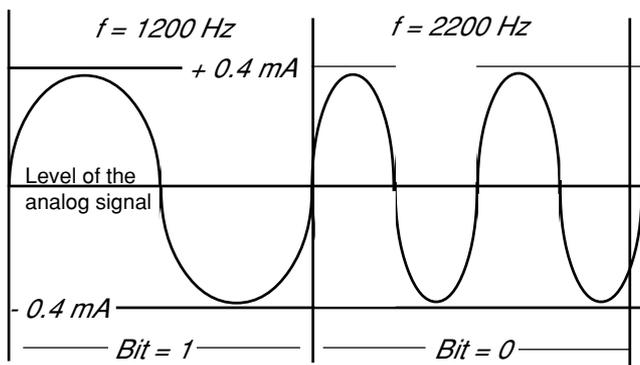
This version of the Communicator is powered by internal rechargeable batteries and **is certified intrinsically safe for use in hazardous locations.**

COMMUNICATION PROTOCOL

The communication between the Hand Held Communicator and the field devices, like Smart Transmitters, is based on HART protocol, that permits simultaneous transmission of the industry-standard 4 to 20 mA analog signal and of the digital signals carrying the communication.

The HART protocol follows the **OSI (Open Systems Interconnection) reference model** proposed by the ISO (International Standard Organization) but uses a collapsed OSI model implementing only the 1, 2 and 7 layers. The other layers are not necessary for this type of communication.

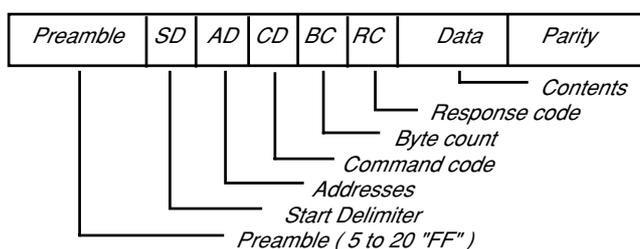
The **Layer 1, the Physical Layer**, physically connects the devices. It is based on the Bell 202 FSK (Frequency Shift Keying) standard, a ± 0.4 mA signal modulation superimposed on the 4 to 20 mA analog output signal. The Data Transfer Rate is 1200 Baud. Two frequencies , 1200 and 2200 Hz, in sinusoidal form, are used to code respectively the bit "1" and "0". The figure below gives the modulation envelope respectively for a "1" and a "0" bit.



Since the energy balance added to the current loop virtually equal to zero and the frequency used for the communication very high compared to that of the process dynamic, no disturbance or interference occurs on the analog process signal.

The Layer 2, the Data Link Layer, provides to form and check the frame of the messages, accordingly to the Hart protocol specification. The frame includes a double parity check, horizontal, at level of each byte transmitted, and vertical, in form of a parity byte added at the end of the frame, in order to insure the maximum data integrity.

The figure below gives the structure of a typical frame.



The Data Link Layer is also responsible for the communication between the field devices and the configurators, either the Hand Held Communicator, a Secondary Master, or the P.C. Configurator, a Primary Master and of the issuing of appropriate error messages in case of communication malfunction.

The **Layer 7, the Application Layer** is based on the use of HART Commands, a set of commands sent to a field device in order to obtain data or information and to remotely change configuration's parameters.

The Hart Command Set is structured in three classes of commands:

Universal commands that are implemented and then recognized by all field devices irrespective of the manufacturer: the implementation of this class of commands is mandatory for each manufacturer using the HART Protocol. This class includes the commands of reading of the process variable and those of reading of Universal Information like the Tag, ranges and limits, date and message, Serial Number, etc.

Common Practice Commands is a class of commands commonly used by a large number of smart devices : unlike the Universal Commands their implementation is not mandatory but the use of this set of commands increases the compatibility between devices using HART protocol. This class includes commands to change common parameters like range values, engineering units, to perform loop test and so on.

Device-Specific Commands is a class of commands implemented for a specific device and therefore not common to other type of equipment. This class includes the commands related to the specific design of the device, such as the command for the sensor trimming or the command to read and interpret the product code, the sensor materials, etc.

Another small set of commands is reserved for the manufacturer for use during the manufacturing process.

Any command sent by a Master Device, either the Primary Master or the Secondary Master, requires a response message that necessarily includes a Specific Response Code: the response code gives information about the correct interpretation and execution of the received command.

The response code pertains to the Data Link Layer, for the part concerning the communication, or to the Application Layer, for the part concerning the application and in case of errors an error message will be issued: a specific section of this manual lists the error messages.

COMMUNICATOR APPLICATIONS

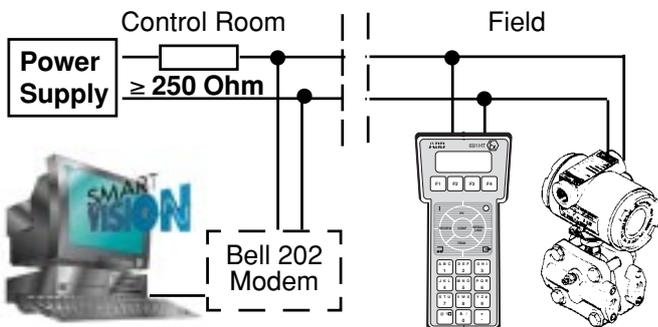
This manual covers the use of the Hand Held Communicator in direct, multidrop or broadcasting mode and gives general information for the use in serial and modem modes. In these two modes the Communicator is in slave mode with all the operations performed by the Personal Computer. The operations that can be performed using a Personal Computer have still to be defined. The Software that is going to be adopted will be probably the SMART VISION! Please refer also to the Operating Instructions of the Smart ABB pressure and temperature transmitters for the general and specific informations on this products.

The Communicator can be used in several different ways to fulfill the needs of commissioning and maintenance of a HART transmitter:

- **direct** : the Communicator is directly connected to the transmitter, either in the field or on the laboratory bench and the plant engineer may use it to configure, calibrate or check the connected instrument. Up to 32 different configurations can be saved in the Communicator memory.

Transmitter direct connection

The Hand Held Communicator can be connected via its leads at any point of the current loop : the connection shall be made in parallel to the transmitter and is polarity independent. Do not connect the Communicator in series in the current loop: this will not damage the instrument but the current loop will be interrupted.



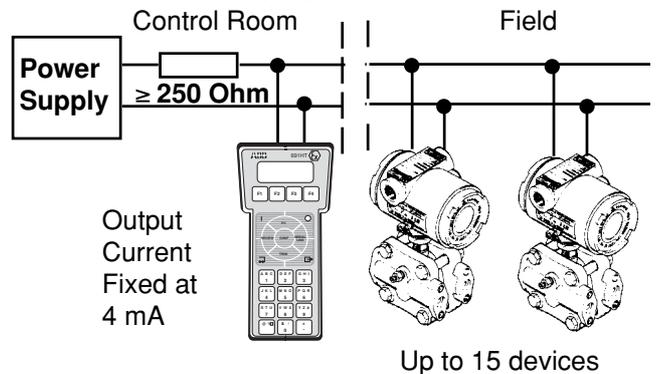
NOTE - A resistor of 250 ohm minimum must be present in the loop, between the Communicator and the power supply for communication purpose.

If the resistor is represented by the intrinsic safety barrier and the connection is made in the hazardous area side of the barrier, **any possible precaution must be taken to avoid hazard via the leads or operator.** The insertion or the removal of the Communicator does not disturb the operation of the loop, whether the instrument is working (ON) or not (OFF).

- **multidrop** : the Communicator is multidrop connected to several transmitters and the access to each transmitter is possible using the **TAG** name. The operation on transmitters are the same indicated for the direct connection. Note that in multidrop connection the analog output of each transmitter is locked to 4 mA and the process value is transmitted through digital signal.

Multidrop connection

The Hand Held Communicator can be connected via its leads at any point of the current loop : the connection shall be made in parallel to the multidrop connected-transmitters, as shown in the figure below, and is polarity independent. **Also in this case, a resistor of 250 ohm minimum must be present in the loop, between the Communicator and the power supply for communication purpose.**



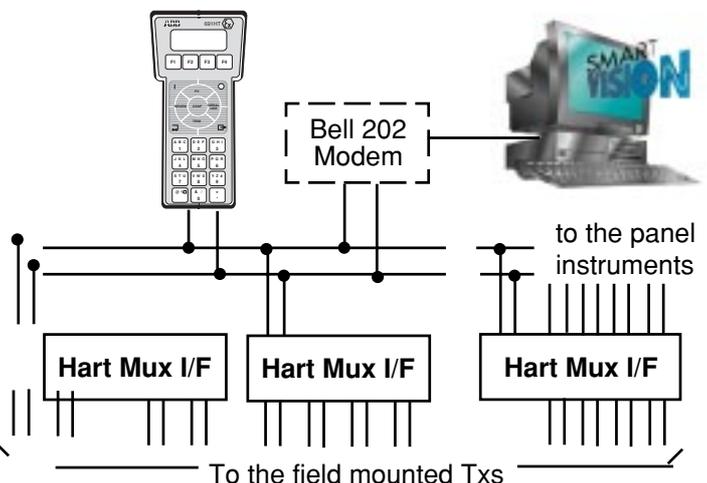
The power supply should provide a minimum voltage of 12 Volt at the transmitters terminals and supply a current of 4 mA for each transmitter connected. A maximum of 15 transmitters can be connected in multidrop mode.

- **broadcasting** : connection to several transmitters using a suitable interface that provides a separation between the analog signals coming from the different transmitters and the HART digital communication. Also in this case the access to an individual transmitter is possible using the **TAG**. With this type of connection each transmitter maintains its analog output and the full functionality of the transmission loop is maintained. The operations on transmitters are the same as indicated for the direct connection.

Broadcasting connection

In the broadcasting configuration the connection can be made in any point of the common Bell 202 link between the interface modules and the modem module.

This connection being not directly branched with a low impedance power supply, no additional resistors are required.



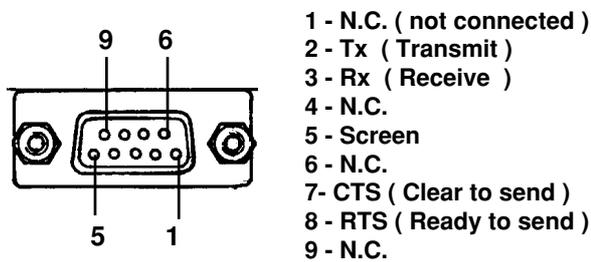
- **serial link** : a RS 232 serial connection provides a link from the Communicator and a Personal Computer. This is used for the 691 Firmware upgrade.

Serial connection

DANGER - Do not use the serial connection when in areas classified as HAZARDOUS LOCATIONS. Such action could result in FIRE OR EXPLOSION.

The included serial cable should be used to connect the Communicator to the PC. The cable consists of a 9 pin male D-sub connector for attaching to the Communicator and a 9 pin female D-sub connector for the PC's serial port. Also included is a 9 pin to 25 pin serial adapter which can be used to adapt the 9 pin end of the cable to a 25 pin serial port.

The figure below shows the pinout of the 9 pole sub-D female connector of the Communicator (view from the rear of the equipment).



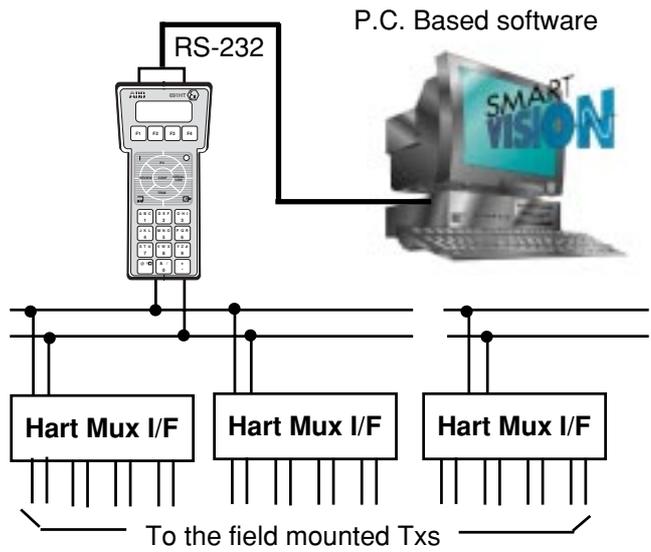
DANGER: the serial link operation are not allowed in hazardous area (area with danger of fire or explosions).

- **modem** : the Communicator can be connected to a Personal Computer Configurator through the serial link connection and connected to the transmitter, using the Bell 202 protocol either in direct mode or in multidrop or broadcasting mode. In the modem mode the Communicator acts simply as a protocol converter between the RS 232 and the Bell 202 with all configuration functions left to the P.C.Configurator.

Modem connection

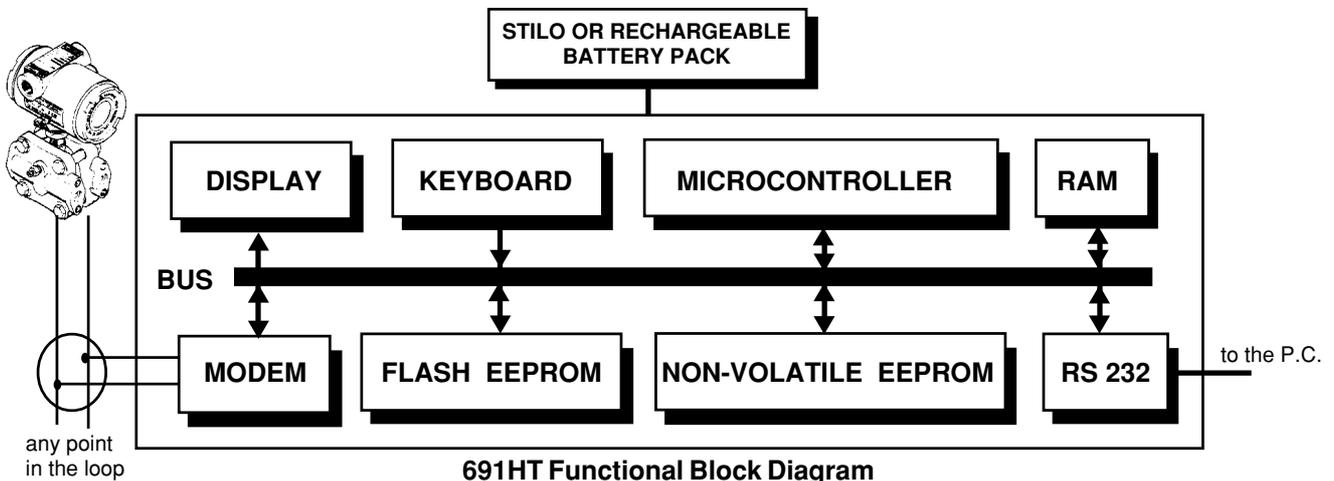
This connection is made to allow the connection of transmitters, either in direct mode or multidrop or broadcasting mode to a Personal Computer using the Communicator as a Bell 202 Modem.

The connection from the Communicator and the Personal Computer is of serial type and therefore make it using the instructions for the serial link. The connection between the Communicator and the transmitter/s should be made using the requested type of connection (direct, multidrop, broadcasting).



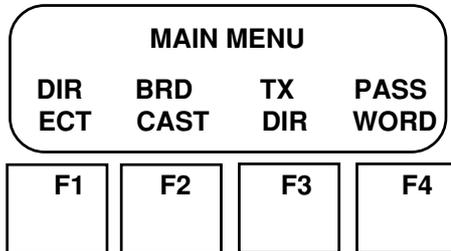
FUNCTIONAL DESCRIPTION

The Hand Held Communicator is a microprocessor based device using a Mitsubishi M377 microcontroller, a random access memory (RAM), a read only memory (FLASH EEPROM) used for the program, a non-volatile RAM used to maintain the transmitters configuration, a Bell 202 Modem, a RS 232 serial interface, the 4 line by 20 characters liquid crystal display and a tactile feedback membrane keyboard. The Hand Held Communicator is powered by a pack of stilo and rechargeable batteries. The following figure shows a functional diagram of the Communicator.



KEYBOARD AND DISPLAY

The display is a 4 line by 20 characters liquid cristal display mounted at an angle to the face of the Communicator to increase readability. The first two lines of the display are dedicated to data or messages for the user. The botton two lines of the display are used for labelling the function keys, as shown in the figure below.



The keyboard is comprised of 25 keys arranged in 3 functional groups.

Located below the LCD display is **a group** of 4 programmable function keys ("softkeys") labelled F1 - F4. The definition of these keys varies based on the operation the user is trying to perform. The function of each key is defined by the corresponding label displayed by the LCD above.

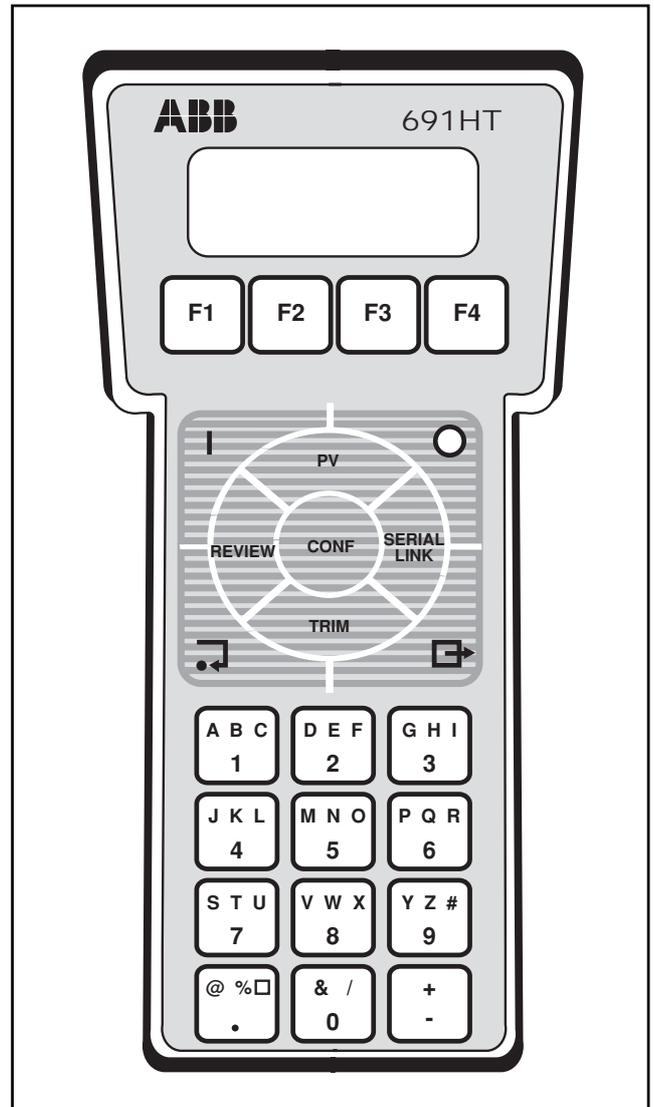
At the bottom of the Communicator there is **a group** of 12 keys used for the entry of numeric data and letters, along with a decimal point (.) and a change sign, i.e. (+/-) keys.

There is **a group** of nine dedicated function keys located on the face of the Communicator. Two keys are dedicated to turning the Communicator ON or OFF. Two other keys assist in keyboard entry (ENTER) and returning to the previous menu (ESCAPE). The remaining keys in the **group** are associated with transmitter functions. A more detailed description of the dedicated keys is presented below.

PV Monitor the process variables and output current values of the transmitter. The Communicator continuously updates the display with this information approximately twice per second. Additional functions available through the use of this key may, depending on the transmitter, include monitoring the sensor temperature or static pressure.

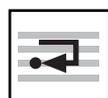
REVIEW Review the connected transmitter's database. This information includes: output parameters; revision info; other miscellaneous info. Use of this key does not give the user the ability to change any information. To make changes the user must use the CONF key.

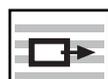
CONF Configure or edit the transmitter's database. The user is allowed to specify output parameters, identification info and material info. In addition the user may perform operations involving transmitter database such as listing, saving, downloading and deleting.



SERIAL LINK Configure the Communicator as a Modem or to upgrade it.

TRIM Perform trimming of the sensor or output circuitry and reranging the sensor.

 Confirm data entry during input operations. This key is sometime super seded by function key F4 which often serves as ENTER also.

 Abort the present operation or return to the next higher (previous) menu screen.

I Switch ON the Communicator ( OFF is for switch off) .

NOTE : The Communicator automatically shut off in order to conserve battery power, if it senses that the unit has not been used for 9 minutes. This feature is disabled when the PV function is currently in use, when the Communicator is in DATA BASE MODE, in MODEM MODE or during firmware and software upgrade, i.e. when in LOAD PROG Mode.

TRANSMITTER TERMINOLOGY

The Communicator primary use is the **commissioning** and the **servicing** of Smart transmitters. The **commissioning** includes all the operation of functional testing of the transmitter and check of the transmitter configuration data normally performed before the putting in service, while the **servicing** is for operation after installation. Commissioning can be done either in the field or on the bench.

The advent of smart microcontroller-based transmitters brings new procedure and terminology to the instrumentation field, not present in the days of pure analog transmitters. This manual would like to present the following terminology to define some of the operations of commissioning as follows:

- **Ranging** - Setting either or both the lower and upper value (LRV & URV) thereby determining the zero and span by user entry of the numeric values. This operation is available to the user via the CONFIguration menu. Also called "Dry Calibration".

- **Reranging** - Setting either or both the lower and upper range values (LRV & URV) using the value of the applied pressure or input reference. This operation requires accurate test equipment. This operation is available to the user via the RERANGING function under the TRIMming menu. Also called "Wet calibration".

- **Trimming** - Performs small corrections to either the sensor measurement value or the analog output value (i.e. corrections to either the input or output sides of the transmitter's microcontroller). Major detail on this operation can be found in the "Use of the green keys-TRIM" section of this manual. This operation requires accurate test equipment. This operation is available to the user via the SENSOR TRIM and the 4-20 mA TRIM under the TRIM menu.

Consideration on accuracy

The use of a sensor having a good intrinsic linearity and repeatability and the possibility to compensate, using a microprocessor, the residual non linearity errors and the errors due to the influence of the temperature and static pressure leads to an instrument having a very high accuracy.

The factory final calibration of the transmitter is done using testing equipment having an accuracy from four to ten times the specified accuracy of the transmitter.

This facts bring to the consideration that, unless your testing equipment is of a suitable class (accuracy three times of the transmitter accuracy), a calibration done using the Ranging procedure leads to results that are surely better than a calibration done using poor quality testing equipment.

Before to decide about the type of calibration to perform it is then to check the transmitter accuracy stated in the specification sheet and the accuracy of the testing equipments available.

GENERAL OPERATIONS

Battery Charging

There are four nickel-cadmium rechargeable batteries: the expected working time of the Communicator with the battery full charged is about 10 hours. When the battery is nearly 90% gone, i.e. 1 working hour is still available, a low battery warning signal, (^LB) is displayed in the lower right corner of the LCD display.

The Non-Volatile EEPROM (which is used to store database configurations) is not affected by a low battery voltage or battery replacement.

The battery pack has an expected life of 1000 charge/discharge cycles. This expectancy is valid if the charge/discharge cycles are properly performed. Nickel-cadmium batteries require that they are nearly fully discharged before recharging, therefore the user should wait for the low battery indication before recharging.

DANGER - Do not use the battery charger in areas classified as HAZARDOUS LOCATIONS. This can result in HAZARD OF FIRE AND EXPLOSIONS.

The battery charging should be done using the battery charger optionally supplied with the Communicator. Use of other chargers is discouraged but can be used. Under such conditions, it should be noted that the maximum charging current be less than 50 mA. If a constant voltage charger is used the voltage must be 7.5 Volt D.C. The full charge of the battery pack requires about 12/15 hours.

Access to the battery charging connector is by removal of the cover plate located at the top of the Communicator. The connector is a 5.5 mm plug with the center contact being positive (+) and the outside contact being negative (-).

CAUTION - Do not maintain the battery charger connected for more than 15 hours: the battery pack and the internal circuit may be damaged.

Battery pack replacement

The battery pack consists in a plastic box containing the Ni-Cd battery and all the necessary intrinsic safety protection diodes and resistors. The plastic enclosure is completely filled with silicon resin to prohibit access to the components.

DANGER : Do not remove the silicon resin protection, don't change or modify intrinsic safety components. This can cause HAZARD OF FIRE AND EXPLOSIONS.

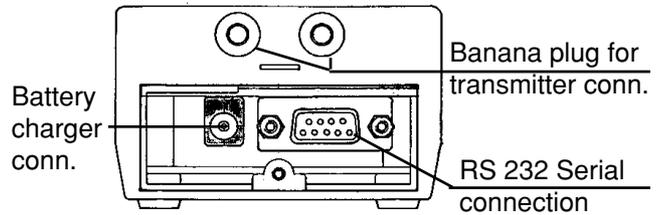
For battery pack replacement proceed as follows:

- Unscrew the two Philips screws and remove the battery pack. Unplug the battery cable connector.
- Plug the battery cable connector in the new battery pack and fit it in the battery recess, paying attention that the cable is properly fitted. Fix it with its screws.
- Switch on the unit and check if the battery low warning appears. In case that doesn't appear discharge the battery until it appears.
- Charge the battery for 12/15 hours.

NOTE - Since the Battery Pack is intrinsically safe it is possible to replace it in a hazardous area. However this is not recommended as good standard practice.

ELECTRICAL CONNECTIONS

All the electrical connections are grouped in the rear part of the Communicator and include the following (see figure below):



- the transmitter connection consists of a double banana jack suitable for a double banana plug patch cord.
- the serial link (RS 232) connection consists in a std. Type D subminiature 9-pole female connector.
- the battery charger connection consists in a 5.5 mm. round socket.

The two latter are protected by a plastic cover that can be removed unscrewing a Allen screw.

DANGER - Do not remove the cover or use the unit with the cover removed in area classified as HAZARDOUS LOCATIONS: THIS CAN RESULT IN HAZARD OF FIRE AND EXPLOSIONS.

GETTING STARTED WITH 691HT HAND TERMINAL

ABB SACE
Firmware Rev. 2
Software Rev. 2.11
Language: ENGLISH

Connect the Communicator with the transmitter following the instruction in the relevant chapter of this manual and then press the **ON** key. The ON key must be kept pressed for one second. The first display at side appears for some seconds, giving indications on the 691HT revisions and language.

MAIN MENU

DIR BRD TX PASS
ECT CAST DIR WORD

After some seconds the Main Menu appears on the screen giving the access to the main procedure:

Transm. Directory
(List of HART devices supported)

Direct and Broadcast : to initialize the communication with a transmitter.
Password : to insert or change the password to protect the access to some operations, namely Conf, Trim, Serial Link and Password itself.
Tx Directory : to visualize (scrolling) the list of device that one configurable using the installed software revision.

Example of Transmitter Directory:

GENERIC HART	1.2
TH02 Temperature	1.1
AS800 Pressure	1.1
Deltapi K Pressure	1.0
600T Pressure	1.1
600T EN Pressure	1.1
600T/2600T SAFE	
2600T Pressure	

PASSWORD PROCEDURE

PASSWORD

ENA DISA
BLE BLE

If you want to enable the password or to change the existing one press the F4 function key, corresponding to the label PASSWORD in the main menu. The password menu will appear. The possible password operation are the following:

- setting a password and enabling it.
- changing an existing password and enabling it
- disabling a password

Input numeric
password:

[_____]

CLR ENTR

Retype password:

[_____]

CLR ENTR

Password enabled

Press any key to
continue

Setting a password. If you want to set a password press the function key F1, labelled ENABLE: If the password is already enabled, then a new display, shown below, gives the possibility to change the existing password or to proceed without changing it. Otherwise, pressing F1, appears the following:

Insert the numeric password: it can be any number from 1 to 6 digits. If a mistake is made, the CLR key should be pressed to start again. After entry as been completed pressing the ENTÉR key a new display appears asking to repeat the entry for security reasons.

Pressing the ENTÉR key the next screen appears confirming that the password has been successfully entered and enabled: if for some reason the procedure aborts then the following message is displayed: **"Password incorrect - Press any key to continue "**

In both cases, pressing any key you will return to the Password Main Menu: then press ESCape if you wish to leave the password procedure.

NOTE - Be extremely careful not to forget an entered password, as the user has no way of circumventing the security feature.

Password already
enabled

CHNG PRO
CEED

Input existing
password:

[_____]

CLR ENTR

Input new
password:

[_____]

CLR ENTR

Retype new
password:

[_____]

CLR ENTR

Changing an existing password. If a password exists and is enabled, the following screen will appear when the F1 key, corresponding to enable, is pressed. Pressing the F4 key you will return to the Password Main Menu while pressing F1 to CHaNGe the following display appears.

Input the existing password. If the password is not correct then the following message is displayed: **"Password incorrect - Press any key to continue "**. Pressing any key you will return to the Password Main Menu.

If the password is accepted then the next screen appears: insert the new numeric password. If a mistake is made, the CLR key should be pressed to start again. After entry has been completed pressing the ENTÉR key a new display appears asking to repeat the entry for security reasons.

Pressing the ENTÉR key a screen appears confirming that the password has been successfully entered and enabled: if for some reason the procedure abort then the following message is displayed: **"Password incorrect - Press any key to continue "**

In both the case, pressing any key you will return to the Password Main Menu: then press ESCape if you wish to leave the password procedure.

Input existing
password:

[_____]

CLR ENTR

Password disable . If you select, from the Password Main Menu, the DISABLE option, then the following screen is presented: insert the existing numeric password and then press F4 to ENTÉR.

The following message is displayed: **" Password disabled - Press any key to continue "**.

Note - If you have unlackely forgotten the Password, please contact your nearest ABB Instrumentation Service Center.

If the password is already disabled or some mistake is made inputting the password, one of the following messages will be displayed:

" Password already disabled - Press any key to continue "

" Password incorrect - Press any key to continue "

In both cases, pressing any key you will return to the Password Main Menu: then press ESCape if you wish to leave the password procedure.

DIRECT CONNECTION

MAIN MENU
DIR BRD TX PASS
ECT CAST DIR WORD

TX : 600T Press (+EN)
TAG : XXXXXXXX
SELECT GREEN KEY

XMTR NOT IN
COMMUNICATION
RETRY
POLL

Polling Address: (03)
PRO
CEED

Supposing that a direct connection to the transmitter has been done, press the function key F1, corresponding to the label "direct", to establish the communication with the transmitter. In the top right angle of the display will appear a symbol, like a T, signalling that the communication is on course and, after some seconds, a new display appears. Some Warning messages can appear : please refer to the Error and Warning Message Section. Press any key if requested.

The transmitter's type, Pressure or Temperature and the TAG are displayed. If the Tag is not yet defined the space after the semicolon will be blank (for other manufacturers' Tx only TAG is displayed). Now, using one of the green keys, you can select one procedure: the use of the green keys will be discussed later on.

In case that the communication does not take place the display at the side will appear: the F1 key allows you to RETRY checking if the transmitter has a polling address different than zero, i.e. is set for multidrop connection. In this case the following display will appear.

The display shows, within square brackets, the polling address of the connected transmitter. Pressing F4 to PROCEED the display showing the TAG and the TX type and the label SELECT GREEN KEY appears. Before TAG and TX type an additional message:

WARNING: Output Current Fixed

is used to indicate that the analog output signal, in case of polling address different than zero, remains fixed at 4 mA value.

See Section in CONF for Polling Address Setting and disabling.

MAIN MENU
DIR BRD TX PASS
ECT CAST DIR WORD

ACCESS METHOD
TAG TAG
ENTR SEL

FT100 LT112
PT234 FT256
STOP NEXT LAST SEL
LIST PAGE PAGETAG

ENTER TAG
<-- --> CLR ENTR

TX : 600T Press. (+EN)
TAG : FTD - 200
SELECT GREEN KEY

BROADCASTING CONNECTION

If transmitters are connected in broadcast mode press the function key F2 in the Main Menu, corresponding to the label "BRD-CAST" and the display will change as follows.

To access a transmitter you can use the TAG name.

If a tag has already been written in the transmitter two methods of access can be used depending if the Tag is included in the Communicator Database or not included. In the first case, pressing F2 (TAG SEL) in the Access Method Menu, the tags stored in the Communicator are displayed, four per display, at a rate of 3 seconds: using F1 you can stop the listing whereas with F2 or F3 you can move forward or backward in the list. When the required tag is on the display, you can select it moving, using F4, the cursor on it: now pressing the ENTER key you make the selection.

The second method of access is via TAG ENTER; in this case the following display appears. Use the key board to input character and the key F1 and F2 to move the cursor. The key F3 can be used to clear the tag name on the screen.

When, using one of the methods, the tagname has been composed press ENTER to establish the communication with the selected transmitter.

In the top right angle of the display will appear a symbol, like a T, signalling that the communication is on course and, after some seconds, the display at side appears. If Warning Messages are displayed, please refer to Error and Warning Message Section for details. Press any key if requested.

USE OF THE GREEN KEYS - PV - PROCESS VALUE

For 600T, 600T EN and Deltapi K Pressure Transmitters

PV: 1234.56 mbar T
OUTPUT: 12.34 mA
STAT SNSR
PRES TEMP

STATIC : 1.234 T
MPa

S TEMP : 23.4 T
Deg. C
NOT PROCESS TEMP

The green key PV (Process Value) allows the user to monitor the process value and the current output of the transmitter. The process value appears in user configured engineering units while the output current is in milliamps.

Monitoring of other transmitter measured value is possible by the use of labelled function keys and is different depending on the transmitter type: the first three displays are related to pressure transmitters while the remaining are for temperature transmitters.

The indication "NOT PROCESS TEMP" reminds that the displayed temperature cannot be considered as the process temperature being the temperature reads in the sensor's core.

For Temperature Transmitters

PV: 123.45 Deg. C T
OUTPUT: 12.34 mA
TEMP SNSR SNSR
ERAT 1 2

CJC Temperature :
20.5 Deg. C

For the temperature transmitters the initial display shows the process value in the user configured engineering units and the output value in milliamps. The secondary displays change depending upon the type of the sensor element (thermocouple, resistance thermometer, variable resistor or mV generator) and single or differential measurement.

For thermocouple and mV measurement pressing the F1 key the CJC temperature is displayed (as shown), while for other types of measurement the electronics internal temperature is displayed.

The F2 and F3 keys can be used only for differential measurement to display the measured value of the two sensors expressed in the same units than the process value. If used for other types of measurement an error message will be displayed: VALID ONLY FOR DIFFERENTIAL T/C.

For Generic HART device

PV: 123.45 Deg. C T
OUTPUT: 12.34 mA
SV TV QV

If the Communicator is connected with a **generic smart HART transmitter** the PV green key will operate in a similar way to display the process variables in the following order:

PV: for primary variable

OUTPUT: for analog output current

F1, F2 and F3 are used respectively to display secondary (SV), tertiary (TV) and fourth (QV) variables.

USE OF THE GREEN KEYS - REVIEW

REVIEW

**TX
INFO**

UNITS : m b a r

**STOP STRT NEXT LAST
LIST LIST ITEM ITEM**

The dedicated function key REVIEW allows the user to view the transmitters configuration data. The information contained under Tx Info varies slightly depending on transmitter type. See below the relevant information for 600T and 600T EN Pressure and for 652/653S Temperature transmitters.

Each parameter of a section is normally displayed at a rate of approximately 2 seconds. The listing of the parameter may be stopped (F1 - STOP LIST), started again (F2 - STRT LIST), advanced (F3 - NEXT ITEM) or backed-up (F4 - LAST ITEM).

The information for Deltapi K and KST Tx are described next in this section.

Information displayed under TX INFO common for all HART transmitters

TX : Model type of transmitter.

BY : Manufacturer of transmitter.

TAG : Tag name identifier of unit.

DESCRIPTOR : The transmitter service.

MSG : A message that can be written, using the P.C. Configurator, for warning or maintenance use.

DATE : User specifiable date. May be used to log the installation, calibration or last servicing date.

DEV NUM : Factory assigned electronics serial number.

UNITS : Engineering units for reporting process value or entering range values.

LRV : Lower Range Value. The lowest value that the transmitter is adjusted to measure. Also known as the zero or 4 mA point.

URV : Upper Range Value. The highest value that the transmitter is adjusted to measure. Also known as the full span or 20 mA point.

DAMPING : The time constant, in seconds, of a first order filter applied to the input.

OUTPUT : Type of the transfer function applied to the input to obtain the output. Linear, Square root and Polynomial for 600T Tx (not for temperature transmitter).

LIMS UNITS : Units used to express the sensor's calibration limits.

MIN SPAN : The minimum allowed value for the span. The span is the algebraic difference between the Upper and Lower Range Values.

LRL : Lower Sensor Limit. The lowest value of the measured value that the transmitter can be adjusted to measure.

URL : Upper Sensor Limit. The highest value of the measured value that the transmitter can be adjusted to measure.

FINAL ASSY NUMBER: the transmitter final assembly serial number.

P V SENSOR S/N : The sensor's module serial number (not for temperature transmitter)

H / W : Electronics hardware revision level

S / W : Electronics software revision level

U C D : HART Universal Command document revision level which the HART protocol was implemented

T S D : Transmitters Specific document revision level

For both 600T and 600T EN pressure transmitter

MAX WORKING PRES. with its units :

The maximum pressure to which the transmitter can be submitted without causing danger and damage.

MAX SENSOR TEMP. with its units :

The maximum temperature to which the transmitter's sensor can be submitted without damage.

MIN SENSOR TEMP. with its units :

The minimum temperature to which the transmitter's sensor can be submitted without damage.

ROOT XFER FUNCTION: (not for 600T EN)

The output variation from 0% to 20% of the output, when the SQR(x) output transfer function is selected.

UP/DOWN SCALE : the value to which the output is forced when a major fault occurs.

POLY COEFF. A0 (to A5) : The coefficients of the polynomial (in scientific notation and not for KSx)

FLANGE TYPE : The flange type

FLANGE MATERIAL : The flange material

O-RINGS : The material of the O-Rings

VENTS : The vents material

NUMBER OF REM.SEAL: the number of remote seal

REMOTE SEAL TYPE : The type of remote seal.

REMOTE SEAL FILL. : The remote seal filling liquid.

REM.SEAL ISOLATOR : The material of the remote seal wetted diaphragm.

SENSOR FILL.FLUID : The filling fluid of the sensor.

SENSOR ISOL.MTL.: The diaphragm sensor's material.

MODEL TYPE : The transmitter model.

SENSOR RANGE : The sensor's range.

LOCAL ADJUSTMENT: Whether the instrument is fitted with Zero and/or Span calibration buttons or not.

LOCAL KEYS CONTROL: The local adjustments are enabled or disabled

LCD DISPLAY MODE: The variables displayed by the LCD integral display.

H / W WRITE PROT. : Whether the configuration is protected by the hardware jumper or not.

METER INST. : Whether the integral meter is installed or not.

CALIBRATION TYPE : Standard or specific on operating pressure or temperature or both.

PROCEDURE TYPE : Type of any special procedure required for the manufacture of the sensor.

PRODUCT CODE : Transmitter's product code.

SEP. &/OR SERVICES : Code of remote seal or code for special services or calibration.

MANIFOLD OR ORIFICE : Code of manifold or integral orifice.

and in addition for 600T EN pressure transmitter

LONG TAG : Process or Plant identifier with a maximum length of 24 characters.

PV BIAS VALUE : Value that can be applied to the primary variable for scaling. It is stated in the same unit of the primary variable.

SQR (x) CUT LINEAR : The connection point between the linear line and square root line (from 10% to 20%).

OPERATIVE LRL : Low operative limit when PV BIAS is active (when PV BIAS VALUE not equal to 0).

OPERATIVE URL : High operative limit when PV BIAS is active (when PV BIAS VALUE not equal to 0).

DOUBLE POLY B0(to B2) - **C0**(to C2): The coefficients of the double polynomial function (in scientific notation).

1ST POLY HIGH LIM. : Output percentage that identifies the connection between the 1st and the 2nd polynomial function of the Double Polynomial function.

and in addition for 652/653 S Temperature

METER OPTION : identifies if the transmitter is provided with output meter (LCD or analog).

SENSOR TYPE : the type of the sensor element: millivolt, thermocouple, resistance thermometer, ohms.

MEASUREMENT TYPE : single or diff. measurement.

CJC TEMPERATURE: constant cold junction compensation value (-40°C to +135°C)

MULTIPLICAT. FACT: Multiplication factor for 100Ω RTDs.

MAX TEMP FOR SENS.: Maximum temperature on individual sensors for differential measurement.

TOTAL RESIST (Ohm) : Total cable resistance value.

CERTIFICATION TYPE : General purpose, intrinsic safety, flame proof.

mA 100%: Output current at 100% range value.

mA 0% : Output current at 0% range value.

mA HLim : Output current upper limit.

Max: Maximum measured value

Min: Minimum measured value

mA LLim : Output current lower limit

SENSOR ERROR CONF. : Sensor error configuration.

SHORT V : Output current for short-circuited sensor.

OFF VAL : Output current for broken sensor.

TRANSMITTER VERSION : the version type of the transmitter, 652S or 653S, head or integral mounted.

DIS (TRIBUTOR) : The name of the distributor.

Here follows the information for Deltapi K Pressure and KST Temperature under Review green key.

REVIEW

OUT TX MATE NEXT
PUT INFO RIAL OPTN

OUT TX REVI PROD
PUT INFO SION DATA

UNITS: mbar

STOP STRT NEXT LAST
LIST LIST ITEM ITEM

USE OF THE GREEN KEYS - REVIEW

Using the green dedicated function key REVIEW allows the user to view different sections of the transmitters configuration. The Review Menu varies slightly depending on transmitter type: the top display is pertinent to the **Deltapi K pressure transmitter** while the partially hidden display is for **KST temperature transmitter**. The F4 key, NEXT OPTN, in the pressure transmitter Review Menu gives the access to a second menu Review screen: the ESCAPE key allows to come back to the previous menu.

Each parameter of a section is normally displayed at a rate of approximately 2 seconds. The listing of the parameter may be stopped (F1), started again (F2), advanced (F3) or backed-up (F4).

The following tables describes the parameters presented under each review section. Some parameters are available only for a type of transmitter: a note gives this information.

Information displayed under OUTPUT

UNITS : Engineering units for reporting process value or entering range values.

LRV : Lower Range Value. The lowest value that the transmitter is adjusted to measure. Also known as the zero or 4 mA point.

URV : Upper Range Value. The highest value that the transmitter is adjusted to measure. Also known as the full span or 20 mA point.

DAMPING : The time constant, in seconds, of a first order filter applied to the input.

OUTPUT : (*Deltapi K Pressure only*) Type of the transfer function applied to the input to obtain the output: linear or square root.

LIMS UNITS : Units used to express the sensor's calibration limits.

MIN SPAN : The minimum allowable value for the span. The span is the algebraic difference between the Upper and Lower Range Values.

LRL : Lower Sensor Limit. The lowest value of the measured value that the transmitter can be adjusted to measure.

URL : Upper Sensor Limit. The highest value of the measured value that the transmitter can be adjusted to measure.

UP/DOWNSCALE : (*Deltapi K Pressure only*) the value to which the output is forced when a major fault occurs.

Information displayed under TX INFO

TX : Model type of transmitter.

BY : Manufacturer of transmitter.

TAG : Tag name identifier of unit.

DESCRIPTOR : The transmitter service.

MSG : A message that can be written, using the P.C: Configurator, for warning or maintenance use.

DATE : User specifiable date. May be used to log the installation, calibration or last servicing date.

DEV NUM : Factory assigned electronics serial number.

MAX WORKING PRES. with its **units** : (*Pressure only*) The maximum pressure to which the transmitter can be submitted without causing danger and damage.

METER OPTION: (*KST Temperature only*) identifies if the transmitter is provided with output (LCD or analog) meter.

Information displayed under REVISION

H / W : Electronics hardware revision level

S / W : Electronics software revision level

U C D : HART Universal Command document revision level which the HART protocol was implemented

T S D : Transmitters Specific document revision level

Information displayed under MATERIAL
(for Deltapi K pressure type only)

FLANGE TYPE : The flange type

FLANGE MATERIAL : The flange material

O-RINGS : The material of the O-Rings

VENTS : The vents material

NUMBER OF REM.SEAL: the number of remote seal

REMOTE SEAL TYPE : The type of remote seal.

REMOTE SEAL FILL. : the remote seal filling liquid.

REM.SEAL ISOLATOR : The material of the remote seal wetted diaphragm.

SENSOR FILL.FLUID : The filling fluid of the sensor.

SENSOR ISOL.MTL.: The diaphragm sensor's material.

MODEL TYPE : The transmitter model.

SENSOR RANGE : The sensor's range.

NUTS AND BOLTS :
The material of the nuts and bolts.

PUSH BUTTONS: Whether the instrument is fitted with Zero and/or Span calibration buttons.

Information displayed under PRODUCT DATA
(for KST Temperature Type only)

SENSOR TYPE : the type of the sensor element: millivolt, thermocouple, resistance thermometer, ohms.

NUMBER OF WIRES : Two, three or four

LINEARIZATION MODE : linear with input or with temperature.

MEASUREMENT TYPE : single or diff. measurement.

EXISTING TRIM : user, or factory calibration

UPPER TRIM POINT : the value of the upper trim point.

LOWER TRIM POINT : the value of the lower trim point.

TRIM POINT UNITS : the units used for the above parameters.

CERTIFICATION TYPE : General purpose, intrinsic safety, flame proof.

CONN. HEAD LENGTH : The length of the connection head's extension.

BROKEN SENSOR DRIVE : Output driven >20 mA or <4 mA if the sensor or the sensor connection breaks.

CAL. CERTIFICATE : Provided or not.

PUSH BUTTONS : Installed or not installed.

PRODUCT CODE : The transmitter's code number.

H/W WRITE PROT. Whether the configuration is protected by the hardware straps.

FINAL ASSY NUMBER : the transmitter's final assembly serial number.

Information displayed under MISCELLANEOUS
(for Deltapi K pressure transmitter only)

FINAL ASSY NUMBER : The transmitter's final assembly serial number

P V SENSOR S/N : The sensor's module serial number

H / W WRITE PROT. : Whether the configuration is protected by the hardware jumper.

METER INST. : Whether the integral meter is installed.

CALIBRATION TYPE : If std. or specific on operating pressure or temperature or both

PROCEDURE TYPE : Type of any special procedure required for the manufacture of the sensor.

PRODUCT CODE: Code of the Transmitter

SEP. &/OR SERVICES : Code of remote seal or code for special services or calibration

MANIFOLD OR ORIFICE : Code of man. or int. orifice.

USE OF THE GREEN KEY - CONF KEY

Transmitter parameters which are user configurable may be changed by the use of the Configuration Menu accessible via the CONFfiguration dedicated function key. These items are organized into Submenus, as follows:

For generic HART Transmitter of other manufacturers

Change I/O Parameters:	Tx Information (XMTRINFO)	General Configuration	Database Memory Oper.
Engineering Units	Tag Name	Polling address	Tag List
Lower/Upper Range Value	Date		Save Configuration
Damping Time Constant			Send Configuration
Output Function			Delete Configuration

For Deltapi K Pressure Transmitter

Change I/O Parameters:	Tx Information (XMTRINFO)	General Configuration	Database Memory Oper.
Engineering Units	Tag Name	Polling address	Tag List
Lower/Upper Range Value	Date	Up/Down scale	Save Configuration
Damping Time Constant			Send Configuration
Output Function			Delete Configuration

For KST Temperature Transmitter

Change I/O Parameters:	Tx Information (XMTRINFO)	General Configuration	Database Memory Oper.
Sensor Type	Tag Name	Polling address	Tag List
Engineering Units	Date		Save Configuration
Lower/Upper Range Value			Send Configuration
Damping Time Constant			Delete Configuration

For 652/653 S Temperature Transmitter

Change I/O Parameters:	Tx Information (XMTRINFO)	General Configuration	Database Memory Oper.
Sensor Type	Tag Name	Polling address	Tag List
Engineering Units	Date		Save Configuration
Lower/Upper Range Value			Send Configuration
Damping Time Constant			Delete Configuration
mA100%			
mA 0%			
Total Resist (Ohm)			
Short Val			
Off Value			
Max			
Min			

For 600T and 600T EN Pressure Transmitter

Change I/O Parameters:	Tx Information (XMTRINFO)	General Configuration	Database Memory Oper.
Engineering Units	Tag Name	Polling address	Tag List
Lower/Upper Range Value	Date	Local Keys Mode	Save Configuration
Damping Time Constant		LCD Display Mode	Send Configuration
Output Function			Delete Configuration
Root Transfer Function (600T only)			
SQR(x) cut linear (600T EN only)			
Poly Coefficients			
Double Poly Coefficients (600TEN only)			
Sensor Temperature Units			
Static Pressure Units			
Long Tag (600T EN only)			

```

Input numeric
password :
(.....)
          CLR ENTR

```

```

Password incorrect

          PRO
          CEED

```

```

CONFIGURATION

CHNG XMTR GEN DBASE
I/O  INFO CONF MEM

```

Use of the Green Key - Access to the CONF procedure

The access to the CONF procedure, as well as the TRIM and the SER.LINK, can be protected by the use of a Password: if this option has been enabled then the following display will appear when the CONF green key will be pressed .

Insert the numeric password using the numeric keys and the function key labelled ENTER. If the password is correct the unit will proceed to the main menu screen. Otherwise a warning message is displayed and the user is allowed to re-attempt entry. If the user makes a mistakes during entry, the CLR key may be used to erase the input and start over.

The access to the above mentioned procedure remains possible until the unit is switched off. If the password is disabled then the access is immediate and the Main Menu screen is suddenly displayed.

```

TAG: OLD TAG

NEXT LAST CHNG
OPTN OPTN

```

```

TAG: [NEWTAG ]

<-- --> CLR ENTR

```

```

TAG: NEWTAG

NEXT LAST CHNG
OPTN OPTN

```

CONF - XMTR INFORMATION - TAG and DATE options

Using the **CONF** key, when the display with the message " SELECT GREEN KEY" is present, the following display will appear:

Pressing F2, corresponding to "XMTR- INFO" (Transmitter Information) you access the procedure of changing some information, these are the TAG and the DATE: usually the TAG changing option is displayed: if a Tag was already assigned to the transmitter, then it will appear on the display. Using the F3 key, corresponding to CHaNGe, the next display will appear:

Use key F1, F2 and F3 together with the keyboard (letters and numbers) to input characters. Up to eight characters can be used to form the tagname: the key CLR deletes the name inserted. When the full tagname has been composed press ENTER to establish the communication with the selected transmitter and store the new tag.

```

DATE: DD/MM/YY
      11/11/00
NEXT LAST CHNG
OPTN OPTN

```

```

DATE: DD/MM/YY
      [ 01/01/ 01]
<-- -->      ENTR

```

```

DATE: DD/MM/YY
      01/01/01
NEXT LAST CHNG
OPTN OPTN

```

After some seconds the new display appears and, as you can see, the new TAGname (as an example NEWTAG) has been included in the display and in the transmitter's configuration. Use the key ESCAPE to return to the previous display/s. Using the F1 key (NEXT OPTioN) it is possible to select the Date changing procedure and the following display will appear.

Using the F3 key, corresponding to CHaNGe, the next display will appear with a blinking cursor visible in the date area. Using the numeric keypad it is possible to change the digit pointed by the cursor. The cursor shifts automatically after each entry. In case of error shift backward using the F1 key and digit the correct number. When the complete date is composed press the F4, corresponding to " ENTeR" to establish the communication with the selected transmitter. After some seconds, a new display appears with the updated date. Using the ESCAPE key you can return to the previous display/s.

CONF - Change I/O - SENSOR TYPE option (KST Temp. Transm.)

```
CONFIGURATION
CHNG  XMTR  GEN  DBASE
I/O   INFO  CONF MEM
```

```
SENSOR TYPE :
Pt100, a=385
NEXT LAST CHNG
OPTN OPTN
```

```
SENSOR TYPE :
( Pt100, a=385 )
NEXT LAST      ENTR
OPTN OPTN
```

```
MEASUREMENT TYPE :
( Single Sensor )
NEXT LAST      ENTR
OPTN OPTN
```

```
NUMBER OF WIRES
( Two Wires )
NEXT LAST      ENTR
OPTN OPTN
```

```
SENSOR TYPE :
Pt100, a=385
NEXT LAST CHNG
OPTN OPTN
```

Unlike the pressure transmitter where the sensor is part of the instrument, the temperature transmitter can be supplied either complete with his sensor (thermocouple or RTD) or without it. It can then be necessary to configure the transmitter accordingly to the type of sensor and of measurement, single or differential, that will be used.

Using the F1 key select the CHaNGe I/O procedure: the following display will appear. Pressing F1 or F2 you can select the next or the last otion of this procedure.

If you wish to change the type of sensor press the F3 key (CHNG): the screen will display a warning message: " **WARNING - Control loop should be in manual**". Press the PROCEED key to acknowledge the message and continue.

The previous screen is newly displayed with the sensor type within square brackets: using the F1, for next otion, or F2, for last option, you can select the sensor type (see the list of the available choice in the next page) you wish to connect to your transmitter. Press F4 to confirm your selection.

The next screen gives the selection of the type of measurement, i.e. if single or differential: you can confirm the displayed option, using F4, or you can, using F1 or F2, select the alternative choice confirming with F4.

The next screen gives the possibility, in case that the sensor type is RTD or Ohm (variable resistor) and the type of measure is single, to select the type of connection, i.e. 2,3 or 4 wires. Also in this case the selection can be done using the F1 or F2 keys and the confirmation with the F4 key.

The sensor type screen is newly displayed: the user can either continue in the Change I/O procedure pressing the F1 key for the next option or to leave this procedure pressing the ESCape key: this leads the Configuration Main Menu to be displayed.

See APPENDIX "A1" for the list of allowed Sensor type

CONF - Change I/O - SENSOR TYPE option (652/653 S Temperature transmitter)

Unlike the pressure transmitter where the sensor is part of the instrument, the temperature transmitter can be supplied either complete with his sensor (thermocouple or RTD) or without it. It can then be necessary to configure the transmitter accordingly to the type of sensor and of measurement, single or differential, that will be used.

Note: the right procedure to change Sensor type or Measurement type is:

- Connect sensor as already defined
- Modify data and send them to TX
- Connect new sensor configured

CONFIGURATION

CHNG XMTR GEN DBASE
I/O INFO CONF MEM

SENSOR TYPE :
P t1 0 0
NEXT LAST CHNG
OPTN OPTN

SENSOR TYPE :
[P t1 0 0]
NEXT LAST ENTR
OPTN OPTN

MEASUREMENT TYPE :
[RTD/ohm d 2 wires]
NEXT LAST ENTR
OPTN OPTN

METER INSTALL
[LCD]
NEXT LAST ENTR
OPTN OPTN

SENSOR TYPE :
P t1 0 0
NEXT LAST CHNG
OPTN OPTN

Using the F1 key select the CHaNGe I/O procedure: the following display will appear. Pressing F1 or F2 you can select the next or the last option of this procedure.

If you wish to change the type of sensor press the F3 key (CHNG): the screen will display a warning message: " **WARNING - Control loop should be in manual**". Press the PROCEED key to acknowledge the message and continue.

The previous screen is newly displayed with the sensor type within square brackets: using the F1, for next option, or F2, for last option, you can select the sensor type (see the list of the available choice in the next page) you wish to connect to your transmitter. Press F4 to confirm your selection.

The next screen gives the selection of the type of measurement, i.e. if single or differential, 2,3 or 4 wires; you can confirm the displayed option, using F4, or you can, using F1 or F2, select the alternative choice confirming with F4.

The next screen gives the possibility to indicate if an LCD meter is used on the transmitter. Also in this case the selection can be done using the F1 or F2 keys and the confirmation with the F4 key.

After the METER INSTALL selection other parameters may be defined: CJC TEMPERATURE, MULTIPLICATION FACTOR and MAXIMUM TEMPERATURE FOR SENSOR (Refer to the REVIEW Section for an explanation related to this parameters).

The sensor type screen is newly displayed: the user can either continue in the Change I/O procedure pressing the F1 key for the next option or to leave this procedure pressing the ESCape key: this leads the Configuration Main Menu to be displayed.

See APPENDIX "A2" for the list of Sensor type and the list of Measurement type

CONFIGURATION

CHNG XMTR GEN DBASE
I/O INFO CONF MEM

UNITS: mbar

NEXT LAST CHNG
OPTN OPTN

UNITS: [mbar]

NEXT LAST ENTR
OPTN OPTN

UNITS: bars

NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - UNITS option

Using the F1 key to select the procedure CHaNGe I/O the following display will appear showing the current units used for defining the operating range of the transmitter, i.e. the LRV and the URV.

Pressing the F3 key (CHNG) the display changes as shown.

The current units are enclosed within square brackets: using F1 or F2 you can select, in turn, all the units, available in the Communicator, for the type of the connected transmitter. When the correct choice has been done press the ENTeR key to send the new unit to the transmitter: the blinking T in the right top corner of the display signals that the communication is in course and after some seconds the previous display appears with the selected new units.

Note that the change of the units does not change the value of the calibration of the transmitter: the LRV and URV will be automatically expressed in the new unit. As an example if you change from mbar to bar and your URV was 70 mbar the new value of URV will be 0.0700.

Note: the measures in inches and mm. of H₂O can be done using different temperature reference. Usually in the United States the measures are referenced at 20°C (68°F) whereas in Europe the usual reference is 4°C (39.2°F). To avoid errors in calibration and measurement the units should be expressed correctly: the display shows, in the units option and in Review, the units with the relevant temperature reference, as an example **in. H₂O@20DegC**. The units at 4°C are only available from 600T Series transmitter revision 5.2 onwards and in the 600T EN Series Transmitter.

See APPENDIX "B" for the list of allowed Primary Variable Units.

For 600T EN transmitters three other options are available under CONF - Change I/O:

In addition for 600T EN Transmitter

SENSOR TEMPERATURE
UNITS: Deg C
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - SENSOR TEMPERATURE UNITS option

Using this option, it is possible to select the unit for the sensor temperature value.

In the APPENDIX "B" there is a list of units available for the temperature units selection.

STATIC PRESSURE
UNITS: MPa
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - STATIC PRESSURE UNITS option

The available units for static pressure indication are MPa, psi and bar. You can select your preferred unit using the key F3 (CHNG) in the displayed menu.

L.TAG.: REV FOR FT100
PF1200
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - L. TAG. option

With this option it is possible to add a longer tag for function or instrument identification.

Select Key F3 (CHNG) and use the function keys from F1 to F3 to define the long tag.

L.TAG.: REV FOR FT100
PF1201
<-- --> CLR ENTR

Press the key F4 (ENTR) to accept the long tag modification.

CONFIGURATION

**CHNG XMTR GEN DBASE
I/O INFO CONF MEM**

UNITS: bars

**NEXT LAST CHNG
OPTN OPTN**

**LRV: 0
URV: 70.0
NEXT LAST CHNG
OPTN OPTN**

**WARNING - Control loop
should be in manual
PRO
CEED**

**LRV: [0]
URV: 70.0
<-- --> CLR ENTR**

**LRV: 0
URV: [70.0]
<-- --> CLR ENTR**

**LRV: 0
URV: 140.0
NEXT LAST CHNG
OPTN OPTN**

**WARNING-loop may be
returned to auto
PRO
CEED**

CONF - Change I/O - RANGING option

The operation of Ranging on the Smart Transmitters differs substantially from the same operation performed in the conventional analog transmitters. The linearity compensation of the Smart Transmitter allows to select any value of the LRV and URV within the LRL and URL (lower and upper range limits) with the unique limitation of the minimum span. The expected accuracy will be in the limits stated in the transmitter specification, providing that the minimum span limit is not exceeded.

The transmitter being pre-calibrated in factory, the operation of ranging can be done without the use of external testing equipment: this peculiarity allows the modification of the range even with the instrument installed in the field and in operation. To perform the ranging operation proceed as follows.

Pressing, from the previous display, the F1 key (NEXT OPTioN), the following display appears (the values shown are just examples). Pressing the F3 key it is possible to change one or both the values: the change of the value will cause a sudden change in the transmitter output and then precautions must be taken to avoid disturbance to the relevant process. A WARNING is then displayed to remember to switch to manual the associated control loop. This message is not repeated when more configuration operations are performed without exiting from the configuration procedure.

Pressing F4 (PROCEED) the new display appears: the LRV value is displayed within square brackets and a blinking cursor will be positioned on the most significant digit. Using the numeric keypad digit the required new value: the cursor automatically shifts right. In case of error it is possible to clear the whole value, using the CLR key, or to clear any digit moving the cursor using the F1 or F2 key and overdigiting the correct value. In case that no changes are required or to enter the new value press the F4 key (ENTeR) : the display changes to the following.

Proceed in the same way to make changes to the URV and confirm the change with the F4 key. If the ESCAPE is used to return to the CONF initial display a WARNING message is displayed to remind to change the loop to Auto.

In case that during the range option operation the LRL or the URL (lower and upper range limits) or the span limit are exceeded, the modification does not take place and the following warning message is displayed: " COMMAND#35 Response Code: 10 (or 11 or 14). Press any key to continue ". See the messages section for full details.

DAMPING: 0 secs
NEXT LAST CHNG
OPTN OPTN

DAMPING: [0.00]secs
<--- ---> CLR ENTR

DAMPING: 0 secs
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - DAMPING option

From the Configuration main menu press the F1 (CHNG-I/O) and then F1 (NEXT-OPTN) until the following display is present.

Pressing F3 a warning message will be displayed: "**WARNING - Control loop should be in manual**". After having acknowledged pressing PROCEED the previous display appears with the damping time within square brackets and a blinking cursor on the most significant digit.

With the numeric keypad introduce the required damping time.

Depending on the transmitter type the admitted values range from zero to more than 32 seconds. If an intermediate value is selected it will be rounded at the nearest acceptable one.

Pressing F4 the selected value will be introduced and displayed in the display at side. Pressing ESCAPE to return to the Main menu a warning message reminding to return the control loop in auto will be displayed.

OUTPUT: Linear
NEXT LAST CHNG
OPTN OPTN

OUTPUT: [SQR (X)]
NEXT LAST ENTR
OPTN OPTN

OUTPUT: SQR (X)
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - OUTPUT option (*Pressure Transmitter only*)

From the Configuration main menu press the F1 (CHNG-I/O) and then F1 (NEXT-OPTN) until the following display is present.

Press F3 and the following warning message will be displayed: "**WARNING - Control loop should be in manual**". After this operation press PROCEED and then the previous display appears but with the type of output within square brackets.

Pressing F1 or F2 you can select between the following:
Linear, SQR (x), SQR (x³), SQR (x⁵), Polynomial.

600T EN Pressure Transmitter has a Double Polynomial Function too. Deltapi K has Linear and SQR (x) only.

Once the selection has been done, press the F4 for ENTER. The display returns to the previous one but with the required option. Press NEXT OPTN if you want to stay in the Change Output option or ESCAPE to return to the Configuration main menu. In this case a warning message is displayed to warn to change the loop in Auto, if necessary.

NOTE: If the SQR (x) function has been selected, the following message will be displayed: "Remember to verify Root Xfer Funct", for a 600T or a Deltapi K transmitter, or "Remember to verify cut linear value", for a 600T EN transmitter, and the PROCEED label. If the polynomial function has been selected the following message will be displayed: "Remember to verify polynomial coeffs!" and the PROCEED label. The SQR (x³) and (x⁵) should be used in conjunction with V-notch, rectangular and Cipolletti weir.

CONF - Change I/O - ROOT XFER FUNCTION option (600T and Deltapi K Pressure Transmitter)

ROOT XFER FUNCTION :
Undefined
NEXT LAST CHNG
OPTN OPTN

When the Square Root option is active and **SQR (x) selected**, two output modes are available in the 600T transmitters:

- when the input varies from 0% to 4% the output varies linearly from 0% to 20%. At input's values greater than 4% the output follows the applied transfer function .
- when the input varies from 0% to 4% the output varies linearly from 0% to 4% too. At input's values greater than 4% the output jumps to 20% and then follows the applied transfer function. To avoid transition problems a hysteresis of 4% of the output signal is applied when the output decreases below the 20%.

WARNING - Control loop
should be in manual
PRO
CEED

The option a) is the default option.

ROOT XFER FUNCTION :
[Undefined]
NEXT LAST ENTR
OPTN OPTN

From the Configuration main menu press the F1 (CHNG-I/O) and then F1 (NEXT-OPTN) until the Root Xfer Function display is present. To change the Root Transfer function press CHNG (F3): the warning message will be displayed.

ROOT XFER FUNCTION :
[Linear 20 % output]
NEXT LAST CHNG
OPTN OPTN

Press PROCEED, use the F1 (NEXT OPTN) or F2 (LAST OPTN) key select one of the required function:

[Lin. 1:1 20% oput] or [Linear 20% output]

WARNING - loop may be
returned to auto
PRO
CEED

and then press the ENTER key. The display returns to the previous one but with the required option. Press NEXT OPTN if you want to stay in the Change Output option or ESCAPE to return to the Configuration main menu. In this case a warning message is displayed to warn to change the loop in Auto, if necessary.

SQR(x) CUT LINEAR :
10.0%
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - SQR(x) CUT LINEAR option (600T EN Pressure Transmitter)

When the output transfer function is set to Square root, the SQR(x) CUT LINEAR option can be used to configure to Square root function.

The user is asked to verify that the control loop is in manual.

With F4 (PROCEED) a screen displays the current CUT LINEAR value: 12.0% in the esample.

Acceptable values are between 10% and 20%.

WARNING - Control loop
should be in manual
PRO
CEED

As already explained in the 600T EN Series Instruction Manual, this value represents the percentage of output where it is used the Square root function. Before this percentage the output varies linearly.

Refer to 600T EN Series Instruction Manual for more information.

SQR(x) CUT LINEAR :
[12.0]%

<-- --> CLR ENTR

Press ENTR to accept the new value.

**CONF - Change I/O - POLY COEFFICIENTS option
(600T and 600T EN Pressure Transmitter)**

POLY COEFFICIENTS

**NEXT LAST CHNG
OPTN OPTN**

The Polynomial function, applied to the input (x) of the transmitter expressed in % of the span, is in the following form:

$$\text{Out} = \pm A0 \pm A1 (x) \pm A2 (x^2) \pm A3 (x^3) \pm A4 (x^4) \pm A5 (x^5)$$

where Out is in the range 4 to 20 mA, A0 is in % of the output span and represents the output bias, A1 to A5 are in real value. All the values are expressed in scientific notation, i.e. in the form: $\pm X.XXXXXX E\pm XX$.

**WARNING - Control loop
should be in manual
PRO
CEED**

From the Configuration main menu press F1 (CHGN-I/O) and then F1 (NEXT OPT) until the top display is shown.

**WARNING: all poly
coefficients are
sent after coef A5
is entered**

Pressing F3 (CHGN) the warning message will be displayed: after having accepted this message with PROCEED a further warning message will be issued signalling that the polynomial coefficient will be sent to the transmitter only after the last coefficient, A5, is entered.

**POLY COEFF. A0
[±0.000000E±00]
<--- ---> CLR ENTR**

After some seconds the following display appears allowing the entry of the 1st coefficient, i.e. A0. Using the F1 and F2 to move the cursor and the numeric keypad, the correct value (and sign) of the coefficient should be entered. The coefficients are usually small values: to maintain the necessary accuracy make use of the scientific notation, i.e. to enter the value 0.000345678 enter 3.456780 E -04. When the value is entered press F4: the display shows the next coefficient to be set. If a term is null press simply F4 to skip to the next.

**Press F4 for send
or ESC to abort
SEND
DATA**

When the last coefficient has been entered, pressing F4 the following display will appear: pressing F4 all the coefficients will be sent to the transmitter and the Poly Coefficients display will be re-issued, while pressing ESCape the procedure will be aborted and the following message displayed.

**Poly Coefficients
Not Sent**

The same message is displayed if, during the Polynomial Coefficients procedure, the ESCape key is used to abort the procedure or when the procedure is automatically aborted because the entered coefficients are not compatible, e.g. all coefficients are 0. This display lasts for some seconds and then the Poly Coefficients display is newly displayed.

To leave the procedure press ESCape: a warning message will be displayed to warn to change the loop in Auto, if necessary.

DOUBLE POLY COEFFS

**NEXT LAST CHNG
OPTN OPTN**

**WARNING - control loop
should be in manual**

**P R O
C E E D**

**WARNING - all double
poly coeffs are sent
after the Pol. Lim
is entered.**

**DOUBLE POLY B0:
[±0.000000E±00]**

<-- --> CLR ENTER

**1ST POLY HIGH LIMIT:
[100.0]%**

<-- --> CLR ENTER

**Press F4 for send
or ESC to abort**

**SEND
DATA**

**DOUBLE POLY COEFFS
NOT SENT**

CONF - Change I/O - DOUBLE POLYNOMIAL COEFFICIENTS option (600T EN Pressure Transmitter only)

The double polynomial function is expressed with the following:

if Out < FIRST POLY LIMIT
then Out = B0 + B1 (x) + B2 (x²)
else
Out = C0 + C1 (x) + C2 (x²)

Proceed as for the previous option by selecting the Double Poly Coeffs option from the configuration main menu.

A warning message informs the user that the last value to be entered, before sending the coefficients, is the POLYNOMIAL LIMIT.

After some seconds the following display appears allowing the entry of the B0 coefficients, and in sequence all the other coefficients values. All the values are expressed in scientific notation.

Function keys from F1 to F4 have the same functionality as already explained for the POLY COEFFICIENTS option.

When the last coefficient has been entered, the user is asked to input the FIRST POLY HIGH LIMIT.

Acceptable values are between 0 and 100%.

Refer to 600T EN Series Instruction Manual for additional information. The operation is completed when F4 (SEND DATA) is pressed.

With ESCAPE the user can abort the operation and a message appears on the display.

CONFIGURATION

CHNG XMTR GEN DBASE
I/O INFO CONF MEM

CONF - General Configuration - UP/DOWN SCALE SETTING (Deltapi K Pressure only)

From the Configuration main menu press the F3 Key (GEN-CONF) and then F2 Key (UP/DOWN SCALE).

CONFIG / GENERAL

POLL UP/DOWN
ADDR SCALE

The current selection appears closed within square brackets: using F1 or F2 you can select, in turn, up or down.

When the correct choice has been done press the ENTER key (F4) to send it to the transmitter.

UP / DOWN SCALE:

[Up]
NEXT LAST ENTR
OPTN OPTN

The Up/Down selection is used to define the setting of the current output, (21 mA for Up and 3, 8 mA for Down) when fatal errors are detected; an electronics failure or a sensor failure can activate Up/Down Scale.

mA 100% : 20.000
mA 0% : 4.000
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - mA output selection (652/653 S Temperature transmitter)

This option, that can be used with a 652/653 S Temperature Transmitter, allows the user to define the output current and the output limits (HIGH and LOW) within the standard output limits of 4-20 mA.

mA 100% :
[18.000]

At 100% of the transmitter analog output signal can be defined to be 20 mA on less than 20 mA.

<-- --> CLR ENTR

A warning message is displayed when entering the procedure:
WARNING - Control loop should be in manual.

Press the key F4 (PROCEED) to acknowledge the message.

mA 0% :
[6.000]

Press the key F3 to change the 100% mA point.

<-- --> CLR ENTR

When the new value has been selected press the key F4 to change the 0% mA point, has indicated in the mA 0% display near here.

mA H Lim :
[18.500]

After 100% and 0% mA output the user must define the High and Low limits.

<-- --> CLR ENTR

At the end of the procedure a warning message is displayed to remember the user to return loop in auto: **WARNING - Loop may be returned to auto** and then press F4 to PROCEED.

mA L Lim :
[5.800]

<-- --> CLR ENTR

Total Resist(Ohm)
0.00
NEXT LAST CHNG
OPTN OPTN

CONF - Change I/O - Total Resistance (Ohm) option (652/653 S Temperature Transmitter)

This procedure is used for line compensation through the addition of the line resistance value.

Total Resist(Ohm)
[5.000]

Total resistance is the line resistance.

After pressing the key F3 (CHNG) a warning message is displayed:

WARNING: Control loop should be in manual the user is asked to enter the total line resistance.

<-- --> CLR ENTR

Press the key F4 (ENTER) to accept the new value.

A warning message will remind the user to return the loop in automatic.

WARNING - loop may
be returned to auto
PRO
CEED

```

SHORT VAL: 23.000
OFF VALUE : 23.000
NEXT LAST CHNG
OPTN OPTN

```

```

SENSOR ERROR CONF.
[ test for broken ]
NEXT LAST ENTR
OPTN OPTN

```

```

SHORT VAL :
[23.000 ]
<-- --> CLR ENTR

```

```

OFF VALUE :
[23.000 ]
<-- --> CLR ENTR

```

**CONF - Change I/O - Short / Off Values option
(652/653 S Temperature transmitter)**

The Short value and Off value procedure available for a Temperature Transmitter model 652/653 S is used to set the test condition and the value of mA analog output in case of short or broken condition. Here are given the display that are used in this procedure.

Press the Key F3 (CHNG) to access the Sensor Error Configuration display, where it is possible to select among:

- Test for broken
- Test for short
- Test for broken, short
- No test

The next step is to define the mA value for short and off selection.

Enter the mA value and then press ENTER key to accept and send the new value to the transmitter.

```

Max: 95.20
Min: 180.14
NEXT LAST RESET
OPTN OPTN

```

**CONF - Change I/O - Max / Min RESET option
(652/653 S Temperature transmitter)**

The transmitter provide an indication for the Minimum and the Maximum value that has been read with the correspondent units, ohm, mV, Deg. C, etc. Press the Key F3 (RESET) to reset the Maximum and Minimum value, to the actual reading.

```

CONFIGURATION
CHNG XMTR GEN DBASE
I/O INFO CONF MEM

```

```

CONFIG / GENERAL
POLL
ADDR

```

```

WARNING - changes must
be done in direct
mode PRO
CEED

```

```

Polling Addr.: [ 00 ]
NEXT LAST ENTR
ADDR ADDR

```

```

Polling Addr.: [ 05 ]
NEXT LAST ENTR
ADDR ADDR

```

**CONF - General Configuration - POLLING ADDRESS SETTING
(for Multidrop operation)**

For multidrop operation, each transmitter must have a unique polling address ranging from 1 to 15 **being the address 0 reserved for normal analog output operations or non-multidrop operation.**

WARNING - The setting of a polling address different than zero FORCES THE TRANSMITTER OUTPUT IN 4 mA FIXED mode: the transmitter transmits only digital data and can then only be used in control systems capable of reading the process value from the transmitter using the HART protocol. THE TRANSMITTER CANNOT BE PART OF AN ANALOG CONTROL LOOP.

Pressing from the Configuration Main Menu the F3 key (GEN CONF) and then F1 (POLL ADDR) on the next display, a warning display informs the user that this procedure can be used only if the connection with the transmitter was established via the DIRECT/POLL method and not via the BROADCAST method. Press F4 to confirm and proceed or ESCAPE to return to the main menu. If PROCEED has been pressed the following display appears. The actual polling address is displayed within square brackets: using F1 or F2 keys you can select the proper polling address, usually progressive from 1 to 15. Press F4 for ENTER: if the change is accepted the display returns to the Configuration Main Menu otherwise a proper message is displayed.

Important Note : Set the Polling Address to 00 (zero) to return the transmitter to the normal analog output operation.

WARNING: If the transmitter is part of a Multidrop Network this operation must not be done: the presence of a transmitter with a polling address 00, having then the analog output ranging from 4 to 20 mA, spoils the functioning of the Multidrop Network.

CONFIG / GENERAL

**POLL LOC LCD
ADDR KEYS DISP**

**LOCAL KEYS CONTROL
[Enable]
NEXT LAST ENTR
LKEY LKEY**

**LCD DISPLAY MODE
[PV and % of range]
NEXT LAST ENTR
MODE MODE**

For 600T and 600T EN Transmitters:

For the 600T transmitters the General Configuration menu allows two further selection: **Local Keys Control** and **LCD Display Mode**: the relevant display are shown aside.

The Local Keys Control allows to enable or disable the zero and span calibration devices fitted in the transmitters. Pressing F2 select this option and using F1 or F2 select Enable or Disable and then press the F4 key.

The LCD Display Mode allows to define the variables to be displayed in the LCD Local display (if fitted). Four selection are possible: Process Variables, PV and output, Percent of range, PV and % of range. Select the required option and then press F4 to Enter the selection. Press ESC to leave the procedure.

CONFIGURATION

**CHNG XMTR GEN DBASE
I/O INFO CONF MEM**

DATABASE OPERATIONS

**TAG SAVE SEND DELET
LIST CONF CONF CONF**

**FT100 LT112
PT234 K.SC
NEXT
TAGS**

CONF - Database operations - TAG LIST option

As mentioned before The Hand Held Communicator can store up to 32 transmitter configurations in his non-volatile memory, having the ability of saving, down-loading and cloning (duplicating) these configurations. The configurations stored in the Communicator memory are identified by their Tag name.

From the Configuration Main Menu, pressing F4 (DBASE MEM) the Database Operations Main Menu appears. Pressing F1 (TAG LIST) the following display appears, showing the list of the configurations saved in the Communicator.

Each display contains up to four tags: if more tags are included in the list the label NEXT TAGS on F1 permits the next page of the list. When the end of the list is reached, the list will be repeated. Use ESCAPE to return to the Database Main Menu.

DATABASE OPERATIONS

**TAG SAVE SEND DELET
LIST CONF CONF CONF**

**Configuration saved
Press any key
to continue**

CONF - Database operations - SAVE CONFIGURATION option

From the Database Main Menu, pressing F2 (SAVE CONF), the configuration data and parameters of the connected transmitter are saved in the Communicator Database and the following display appears (See Appendix "D" for the list of transmitter's data saved in database).

If that tag already exists in the database, a message is issued: TAG ALREADY EXIST in this case it is necessary to delete the existing tag from the database in order to save the new one. If no slots are available in the database memory for storing the configuration, a warning message appears declaring: "Database memory full". Use ESCAPE to return to the Database Main Menu.

DATABASE OPERATIONS

**TAG SAVE SEND DELET
LIST CONF CONF CONF**

**WARNING - Control loop
should be in MANUAL
PRO
CEED**

CONF - Database operations - SEND CONFIGURATION option

This option permits to send a configuration stored in the Database memory of the Communicator to a connected transmitter. Note that only the data and parameters necessary to configure a transmitter are sent.

The selection of the configuration to be sent can be made from the list of the stored configurations.

WARNING - Maximum attention MUST be given to this operation. Ensure that the configuration to send is suitable for the transmitter application and the connected controller is in manual status. Not following these precautions could result in dangerous situations with effects on personal injury or property damage.

```
Choose Conf. to send
Select TAG
PRO
CEED
```

```
FT100      LT112
PT234      K.SC
STOP NEXT LAST SEL
LIST PAGE PAGE TAG
```

```
WARNING - Loop may be
returned to AUTO
PRO
CEED
```

Starting from the Database Main Menu, pressing F3 (SEND CONF) the warning message is displayed and the following display appears. Pressing F4 to PROCEED, appears the next display showing the list of the configurations present in the Communicator. All tags stored in the Communicator are displayed, four per display, at a rate of 2 seconds: using F1 you can stop the list whereas with F2 or F3 you can move forward or backward in the list.

When the required tag is on the display you can select it moving the cursor on it, using F4 (SEL TAG).

The transmission of a new configuration to a transmitter is achieved pressing the ENTER and requires some seconds.

The message "**Configuration sent**" confirms that the operation has been completed with success; in case of error an appropriate message will be displayed (see the relevant section of this manual) and it will be allowed to return to DATABASE OPERATION menu.

DATABASE OPERATIONS

```
TAG  SAVE  SEND  DELET
LIST CONF  CONF  CONF
```

```
Choose Conf. to del
Select TAG
PRO
CEED
```

```
FT100      LT112
PT234      KSC
STOP NEXT LAST SEL
LIST PAGE PAGE TAG
```

```
Config. deleted
Press any key to
continue
```

CONF - Database operations - DELETE CONFIGURATION option

This option permits deletion of a configuration stored in the Database memory of the Communicator. Press F4 for DELET CONF and the next display appears.

The selection of the configuration to be deleted can be made selecting the configuration from the list of the stored configurations. All tags stored in the Communicator are displayed, four per display, at a rate of 2 seconds: using F1 you can stop the list whereas with F2 or F3 you can move forward or backward in the list.

When the required tag is on the display you can select it moving, using F4, the cursor on it: now pressing the ENTER the configuration will be deleted from the list of the stored configurations while pressing ESCape you will return to the previous display.

If the operation is correctly performed a confirmation display appears: then pressing any key returns to the Database Operations Main Menu. In case of errors a proper message will be displayed: see the relevant section of this manual.

USE OF THE GREEN KEY - TRIM KEY

Transmitter parameters which can be calibrated or operations aiding in instrument checkout may be accessed by the use of the Trimming and Setup Menu accessible via the TRIM dedicated function key. The access to this operation is protected by a password, as already explained for CONF dedicated Function Key.

This items are organized into four procedures as shown below:

For all HART Transmitter of other manufacturers

Sensor Trim	4 - 20 Trim	Loop Test	Reranging
Zero Align	4 to 20 mA Trim Other scale	4 mA Output 20 mA Output Other mA Output	Ranging to Applied Value: - Set 4 mA Point - Set 20 mA Point

For Deltapi K Pressure Transmitter

Sensor Trim	4 - 20 Trim	Loop Test	Reranging
Full Trim Zero Trim Stat Trim	4 to 20 mA Trim Other scale	4 mA Output 20 mA Output Other mA Output	Ranging to Applied Value: - Set 4 mA Point - Set 20 mA Point

For KST Temperature Transmitter

Sensor Trim	4 - 20 Trim	Loop Test	Reranging
User Trim Factory Trim	4 to 20 mA Trim Other scale	4 mA Output 20 mA Output Other mA Output	Ranging to Applied Value: - Set 4 mA Point - Set 20 mA Point

For 652/653 S Temperature Transmitter

Sensor Trim	4 - 20 Trim	Loop Test	Reranging
Not Available	4 to 20 mA Trim Other scale Factory Trim	4 mA Output 20 mA Output Other mA Output	Not Available

For 600T and 600T EN Pressure Transmitter

Sensor Trim	4 - 20 Trim	Loop Test	Reranging (for 600T)
Full Trim Zero Trim Stat Trim Factory Trim (Rev. 5.2 on wards)	4 to 20 mA Trim Other scale Factory Trim	4 mA Output 20 mA Output Other mA Output	Ranging to Applied Value: - Set 4 mA Point - Set 20 mA Point Calibration (for 600T EN) PV Scale Output % Reranging - as above for 600T

Use of the Green Keys - TRIM - Calibration - Reranging option (Not for 652/653 S Temperature transmitter)

Unlike the Ranging operation, that is essentially an operation of configuration performed through the digital setting of the value of the LRV and URV, the Reranging operation requires the physical connection of the transmitter to an input source and the setting of the range values is directly performed by the transmitter itself directed by a suitable command.

This operation is the same as the setting of the zero and span by the use of the optional local adjustments fitted on the pressure transmitters housing.

The reranging can be used either to set the transmitter to a new calibration or, for the pressure transmitter, to adjust the calibration to the installation effects, like tilt position, wet leg on positive or negative connection in level measurement, etc.

The difference between this procedure and the Ranging procedure, which uses digital values, is the fact that a change in the zero point value in this procedure does not affect the span.

Another point that should be taken into consideration during an operation of reranging is that the setting of the initial and final point of your range depends directly of the **real input**. Although the analog output of the transmitter is correct in relation to the applied input, the digital reading of the Process Value can indicate a slightly different value. The difference, due to inaccuracy of the testing equipment or to installation effects, can be corrected using the trimming option.

For Deltapi K Pressure or KST Temperature transmitters

```
TRIMMING AND SETUP
SNSR 4-20 LOOP RERAN
TRIM TRIM TEST GING
```

```
Apply input -----
Press any key to
continue
```

```
P V: 0.00 mbar T
INPUT REFERENCE TO:
SET SET
4 mA 20 mA
```

```
P V: 0.00 mbar T
4 mA POINT SET
SET SET
4 mA 20 mA
```

Using the **TRIM** key, when the display with the message " SELECT GREEN KEY" is present, the following display will appear:

Pressing the F4 key (RERANGING), a warning message is displayed : " **WARNING - Control loop should be in manual**" and the label PROCEED for the key F4. Pressing this key the following display appears:

Apply the input, a **pressure** or a **ohms/mV** signal depending on the type of transmitter, corresponding to the 4mA (or 20 mA) setting and press any key: a new display appears showing the process value, represented by the applied input with its measuring units continuously updated .

Press the F1 key to set the 4 mA point or the F2 key to set the 20 mA point: the display will show the confirmation message " ... **mA POINT SET**". It is suggested that the 4 mA point be set first, and then the span endpoint. This is because changes to the 4 mA point will affect the previously set values of the span endpoint. Pressing ESCAPE to leave the procedure the following message will be displayed "**WARNING - loop may be returned to auto**"

In case that during the reranging option operation the LRL or the URL (lower and upper range limits) or the span limit are exceeded, the modification does not take place and the following warning message is displayed: " COMMAND#36 (37) Response Code: 9 (or 10 or 14). Press any key to continue ". See the messages section for full details.

For 600T EN Pressure Transmitter

```
TRIMMING AND SETUP
SNSR 4-20 LOOP CALI
TRIM TRIM TEST BRA
SNSR 4-20 LOOP RERAN
TRIM TRIM TEST GING
```

For 600T Pressure Transmitter

```
CALIBRATION
PV OUT RERAN
SCALE % GING
```

```
Apply input pressure
Press any key to
continue
```

```
P V: 0.00 mbar T
INPUT REFERENCE TO:
SET SET
4 mA 20 mA
```

```
P V: 0.00 mbar T
4 mA POINT SET
SET SET
4 mA 20 mA
```

Using the **TRIM** key, when the display with the message " SELECT GREEN KEY" is present, the following display will appear:

Pressing the F4 key (CALIBRATION) and then F3 key (RERANGING), a warning message is displayed : " **WARNING - Control loop should be in manual**" and the label PROCEED for the key F4. Pressing this key the following display appears:

For the 600T Pressure Transmitter, the RERANGING operation can be accessed by pressing F4 (RERANGING).

Apply the input **pressure** corresponding to the 4mA (or 20 mA) setting and press any key: a new display appears showing the process value, represented by the applied input with its measuring units continuously updated .

Press the F1 key to set the 4 mA point or the F2 key to set the 20 mA point: the display will show the confirmation message " ... **mA POINT SET**". It is suggested that the 4 mA point be set first, and then the span endpoint. This is because changes to the 4 mA point will affect the previously set values of the span endpoint. Pressing ESCAPE to leave the procedure the following message will be displayed "**WARNING - loop may be returned to auto**".

In case that during the reranging the LRL or the URL (lower and upper range limits) or the span limits are exceeded, the modification does not take place and the following warning message is displayed: " COMMAND#36 (37) Response Code: 9 (or 10 or 14). Press any key to continue ". See the messages section for full details.

Use of the Green Keys - TRIM - 4 to 20 mA Trimming

The scope of this operation is to adjust the digital to analog converter to cover exactly the range 4 to 20 mA. This operation requires that a high accuracy digital meter is connected to the current loop output : it is possible to use either a precision milliammeter with a resolution of 1 μ A or a voltmeter with a 1/20000 resolution. In the case that the voltage reading is selected particular attention should be paid to the accuracy and thermal stability of the resistor connected in series with the current loop. Please check that the transmitter is adequately powered before doing this operation. This can be done by performing the Loop Test operation to

exercise the output to a full 21 mA, thereby ensuring that the power supply is capable of providing the necessary current.

If the transmitter output is out by more than $\pm 5\%$ then a multiple trimming operation should be done (see section: Multiple Trim Generation).

A third option is foreseen, **Factory Trim**, that allows the user to restore the calibration done during the manufacturing process: the parameters of this calibration cannot be changed by the user.

This option is available for 600T, 600T EN and 652/653 S Transmitters.

TRIMMING AND SETUP

SNSR 4 - 20 LOOP CALI
TRIM TRIM TEST BRA

4-20 mA TRIM - CHOOSE
INTERNAL SCALE
OTHR 4 TO FACT
SCALE 20mA TRIM

Trim will be scaled:
- 0.000 to 0.000

CHNG ENTR

Set scale - 4 mA point
4 mA : [- 0.000]

<-- --> CLR ENTR

Set scale - 20 mA point
20 mA : [0.000]

<-- --> CLR ENTR

Connect reference
meter

PRO
CEED

Input present meter T
Value : [4.000] mA

<-- --> CLR ENTR

Scaled op ut : 4.000
equal to ref. meter

NO YES

Starting from the top display press the F2 key (4-20 TRIM) : the display at the side appears; the screen then displays two methods for specifying the output current trimming value: "OTHER SCALE and 4 to 20 mA". Press F2 for current reading or F1 (OTHR SCALE) for voltage reading: If "Other Scale" will be selected the following warning message is then displayed. **"WARNING-Control loop should be in manual - PROCEED"**. Press the PROCEED key to acknowledge the message and continue and the following sequences of display ask you to define the appropriate scale.

A first display indicates the actual trimming scale, by default -0.0 to 0.0. Pressing F3 for Changing, a new display sets the initial point of the scale corresponding to an output of 4 mA. A blinking cursor appears on the first character of the figure within square brackets: using the cursor and the numerical keypad enter the value (for instance 1.000) and then press the F4 key for ENTER.

The display now shows the final point of the scale corresponding to an output of 20 mA. Proceed as above to set this value (for instance 5.000). This ends the procedure of setting any other scale than 4 to 20mA.

The message in the display below asks you to connect the reference meter, i.e. the precision milliammeter or voltmeter. When you have done this press F4 to proceed. The Communicator is now ready to set the output to 4 mA and the following message is displayed:

"About to set Xmtr output to 4 mA - PROCEED".

Pressing the F4 key to proceed the display at the side appears. In the top right corner a T blinks for some seconds to indicate that communication with the transmitter is in course to read the actual value of the output: this value is then displayed within square brackets as in the example. As usual a blinking cursor appears in the first digit. Using the cursor and the numerical keypad enter the value read on the reference meter (for instance 4.025) and then press the F4 key for ENTER.

Note: the maximum allowed change is $\pm 5\%$ of the output range, corresponding to $\pm 800 \mu$ A: if this value (i.e. the difference between the displayed value and the meter reading) is exceeded an appropriate message is displayed, the operation is aborted and an operation of multiple trimming should be performed (see next page).

The value is transmitted to the connected instrument and a message is displayed for some seconds: **"Making changes permanent - PLEASE WAIT"**. The Communicator reads and displays the new value and then queries if the reading is sufficiently close to the reference meter reading. If the reading (within $\pm 3 \mu$ A) is not sufficiently close, press the NO key to repeat the above procedure, otherwise press the YES key and the procedure will be repeated for the 20 mA setting.

Returning Xmtr to
original output

When the procedure has been completed the screen shows for some seconds the display aside. This notice will be followed by the message: **"WARNING - Loop may be returned to auto"** Press PROCEED to acknowledge .

4-20 mA TRIM - CHOOSE
INTERNAL SCALE
OTHR 4 TO FACT
SCALE 20mA TRIM

As already mentioned, a third option is available for 600T and 600T EN pressure transmitter and for 652/653 S Temperature transmitter to allow the user to restore the original factory calibration. Selecting with the F3 key this option the following warning message will be displayed: **"WARNING - Control loop should be in manual - PROCEED"**. Pressing the PROCEED key to acknowledge the message and continue the following display appears: the user can abort the procedure pressing ESCape or accept the selection pressing F4 to PROCEED . In this case the small T blinks in the upper right corner signalling that the appropriate command is sent to the transmitter. A warning message warns that the control loop, if necessary, can be returned to automatic control. Press F4 to return to the 4 to 20 mA Trim menu.

Trim will be set
as at factory

PRO
CEED

Multiple Trim Operation

If the previous operation aborts because the passed parameter is too large or too small then multiple trim is necessary.

The 4 mA trimming should be done first. If the output looks saturated, i.e. the reading is around 3.75 mA (or 0.938 Volt if 1 to 5 Volt scale has been selected) enter the value 3.25 mA (or 0.81 Volt) until the output desaturates and then the value read on the reference meter. If the reading is above 4.8 mA enter the value 4.75 mA until the reading falls below 4.8 and then the value read on meter.

Proceed in the same way for the 20 mA trimming. If the output looks saturated, i.e. the reading is 21 mA enter the value 20.8 until the output desaturates and the reading falls below 21 mA, then introduce the meter reading.

If the reading is less than 19.2 mA enter the value 19.3 mA until the reading rises above 19.2 and then introduce the reference meter reading. If the value does not rise to 20 mA check the transmitter power supply.

TRIMMING AND SETUP

SNSR 4-20 LOOP CALI
TRIM TRIM TEST BRA

LOOP TEST- CHOOSE
CURRENT OUTPUT LEVEL

4 mA 20mA OTHER

Select output
[12.500] mA

<--- ---> CLR ENTR

About to set Xmtr T
output to 12.5 mA

PRO
CEED

Loop test: Xmtr T
output is 12.5 mA

END

Returning Xmtr T
to original output

WARNING - loop may be
returned to auto

PRO
CEED

Use of the Green Keys - TRIM - Loop Test Option

The scope of this procedure is to test the transmitter output at fixed values, 4 or 20 mA, or at a value selected by the user, and so to test the integrity of the transmission loop and the operation of receiving instruments like controllers, recorders, etc. This option is useful during the plant commissioning when a transmitter fixed value is required.

Use the LOOP TEST function key to select this procedure from the TRIMMING and SETUP submenu. The screen will display the warning message:

"WARNING - Control loop should be in manual".

Press the PROCEED key to acknowledge the message and continue.

Use F1 or F2 to select 4mA or 20 mA output. If you select F3 (OTHER) then the following display appears allowing any value from 3.875 to 21 mA to be entered. In this case the last set value is displayed within square brackets with the first figure blinking: using the F1 and F2 and the numerical keypad a new value in the range 3.875 to 21 mA can be introduced.

The Hand Held Communicator is now ready to set the transmitter to the required current (12.5 in the example): press F4 to PROCEED.

The blinking T appears in the upper right corner of the display signalling that the communication is on course and after some seconds the next display appears with the output set to the required value.

At this time, the user may verify the current by reading an appropriate meter or can check the functionality of the instruments connected to the control loop.

Pressing F4 (END) returns to the Loop Test main menu enabling the execution of the procedure with a different setting, whereas pressing ESCAPE forces the exit from the procedure: in this case the next display will appear notifying the user of the restoration of the original output.

After some seconds a new display warns to return the control loop in auto.

Pressing F4 to PROCEED the Communicator returns to the Trimming Main Menu.

Use of the Green Keys - TRIM - Sensor Trimming option (for 600T and 600T EN pressure transmitter only)

The scope of the Sensor Trimming operations is to correct the characterisation parameters stored in the transmitter's EEPROM during the last characterisation process, either the first, factory done, or the subsequent trimming operation. To understand completely the reason for this operation it is necessary to know that during manufacturing the sensor output characteristics are compared to different pressure input in order to obtain parameters that are stored in the EEPROM and represents a sort of "fingerprint" of a specific sensor. These parameters, are applied to a suitable algorithm that provides a precise primary output linearisation. During the use of the transmitter the sensor is submitted to various influences (ageing, one side overpressure, shocks, mounting position, etc) that can affect the original characteristics. The effect of these changes is that, although through the reranging operation the analog output matches with the input pressure, the interpretation of this pressure by the transmitter is incorrect and the Process Value indication, in engineering units, doesn't match with the real input pressure. The **full trimming** operation forces two points, usually the zero and full scale values, to match exactly the primary output: these values are stored in the transmitter in a permanent way. Using the full trimming operation it is possible, providing that suitable high accuracy equipment is available, to restore the original performance or in case that the transmitter is calibrated to a new range to match exactly

the digital reading with the corresponding analog output value. The best accuracy is accomplished trimming at values corresponding to the LRV and URV or slightly more. Nevertheless trim with span smaller than sensor minimum span are not allowed.

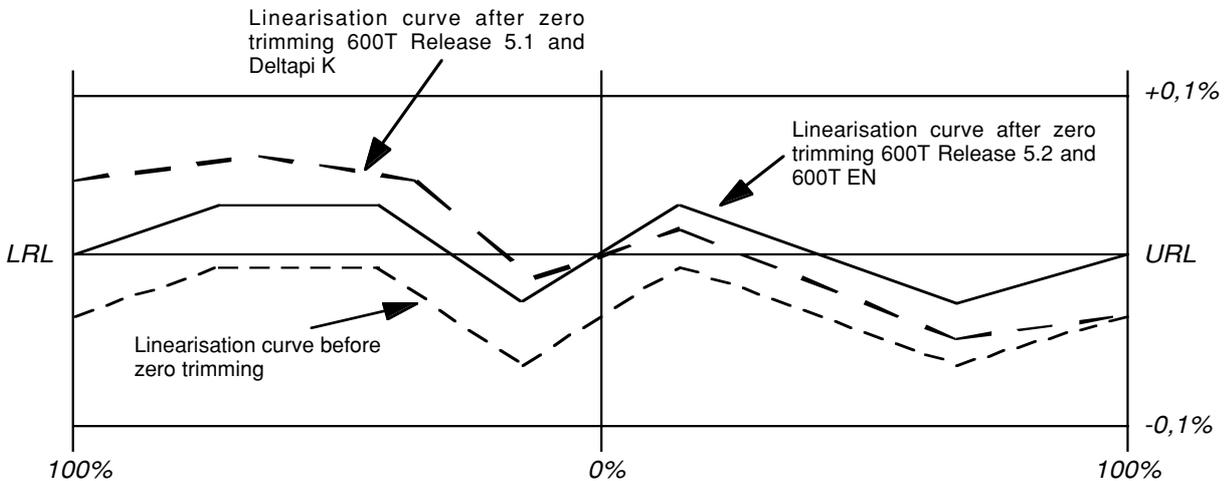
The **zero trimming** operation involves the zero and the span points of the scale and can be usually done without the need of external equipment. It can be used to compensate small errors $\leq 0.1\%$ (e.g. mounting position effects). The figures below show the linearity errors of the transmitter primary output at the maximum span (URL less LRL) and the different effects of the full and zero trimming. The full trimming has been applied to a span of about 75% of the sensor limits. **With a 600T EN Pressure transmitter full trimming and Zero trimming operations are not accepted if a PV BIAS VALUE has been introduced.** When trying to do a trimming with the PV bias value not equal to zero the following message appears: **"WARNING: TRIM is not available when PV is scaled, reset the PV BIAS before trim"**.

See next (PV scaling option).

Note for 600T Transmitters Revision 5.2 and 600T EN

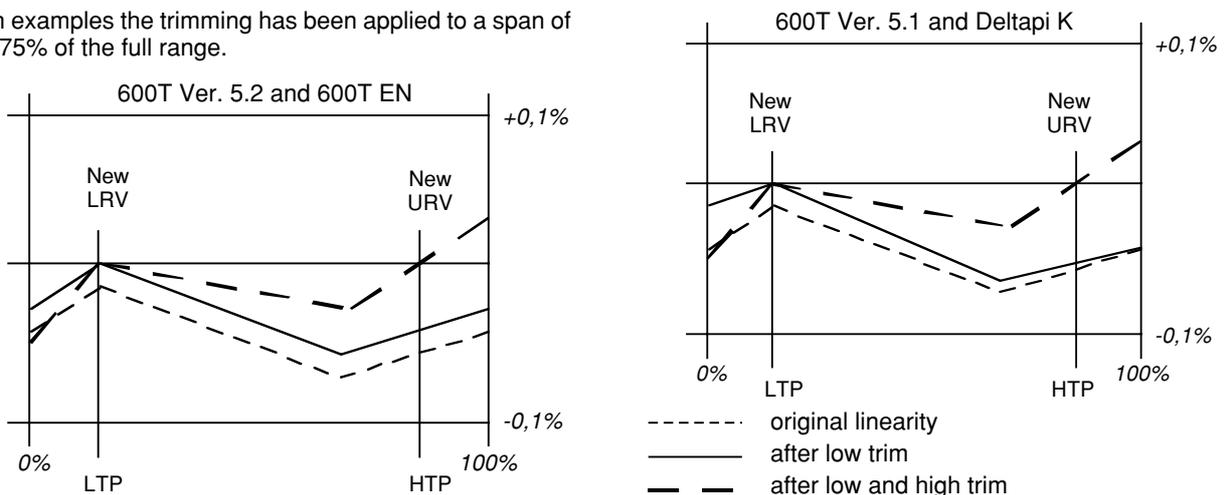
The procedure for the sensor trimming of 600T transmitters slightly differs from the described one: a fourth option is foreseen, **Factory Trim**, that allows the user to restore the calibration done during the manufacturing process: the parameters of this calibration cannot be changed by the user.

ZERO TRIMMING



FULL TRIMMING

In both examples the trimming has been applied to a span of about 75% of the full range.



TRIMMING AND SETUP

SNSR 4-20 LOOP CALI
TRIM TRIM TEST BRA

SENSOR TRIM, SELECT
TYPE

FULL ZERO STAT
TRIM TRIM TRIM

Last input value used

LoVal = 0 mmH2O
HiVal = 1400.000 mmH2O

LoVal = 0 mmH2O
HiVal = 1400.000 mmH2O
LOW HIGH DISP
TRIM TRIM LIMIT

LRL = -2800.000 mmH2O
URL = 2800.000 mmH2O
PRO
CEED

Apply a LoVal Press.
lower than HiVal
PRO
CEED

Pressure stabilizing
--- PLEASE WAIT ---

Enter applied LoVal
[-5.015] mmH2O

<--- --> CLR ENTR

LoVal = 0 mm H2O
HiVal = 1400.000 mm H2O
LOW HIGH DISP
TRIM TRIM LIMIT

Apply a HiVal Press.
higher than LoVal
PRO
CEED

WARNING - loop may be
returned to auto

PRO
CEED

Use of the Green Keys - TRIM - Sensor Trimming - FULL TRIM
(for 600T, 600T EN and Deltapi K pressure transmitter)

CAUTION : remember that this procedure **must be done by applying input pressure, especially when the chosen span is unfortunately small (<5% of URL)**. **If you don't apply input pressure, there will be a permanent error in the output of the transmitter.** Let us say that the trimming operation on values <10% of URL, does not make better instrument efforts on this span.

Starting from the top display press the F1 key (SNSR TRIM) : the following display will appear.

Pressing the F1 key (FULL TRIM), a warning message is displayed: **"WARNING - Control loop should be in manual "** and the label PROCEED for the key F4. Pressing this key the following display appears:

The display gives indication about the input values used during the last trimming operation. This indication lasts for some seconds and is then replaced by the new display below.

The same values are displayed but two labels appear for the keys F1 and F2 , respectively LOW TRIM and HIGH TRIM, while the key F3 - DISP LIM can be used to display the lower and upper range limits (LRL and URL). Pressing the F1 a message is displayed asking the user to apply the low pressure value.

If the Low Trimming value corresponds to zero and you are trimming a transmitter other than absolute pressure, the atmospheric pressure can be taken as reference or the bypass opened to equalize the pressure on both side of the sensor. Care should be paid to the absolute pressure transmitters where a vacuum reference should be used or the actual atmospheric pressure taken into consideration. After having applied the pressure press the F4 to PROCEED.

The value of the pressure read by the transmitter is then displayed within square brackets : this value can differ from the value read in the reference meter. A blinking cursor is present in the most significant digit : using the F1, to move left, or the F2, to move right, and the numerical keypad introduce the value read on the reference pressure meter or zero if appropriate. When the value is correctly introduced press F4 to ENTER the value. If the value is incorrect then one of the following messages is issued :

- Trim span too small
- Trim on negative side not allowed (for Deltapi K transmitter)

NOTE : Do not introduce change, on the value read, of more that 5% of the URL at once. If this limit or pressure limits are exceeded a message will be displayed (see the relevant section of this manual). The Communicator accepts the first five digits of the input.

Small differences, of the order of the 0.003% of the URV, on the reading, are tolerated.

The introduced value is sent to the transmitter: the usual blinking T appears in the upper right corner of the display signalling that a communication is on course. Right after the display at side appears showing the modified value.

The procedure to trim the high value is the same: pressing the F2 key the following message appears: proceed then as for low trimming.

Note: Do not attempt to apply, as Hival, a value resulting in a span smaller than the minimum span and, for Deltapi K Pressure Tx having a S/W Rev. up to 5.1 a negative value or a value too close to zero. In this case the operation will abort and an error message is displayed.

For best results perform a low trimming, a high trimming and a low trimming again. To exit from the trimming procedure press ESCAPE : the following display appears. Take note of it and then press PROCEED: the display returns to the Sensor Trimming menu.

```

SENSOR TRIM, SELECT
TYPE
FULL ZERO STAT
TRIM TRIM TRIM

```

```

Apply "zero"
pressure input
PRO
CEED

```

```

Applied zero read T
[ 0.2345 ] mmH2O
SEND
DATA

```

```

Making changes T
permanent
- - - PLEASE WAIT - - -

```

```

Applied zero read T
[ 0.0027 ] mmH2O
END

```

```

WARNING - loop may be
returned to auto
PRO
CEED

```

Use of the Green Keys - TRIM - Sensor Trimming - ZERO TRIM (for 600T, 600T EN and Deltapi K Pressure Transmitter)

Starting from the main display press the F1 key (SNSR TRIM) : the following display will appear.

Pressing the F2 key (ZERO TRIM), the following message is displayed: "**WARNING - Control loop should be in manual - PROCEED**".

Pressing the F4 key the following display appears :

If you are trimming a transmitter other than absolute pressure, the atmospheric pressure can be taken as reference or the bypass opened to equalize the pressure on both side of the sensor. Care should be paid to the absolute pressure transmitters where a vacuum reference should be used or the actual atmospheric pressure taken into consideration. After having applied the pressure press the F4 to PROCEED. The following message appears: "**Pressure stabilizing - PLEASE WAIT--**" and after some seconds the following display appears.

The value of the pressure read by the transmitter is then displayed within square brackets: this value represents the zero shift due to mounting position, ageing, etc. A blinking T in the upper right corner of the display signals that the value is continuously updated. Pressing the F4 key the displayed data are sent to the transmitter: the usual blinking T appears in the upper right corner of the display signalling that a communication is on course.

NOTE : Changes of more that 5% of the URL are not accepted. If this limit is exceeded a message will be displayed (see the relevant section of this manual)

The zero trimming has been performed: the display shows the residual zero error usually due to rounding in the Communicator operations. Small differences, of the order of the 0.003% of the URV, on the reading, are tolerated: if the difference appears too big repeat the zero trimming procedure.

Pressing the F4 key (END) the warning message at side is displayed: pressing PROCEED you will leave the zero trimming procedure.

```

TRIMMING AND SETUP
SNSR 4-20 LOOP RERAN
TRIM TRIM TEST GING

```

```

SENSOR TRIM, SELECT
TYPE
ZERO
ALIGN

```

```

Apply 'zero'
Source input
PRO
CEED

```

```

Applied zero reads
[ -2.842 ] mV
SEND
DATA

```

Use of the Green Keys - TRIM - Sensor Trimming Zero Align (for generic HART Transmitter)

Starting from the top display and selecting (SNSR TRIM) option using F1 key the SENSOR TRIM menu appears with the ZERO ALIGN option.

Pressing F1 key a warning message is displayed: "**WARNING - Control loop should be in manual**" with the label PROCEED for the key F4.

Pressing F4 to proceed the following display appears, giving indication of applying input source. Press F4 again and wait for the input source reference to stabilize as indicated on the display. Then, using F4 key (SENS DATA), the value is sent to the device and used to trim the Primary Variable so that it reads Zero with the existing process applied to the device.

The resulting offset must be within limits defined by each transmitter. When you press F4 the following message appears: "**WARNING - Loop may be returned to auto - PROCEED**". Use F4 to continue and to return to the SENSOR TRIM menu.

SENSOR TRIM, SELECT
TYPE
FULL ZERO STAT FACT
TRIM TRIM TRIM TRIM

Stat Value read
[1.154] MPa
PRO
CEED

Is stat value OK?
[1.154] MPa
NO YES

Enter stat value
[.....] MPa
<-- --> CLR ENTR

SENSOR TRIM, SELECT
TYPE
FULL ZERO STAT FACT
TRIM TRIM TRIM TRIM

Trim will be set
as at factory
PRO
CEED

Use of the Green Keys - TRIM - Sensor Trimming - STATIC TRIM (for 600T, 600T EN and Deltapi K Pressure Transmitter)

Using this procedure it is possible to trim the value of the static pressure used by the transmitters to perform the static pressure compensation. The transmitter should be connected to a pressure source of known value: the atmospheric or the process pressure can be used for static trimming. The applied pressure should be applied on both sides of the measuring diaphragm: an accuracy of the reference meter of 1% of the max. static pressure is sufficient for a good static compensation. Selecting this option, the following message is displayed: "**WARNING- Control loop should be in manual - PROCEED**". Pressing F4 the next display appears giving indication of the value read by the transmitter. Press F4 to PROCEED: the next display requests to confirm if the read value is OK or not. If it is OK pressing F4 for YES you will leave the procedure while, if it is not, pressing F1 the following display appears.

Using the F1 or F2 keys and the numeric keypad the known value of the static pressure should be entered and confirmed pressing the F4 key. Leaving the procedure a warning message warns that the loop can be returned to automatic control.

For 600T Transmitters Revision 5.2 and 600T EN - FACTORY TRIM

As already mentioned, a fourth option is presented for the 600T and 600T EN Transmitters: it allows the user to restore the original factory calibration. Selecting with the F4 key this option the following warning message will be displayed: "**WARNING - Control loop should be in manual - PROCEED**". Pressing the PROCEED key to acknowledge the message and continue the following display appears: the user can abort the procedure pressing ESCape or accept the selection pressing F4 to PROCEED . In this case the small T blinks in the upper right corner signalling that the appropriate command is sent to the transmitter. A warning message that the control loop can be returned to automatic control.

**Use of the Green Keys - TRIM - Calibration - PV Scale Option
(600T EN Pressure transmitter only)**

TRIMMING AND SETUP

SNSR 4 - 20 LOOP CALI
TRIM TRIM TEST BRA

CALIBRATION

PV OUT RERAN
SCALE % GING

PV : 25 mbar

RSET SET SET
BIAS PV0 PV

LRV : [-60.00]
URV : 130.00

<-- --> CLR ENTR

PV : 25 mbar

RSET SET SET
BIAS PV0 PV

PV : [30] mbar

<-- --> CLR ENTR

CALIBRATION

PV OUT RERAN
SCALE % GING

CALIBRATION

PV OUT RERAN
SCALE % GING

**WARNING - Control loop
should be in manual**

PRO
CEED

PV : 0.01 mbar
OP : 50 %
O/P O/P
LOW HIGH

The scope of this procedure is to allow the user to set the transmitter for reading a specified value of PV, that is to apply a scaling to the PV reading. This option is useful every time it is required to elevate or suppress a pressure indication.

Starting from the SELECT GREEN KEY menu, press TRIM and then F4 (CALIBRATION).

The PV Scale option appears as key F1 in the CALIBRATION menu.

Pressing key F1 (PV SCALE) a warning message is displayed: **"WARNING - Control loop should be in manual"** with the label PROCEED for the key F4.

The PV SCALE option menu contains three options: Reset bias, Set PV 0 and Set PV.

The PV value appears on the display and is continuously updated.

Pressing F1 the value of the Bias is set to 0. Let's remind that a bias value set (not equal to 0) disables the trimming operations; the Bias value can be verified in the review section. On the first line of the display "wait . . ." message appears during the reset operation.

The key F2 (Set PV 0) is used to set the actual PV reading to 0. If the operation is performed correctly the user is then asked to define the range values; the LRV and URV are expressed in the same unit of the PV.

The key F3 (Set PV) is similar to set PV 0, but allows the user to decide for a PV reading value different than zero.

The user is asked to enter the value and then the bias value is automatically calculated and applied to the actual reading. Again the user can reconfigure the range of the transmitter by entering the LRV and URV.

By pressing ESCAPE the following message appears: **"WARNING - Loop may be returned to auto - PROCEED"**. Use F4 to continue and to return to the CALIBRATION menu.

With another ESCAPE the TRIMMING and SETUP menu appears on the display.

Use of the Green Keys - TRIM - Calibration - Out % option (600T EN Pressure transmitter only)

Starting from the CALIBRATION menu press F2 (Out %) to access the procedure. This setting is used to automatically redefine the transmitter calibration by using the reading value in percentage.

After the warning message that reminds the user to verify the loop conditions, and pressing the key F4, the following display appears:

The display is continuously updated with the PV value and the output percentage. The latter can be redefined by accessing the two options: **O/P LOW** and **O/P HIGH**.

LRV : - 200
 URV : + 200
 OP : [50] %
 < - - - > CLR ENTR

PV : 0.01 mbar
 OP : 45 %
 O/P O/P
 LOW HIGH

LRV : - 180
 URV : + 220
 OP : [45] %
 < - - - > CLR ENTR

PV : 0.01 mbar
 OP : 60.00 %
 O/P O/P
 LOW HIGH

WARNING - Loop may
 be returned to Auto
 PRO
 CEED

CALIBRATION

PV OUT RERAN
 SCALE % GING

While the first one recalculates the LRV and URV maintaining the original SPAN, the O/P HIGH recalculates the URV so the SPAN can be changed.

When F1 (O/P LOW) is pressed the existing LRV and URV are displayed, and the user is asked to input the evaluated output in percentage, while between square brackets it is given the actual one.

Press F4 (ENTER) to accept the new percentage.

The "wait" message is given till the operation is completed, and so the new output percentage is displayed.

LRV and URV have been changed, according to the new output percentage.

When F2 (O/P HIGH) is used, again the LRV and the URV are displayed.

By setting the new output percentage and pressing F4 (ENTER) a new URV is calculated according to the new output percentage.

If the new setting has been performed correctly, the new output percentage is displayed, together with the PV indication.

Use ESCAPE to exit and to return to the CALIBRATION menu.

After the warning message: "Loop may be returned to auto" press F4 (PROCEED) to return to the CALIBRATION MENU.

Additional information and examples on the use of PV Scale and Output % reranging are given in the 600T EN Series Instruction manual.

Use of the Green Keys - TRIM - Sensor Trimming option (for KST temperature transmitters)

The Sensor Trimming operations in the temperature transmitters is to correct the characterisation parameters stored in the transmitter's EEPROM during the last characterisation process, either the first, factory done, or a subsequent trimming operation, in order to match your standard calibration equipment.

To understand completely the reason for this operation it is necessary to know that during the manufacturing the transmitter's digital output is compared to different input in order to obtain parameters that are stored in the EEPROM: these parameters, applied to a suitable algorithm, provide a precise primary output linearisation.

During the use of the transmitter the sensor is submitted to various influences, mainly ageing, that can affect the original characteristics.

The effect of these changes is that, although through the reranging operation the analog output matches with the input signal, the interpretation of this signal by the transmitter is incorrect and the Process Value indication, in engineering units, doesn't match with the real input.

The **sensor trimming** operation forces two points, usually the zero and full scale values, to match exactly the primary output: these values are stored in the transmitter in a permanent way.

The K-ST Smart Temperature Transmitter is able to store in its EEPROM two different set of parameters, related to the **Factory Trim** and the **User Trim**.

The Factory trim parameters are obtained during the manufacturing process and are not modifiable by the user, while the User trim parameters can be set by the user using his standard calibration equipment.

The user trim parameters are set by default, unless a custom calibration is required, to the same values than the factory trim parameters. If the transmitter has been custom calibrated the user trim parameters are set accordingly to the custom calibration.

The sensor trimming operation should be done using testing equipment, millivolt generator or ohms reference, of a suitable class (accuracy at least three times of the transmitter accuracy). If such equipment is not available, the Factory trim parameter can be satisfactorily used in most of the cases.

For **millivolt or thermocouple sensor** type connect your millivolt source across the terminals 2 (+) and 1 (-). If the transmitter is set for differential measurement short the terminal 2 and 3. **All the connection should be done using copper wires.**

For **ohm or RTD sensor** type connect your ohms reference across the terminals 1 and 4. If the transmitter is set for a three wires measurement short the terminal 1 and 2, while if it is set for four wires measurement the terminals 3 and 4 should be shorted as well. For ohm or RTD differential measurement connect your ohms reference across the terminal 1 and 4 and insert across the terminal 1 and 5 a resistor having a value included between the low and the high trimming value.

**Use of the Green Keys - TRIM - Sensor Trimming - SNSR TRIM
- (for KST temperature transmitters)**

TRIMMING AND SETUP

SNSR 4-20 LOOP RERAN
TRIM TRIM TEST GING

Starting from the top display press the F1 key (SNSR TRIM) a warning message is displayed:

"WARNING - Control loop should be in manual " and the label PROCEED for the key F4.

Last trim: factory
Snsr: T/C Type J NBS
USER FAC
TORY

Pressing F4 to proceed the following display appears, giving indication about the type of trimming presently in use and the type of the selected sensor. The F1 and F2 keys are respectively labelled to select the user or the factory trim.

NEW TRIM: USER

PRO
CEED

If you wish to change either the type of trim or the trim values press the appropriate key.

As explained above the factory trim cannot be modified: nevertheless if you press F2 for Factory Trim while presently in use the display gives the indication " **NEW TRIM : factory** ". When you press F4 the following message appears: " **WARNING - Loop may be returned to auto - PROCEED** ". Pressing F4 to proceed you will return to the Trimming and Setup Main Menu.

LAST TRIM VAL USED
LoVal= 0 mV
HiVal= 14.000 mV

Let now us assume that you wish to change your trim to USER. This operation requires that a suitable reference source is connected to the K-ST terminals as explained in the previous section. Pressing F1 the display indicates that the new trim is now User.

Pressing F4 to proceed a new display gives indication about the input values used during the last trimming operation. This indication lasts for some seconds and is then replaced by the new display below.

LoVal = 0 mV
HiVal = 14.000 mV
LOW HIGH DISP
TRIM TRIM LIMIT

The same values are displayed but the function keys F1 and F2 are activated for LOW TRIM and HIGH TRIM operations while F3 gives the opportunity to read the LOWER and UPPER RANGE LIMITS (LRL and URL). The values are displayed accordingly to the type of sensor either in mV or in ohms. Pressing F4 to proceed you will return to the previous screen.

LRL= - 7.402 mV
URL= 42.283 mV
PRO
CEED

Press the Low Trim key and a screen prompting the user to apply the low value is displayed. The input reference must be within the range of the specified sensor and displayed under DISP LIMIT. To obtain the best results the input reference should be equal to zero, for zero based measurement, or as close as possible to the Lower Range Value.

Apply a LoVal
lower than HiVal
PRO
CEED

When the input has been applied press F4 to proceed.

Enter applied LoVal
[-5.015] mV

The value of the input read by the transmitter is then displayed within square brackets : this value can differ from the value read in the reference meter. A blinking cursor is present in the most significant digit : using the F1, to move left, or the F2, to move right, and the numerical keypad introduce the value read on the reference meter. When the value is correctly introduced press F4 to ENTER the value. If, the value is incorrect or out of limits then an appropriate messages will be issued: see the relevant section of this manual.

<-- --> CLR ENTR

LoVal = 0 mV
HiVal = 14.000 mV
LOW HIGH DISP
TRIM TRIM LIMIT

NOTE : Do not introduce change, on the value read, of more that 5% of the URL at once. If this limit is exceeded a message will be displayed (see the relevant section of this manual). The Communicator accepts the first five digits of the input. Small differences, of the order of the 0.003% of the URV, on the reading, are tolerated.

Apply a HiVal
higher than LoVal
PRO
CEED

The introduced value is sent to the transmitter: the usual blinking T appears in the upper right corner of the display signalling that a communication is on course. Right after the display at side appears showing the modified value.

WARNING - loop may be
returned to auto
PRO
CEED

The procedure to trim the high value is the same: pressing the F2 key the following message appears: proceed then as for low trimming.

NOTE : Do not attempt to apply, as Hi Val, a negative value or a value too close to zero or within the minimum span. In this case the operation will abort and an error message is displayed.

For best results perform a low trimming, a high trimming and a low trimming again. To exit from the trimming procedure press ESCAPE : the following display appears. Take note of it and then press PROCEED: the display returns to the Sensor Trimming menu.

SERIAL LINK
MODEM LOAD
MODE PROG

USE OF THE GREEN KEYS - SERIAL LINK

As already explained it is possible to connect, using an RS 232 serial connection, the Hand Held Communicator with a Personal Computer in order to use the Communicator as a Bell 202 Modem, connecting a Personal Computer to the transmitter.

Hand Terminal ready T
for serial link
communication

Pressing the Green key SERIAL LINK or the key F3 in the Main Menu the top display appears, allowing the choice among DataBase MODE, MODEM MODE and LOAD PROG. By pressing F1 or F2 respectively appear the second or the third display. In the Database Mode a small T is blinking in the upper right corner of the display when a serial communication is on course. During the Serial Link mode the Communicator is under the control of the Host P.C. until the ESCAPE Key is pressed.

H T in Modem Mode

The F3 key LOAD PROG is used when an upgrade of the installed software is required. This operation is performed in the production factory. If a software upgrade is required, refer to your nearest Service Center.

HART RESPONSE MESSAGES

ERROR AND WARNING MESSAGES

Four types of error and warning messages are generated and displayed by the Hand Held Communicator:

- communication errors
- transmitter diagnostic messages
- database operations messages
- Hart Commands Response Code

The next paragraph gives a more detailed description of the error and warning messages and the action that should be taken.

COMMUNICATION ERRORS

XMTR NOT IN COMMUNICATION

timeout in communication, instrument not connected
Check that the connection is properly done, particularly check if the resistance between the insertion point of the Communicator and the power supply is 250 Ohm min. If safety barriers are included in the loop check that they are suitable for HART Communication.

If in direct mode check that only one transmitter is connected. If in broadcast or multidrop mode check for tag duplication. Try a connection closer to the transmitter terminals. Check the Communicator with another transmitter to localize the fault in the transmitter or in the Communicator. Refer to your nearest Service Center.

WARNING : TX Rev. XX.YY TOO NEW

Indicates that the Smart Transmitter has a S/W Rev. level newer than the S/W supported by the H.H. Communicator. Contact your nearest Service Center for a S/W upgrade.

WARNING: TX NOT SUPPORTED

the transmitter connected to the KHT is unknown.

WARNING : FUNC. NOT SUPPORTED

the function that you are trying to execute with the KHT is not available in the transmitter.

WARNING : OUTPUT CURRENT FIXED

The transmitter output is at fixed value (4 mA for Broadcast connection or rarely any value for loop test not complete.

COMMUNICATION ERROR

Hand Held Terminal has detected an error on Checksum, parity, etc. (*see XMTR not in communication*)

ADDRESS ERROR

Answer received from an address different than the requested (usually in Multimaster Mode)
Mismatch in communication : repeat the command.

COMMAND ERROR

Answer received with a command number different than the requested
Mismatch in communication : repeat the command.

CHECKSUM ERROR

The connected transmitter signals a communication error: checksum not OK
The line appears noisy. Try a different point of connection closer to the transmitter terminals.

PARITY ERROR

The connected transmitter signals a communication error: parity not OK (*see Checksum error*)

TRANSMITTER DIAGNOSTIC MESSAGES

ANALOG OUTPUT SATURATED

The process value is outside of the calibrated range of the transmitter. Consider reranging the transmitter

PV OUT OF LIMITS

The process value is outside of the sensor limits. Consider changing the transmitter or the sensor.

EEPROM 1 FAILED (pressure transmitters)

Fatal error: consider to replace the transducer. Refer to the Transmitter Instruction manual.

EEPROM 1 FAILED (Deltapi K pressure Tx)

Refer to the Transmitter Instruction manual. Remove the Compensation Module from the Electronics and clean, with appropriate cleaning liquid, the contacts. Try again and if still failing remove the electronics and replace with a spare one fitting the compensation module: if still failing the failure should regard the EEPROM otherwise the electronics is faulty. 600T Transmitters have not Compensation Module. Consider the replace of the electronics.

EEPROM 2 FAILED (pressure transmitters)

Fatal error : the transmitter's electronics should be replaced.

EEPROM 1 & 2 FAILED (pressure transmitters)

Fatal error: the transmitter's electronics should be replaced.

STARTUP CKSUM ERROR (pressure transmitters)

During the startup the transmitter's S/W found a checksum error. Try to restart the transmitter: if the error is still present the transmitters should be replaced.

SENSOR FAILED (pressure transmitters)

The transmitter's sensor failed

SENS. TEMP. OUT OF LIM (pressure transmitters)

The sensor temperature is outside of the specification limits: check in field if this appears true and then take appropriate action to return within the limits. In case that the temperature is within the limits the temperature sensor or the sensor connection can be faulty: see the transmitter's instruction manual for fault finding.

STAT PRES OUT OF LIM (pressure transmitters)

The static pressure is outside of the specification limits: check in field and if true immediately disconnect the transmitter from the process and consider to replacing with another having appropriate rating. In case that the pressure is within the limits the pressure sensor or the sensor connections are suspect: see the transmitter's instruction manual for fault finding.

ELECTRONICS TEMP OUT OF LIM (pressure TxS)

The temperature of the electronics appears outside of the specification limits: check in field and, if true, provide adequate protection to prevent excess temperature of the transmitter's topwork due to radiation, freezing, etc. If the topwork temperature appears regular the electronics is faulty and should be replaced.

ASIC UPDATE FAILURE (pressure transmitters)

The ASIC input is not being updated. Check connector between sensor and electronics. In 600T tx. possible fault of the sensor or primary electronics.

ASIC COUNTER OUT OF LIMITS (pressure TxS)

The ASIC input is outside of its physical limits. Check sensor connector or the sensor. Possible fault of the sensor or primary electronics.

DAC VALUE OUT OF PHYSICAL LIMITS (600T EN pressure transmitters)

The analog output trimming values are incorrect. It is necessary to perform a 4-20 mA trimming (DAC Trim) to correct the output signal indication.

For 652/653 S temperature transmitter

**ADC ERROR
INCONGRUENT MEASUREMENT
XOR ERROR
ERROR IN ADC BITS
WATCHDOG TIME/OUT
EEPROM / ADC ERROR
EEPROM / ADC ERROR DW
RAM / XOR ERROR DW
EEPROM / XOR ERROR DW
EEPROM ACK ERROR**

All the above errors are HARDWARE errors related to the transmitter electronic.

Consider to replace the electronic. Please refer to the manufacturer for additional explanation.

**ERROR ON MEASUREMENT 1
ERROR ON MEASUREMENT 2
ERROR ON CJC / ELECTRONIC TEMPERATURE**

All the above errors are errors related to the measurement sensor 1 or 2.

Verify the sensor 1 or 2 status and if the failure persists consider to replace the measurement sensor.

COMMANDS AND COMMAND-SPECIFIC RESPONSE CODES

This section contains Hart Commands involved in Hand Held Communicator operations with the Response Codes, that may appear on its display. It also contains a brief explanation of warning and error messages.

When an error occurs during a command execution a message is displayed, indicating the number of the command and the relevant Response Code:

COMMAND# XX Response Code YY

The list below represents the reference guide for the user illustrating the meaning of each Command-Specific Response Code.

UNIVERSAL COMMANDS

COMMAND 6: WRITE POLLING ADDRESS Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 18: WRITE TAG, DESCRIPTOR, DATE Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMON PRACTICE COMMANDS

COMMAND 34: WRITE PRIMARY VARIABLE DAMPING VALUE Command-Specific Response Codes

- 3 Passed Parameter too Large

- 4 Passed Parameter too Small
the damping value range is 0 to 16 seconds
7 In Write Protect Mode
the write protect link on the transmitter is "on"
8 Warning: Set to Nearest Possible Value
the damping values are 0, 0.25, 0.5, 1, 2, 4, 8, 16.

COMMAND 35: WRITE RANGE VALUES Command-Specific Response Codes

- 2 Invalid Selection
7 In Write Protect Mode
the write protect link on the transmitter is "on"
9 Lower Range Value too High
10 Lower Range Value too Low
11 Upper Range Value too High
12 Upper Range Value too Low
13 Upper and Lower Range Values Out-of-Limits
14 Span too Small

COMMAND 36: SET UPPER RANGE VALUE (SPAN Push Button) Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
9 Applied Process too High
10 Applied Process too Low
the applied pressure exceed the Range limits
14 Span too Small
the resulting span is too small

COMMAND 37: SET LOWER RANGE VALUE (ZERO Push Button) Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

- 9 Applied Process too High
- 10 Applied Process too Low
the applied pressure exceed the Range limits
- 14 New Lower Range Value shift the Upper Range Value over the Sensor Limit

COMMAND 40: ENTER/EXIT FIXED CURRENT MODE Command-Specific Response Codes

- 3 Passed Parameter too Large
- 4 Passed Parameter too Small
the fixed current O/P limits are 3.75 and 21 mA
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 11 Analog Output Not Active
the transmitter output is fixed to 4 mA (multidrop)

COMMAND 44: WRITE PRIMARY VARIABLE UNITS Command-Specific Response Codes

- 2 Invalid Selection
the units selected does not correspond with the transmitter type
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 45: TRIM DAC ZERO Command-Specific Response Codes

- 3 Passed Parameter too Large
- 4 Passed Parameter too Small
the maximum change is 5% of the output span
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 9 Not In Proper Current Mode
procedure error : repeat the operation
- 11 Analog Output Not Active
the transmitter output is fixed to 4 mA (multidrop) and the trimming procedure is not admitted

COMMAND 46: TRIM DAC GAIN Command-Specific Response Codes

- 3 Passed Parameter too Large
- 4 Passed Parameter too Small
the maximum change is 5% of the output span
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 9 Not In Proper Current Mode
procedure error : repeat the operation
- 11 Analog Output Not Active
the transmitter output is fixed to 4 mA (multidrop) and the trimming procedure is not admitted

COMMAND 47: WRITE TRANSFER FUNCTION Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 48: READ ADDITIONAL TRANSMITTER STATUS

Command-Specific Response Codes

- 8 Warning: Update In Progress

TRANSMITTER SPECIFIC COMMANDS

(for 600T, 600T EN and Deltapi K PRESSURE Transmitters)

COMMAND 129: WRITE STATIC DATA - MATERIALS

Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 130: WRITE UPPER SENSOR TRIM POINT

COMMAND 131: WRITE LOWER SENSOR TRIM POINT

Command-Specific Response Codes

- 1 Type Code Mismatch
- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 3 Passed Parameter too High
- 4 Passed Parameter too Low
the maximum change is 5% of the span
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 9 Applied Process too High
- 10 Applied Process too Low
the applied pressure exceed the Range limits
- 11 Excess Correction Attempted
- 13 Trim span too small
- 16 Access Restricted
trimming operation not allowed because PV bias not equal to 0

COMMAND 132: WRITE CONTROL MODES

Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 134: RESET FACTORY OUTPUT TRIM VALUES

Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 135: WRITE POLYNOMIAL COEFFICIENTS

Command-Specific Response Codes

- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 137: WRITE UP/DOWN SCALE MODE

Command-Specific Response Codes

- 1 Type Code Mismatch
- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 138: WRITE STATIC PRESSURE TRIM POINT

Command-Specific Response Codes

- 3 Passed Parameter too High
- 4 Passed Parameter too Low
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 11 Excess of correction attempted

COMMAND 139: RESET FACTORY SENSOR TRIMMING

Command-Specific Response Code

- 7 In Write Protect Mode
The Write protect link on the transmitter is "on"

COMMAND 140: RESET PRIMARY VARIABLE BIAS VALUE

Command-Specific Response Code

- 7 In Write Protect Mode
The Write protect link on the transmitter is "on"

COMMAND 141: SET PRIMARY VARIABLE TO A SELECTED VALUE

Command-Specific Response Codes

- 3 Passed Parameter too High
- 4 Passed Parameter too Low
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 9 Applied Process too High
- 10 Applied Process too Low

COMMAND 142 : WRITE LIMIT FOR DOUBLE POLY
Command-Specific Response Codes

- 3 Passed Parameter too High
- 4 Passed Parameter too Low
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 238: SET LOWER RANGE VALUE ON O/P SELECTED VALUE

COMMAND 239: SET UPPER RANGE VALUE ON O/P SELECTED VALUE

Command-Specific Response Codes

- 3 Passed Parameter too High
- 4 Passed Parameter too Low
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 242: WRITE SQUARE ROOT CUT OFF VALUE

Command-Specific Response Codes

- 3 Passed Parameter too High
- 4 Passed Parameter too Low
- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

COMMAND 244: WRITE DOUBLE POLYNOMIAL COEFFICIENTS

Command-Specific Response Codes

- 5 Too few bytes received
the number of bytes received is less than expected
- 7 In Write Protect Mode
the write protect link on the transmitter is "on"

TRANSMITTER SPECIFIC COMMANDS

(for 652/653 S TEMPERATURE Transmitters)

COMMAND 141: WRITE CONFIGURATION DATA

Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected
- 6 Transmitter specific command error
the transmitter generates an unexpected error

- 7 In Write Protect Mode
the transmitter is in write protect mode
- 9 CJC too low
Input value for CJC is lower than expected
- 10 RTD multiplication factor too high
Multiplication factor in input is too high
- 11 CJC too high
Input value for CJC is higher than expected
- 12 RTD multiplication factor too low
Multiplication factor in input is too low

COMMAND 143: WRITE CABLE RESISTANCE
Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected
- 6 Transmitter specific command error
the transmitter generates an unexpected error
- 7 In Write Protect Mode
the transmitter is in write protect mode

COMMAND 147: WRITE CURRENT OUTPUT RANGE VALUES
Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected
- 6 Transmitter specific command error
the transmitter generates an unexpected error
- 7 In Write Protect Mode
the transmitter is in write protect mode
- 9 100% Current value too high
the value defined for current is out of the high limits
- 10 0% Current value too low
the value defined for current is out of the low limits
- 11 Upper Current Limit value too high
the value defined for upper current limit is out of the high limits
- 12 Lower Current Limit value too low
the value defined for lower current limit is out of the low limits

COMMAND 151: WRITE SENSOR ERROR VALUES
Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected
- 6 Transmitter specific command error
the transmitter generates an unexpected error

- 7 In Write Protect Mode
the transmitter is in write protect mode
- 9 Shorted sensor value too high
the value defined for shorted sensor is too high
- 10 Shorted sensor value too low
the value defined for shorted sensor is too low
- 11 Broken sensor value too high
the value defined for broken sensor is too high
- 12 Broken sensor value too low
the value defined for broken sensor is too low

COMMAND 153: READ/RESET MAX MIN VALUES
Command-Specific Response Codes

- 2 Invalid Selection
the selection does not correspond with the transmitter type
- 5 Too few bytes received
the number of bytes received is less than expected

COMMAND 154: RESET DAC TRIM
Command-Specific Response Codes

- 7 In Write Protect Mode
the transmitter is in write protect mode

TRANSMITTER SPECIFIC COMMANDS
(for KST TEMPERATURE Transmitters)

COMMAND 131: WRITE STATIC DATA - CONFIGURATION
Command-Specific Response Codes

- 7 In Write Protect Mode
the write protect link on the transmitter is "on"
- 8 Warning: 4/20 points set to selected sensor limits
- 11 Invalid Sensor Type Code
Wrong Type of Sensor specified
- 12 Invalid Number of Wires Code
Invalid number of wires specified for the specific sensor

COMMAND 133: WRITE LOWER TRIM POINT
COMMAND 134: WRITE UPPER TRIM POINT
Command-Specific Response Codes

- 3 Passed Parameter too large
- 4 Passed Parameter too small
The maximum change is 5% of the span
- 7 In Write Protect Mode
The Write protect link on the transmitter is "on"
- 10 Calibration Location not set to User
The Factory set trim parameter cannot be changed (see Sensor Trimming option)
- 11 Excess of correction attempted
- 12 Invalid Calibration Point Units Code
The calibration units are not proper for the type of sensor
- 13 Trim span too small
The trim span is smaller than the span limits

COMMAND 135: WRITE CALIBRATION LOCATION

Command-Specific Response Code

- 7 In Write Protect Mode
The Write protect link on the transmitter is "on"
- 12 Invalid Calibration Location code
- 14 Warning: Default values set for User calibration
This message is made the first time the user calibration is selected

COMMAND 136: READ LAST TRIM POINT VALUES

Command-Specific Response Code

- 10 Error: Calibration Location not set to User
The trim point values can be read only if the User location has been selected

COMMAND 137: READ TRIM VARIABLE VALUE

Command-Specific Response Code

- 3 Applied input too large
- 4 Applied input too small
The input applied during a sensor trimming operation exceed the sensor limits

COMMAND 138: WRITE STATIC DATA - OPTIONS

Command-Specific Response Code

- 7 In Write Protect Mode
The Write protect link on the transmitter is "on"
- 13 Invalid Meter Option

DATA BASE OPERATIONS MESSAGES

NO TAGS IN DATABASE

No configurations stored in the Communicator Database memory.

TAG IS NOT IN HT

The selected Tag is not included in the Communicator Tag list : no configuration is saved for this Tag.

TAG ALREADY EXIST

A configuration with the same Tag has already been saved in the Communicator Database memory.

DATABASE MEMORY FULL

No more space available in the Communicator Database memory.

INCOMPATIBLE MANUFACTURER

Attempt to load a configuration in a device of a different manufacturer.

INCOMPATIBLE DEVICE

Attempt to load a configuration in a device incompatible with that configuration.

APPENDIX "A1"

List of the allowed Sensor Types and relevant Units for 652/653 S Temperature transmitter

Sensor Type	Measuring Units
Ohms	Ohms
Pt 100	Deg. C, Deg. F, Deg. R, Kelvin
Ni 100	Deg. C, Deg. F, Deg. R, Kelvin
Special RTD	Deg. C, Deg. F, Deg. R, Kelvin
Millivolt	mV
T/C Type B	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type E	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type J	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type K	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type L	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type N	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type R	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type S	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type T	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type U	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type W3	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type W5	Deg. C, Deg. F, Deg. R, Kelvin
Special T/C	Deg. C, Deg. F, Deg. R, Kelvin

List of the allowed Measurement type for 652/653 S Temperature transmitter

TC / (voltage	(differential	CJC (internal
TC / (voltage	(differential	CJC (external Pt100
TC / (voltage	(differential	CJC (external Ni100
TC / (voltage	(differential	CJC constant (k)
RTD / ohm	(differential	2 wires
TC / (voltage	(single	CJC (internal
TC / (voltage	(single	CJC (external Pt100
TC / (voltage	(single	CJC (external Ni100
TC / (voltage	(single	CJC constant (k)
TC / (voltage	(average	CJC (internal
TC / (voltage	(average	CJC (external Pt100
TC / (voltage	(average	CJC (external Ni100
TC / (voltage	(average	CJC constant (k)
RTD / ohm	(single	2 wires
RTD / ohm	(single	3 wires
RTD / ohm	(single	4 wires
RTD / ohm	(average	2 wires

APPENDIX "A2"

List of the allowed Sensor Types and relevant Units for KST Temperature transmitter

Sensor Type	Measuring Units
Ohms	Ohms
RTD - Pt 100, a = 385	Deg. C, Deg. F, Deg. R, Kelvin
RTD - Pt 100, a = 392	Deg. C, Deg. F, Deg. R, Kelvin
RTD - Pt 200, a = 385	Deg. C, Deg. F, Deg. R, Kelvin
RTD - Pt 500, a = 385	Deg. C, Deg. F, Deg. R, Kelvin
RTD - Ni 120	Deg. C, Deg. F, Deg. R, Kelvin
Special RTD	Deg. C, Deg. F, Deg. R, Kelvin
Millivolt	mV
T/C Type B NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type E NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type J NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type K NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type N BS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type R NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type S NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type T NBS	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type DIN J	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type DIN K	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type DIN S	Deg. C, Deg. F, Deg. R, Kelvin
T/C Type DIN T	Deg. C, Deg. F, Deg. R, Kelvin
Special T/C	Deg. C, Deg. F, Deg. R, Kelvin

APPENDIX "B"

List of the Primary Variable Units allowed (600T Pressure Transmitter) :

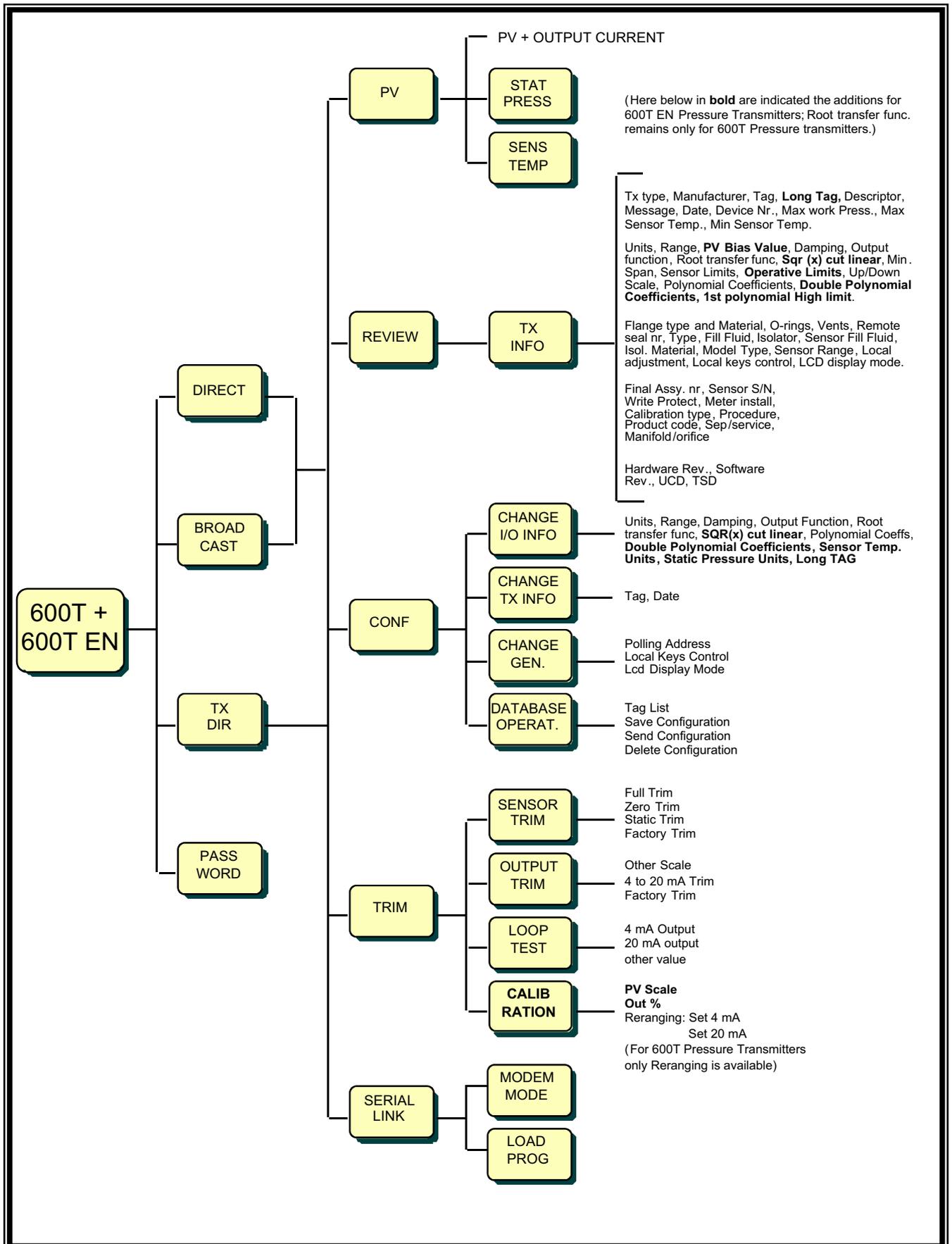
inches H2O	(20 deg C)
inches Hg	(0 deg C)
feet H2O	(20 deg C)
millimetres H2O	(20 deg C)
millimetres Hg	(0 deg C)
pounds / in ^2	
bars	
millibars	
grams / centimeter^2	
kilograms / centimeter^2	
pascals	
kilopascals	
torr @	(0 deg C)
atmospheres	
megapascal	
inches H2O	(4 deg C)
millimetres H2O	(4 deg C)

List of the Primary Variable Units allowed (652/653 S and KST Temperature Transmitter) :

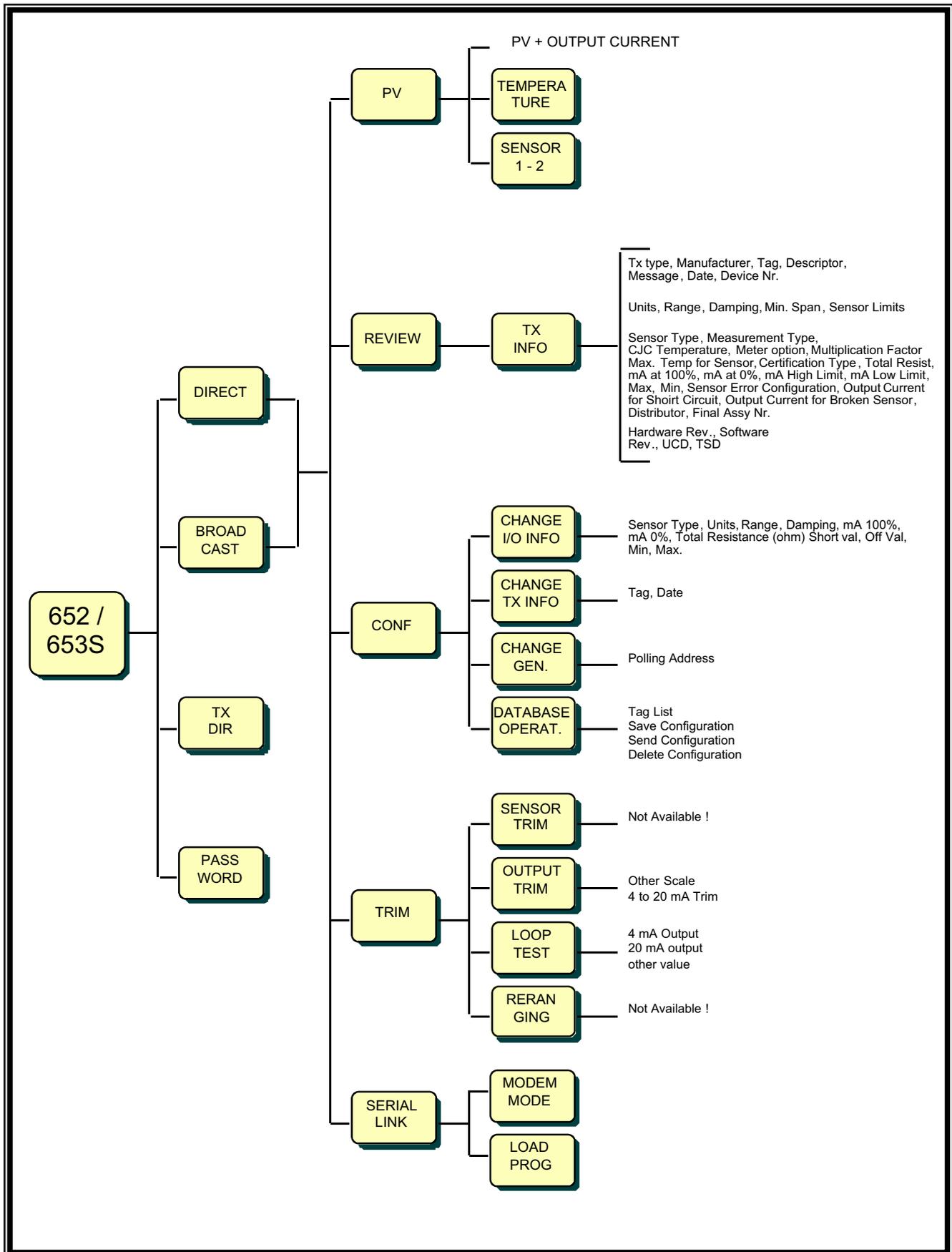
Degrees Celsius
 Degrees Fahrenheit
 Degrees Rankine
 Kelvin
 millivolts
 ohms

APPENDIX "C"

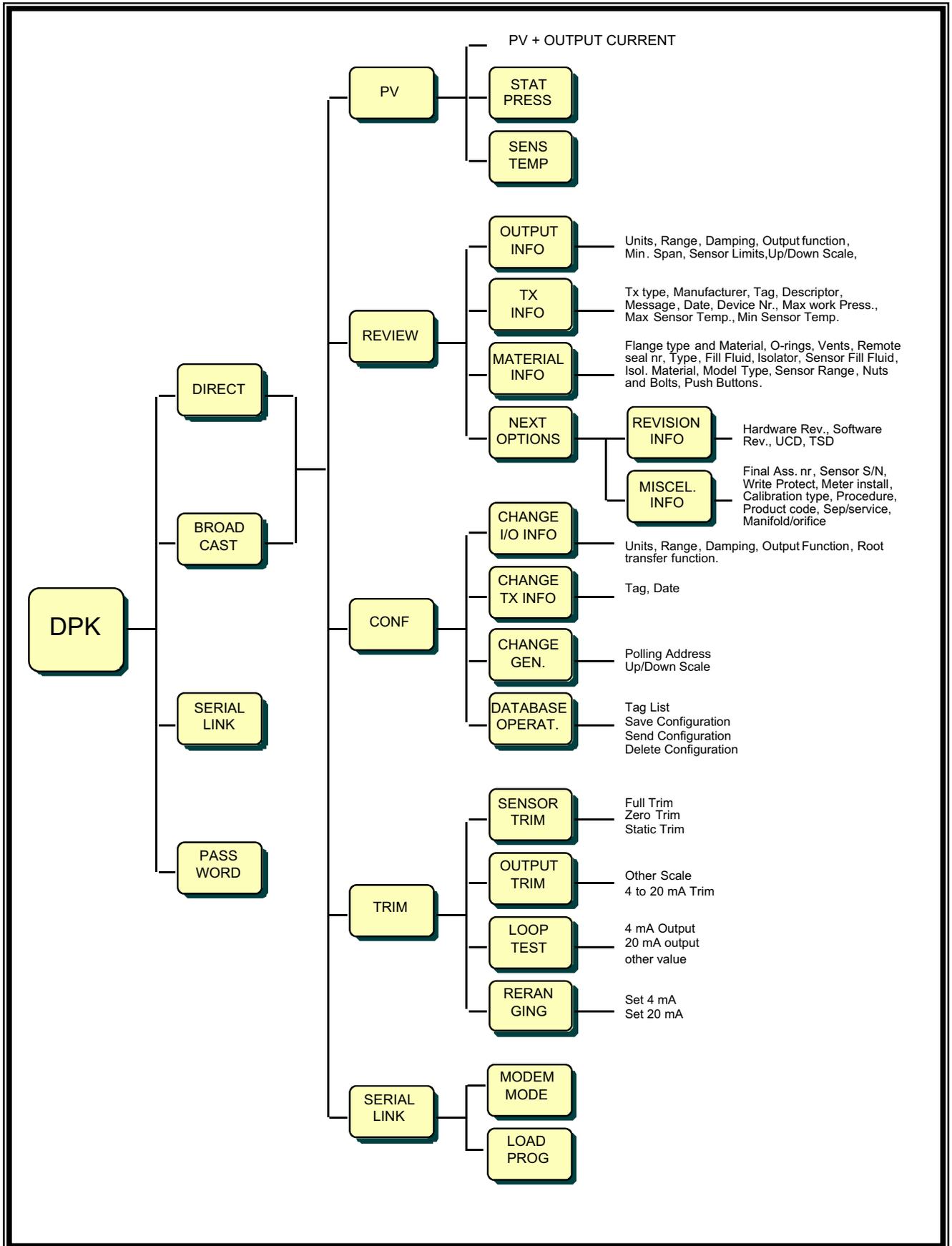
OPERATIONS GUIDE (For 600T and 600T EN pressure transmitter)

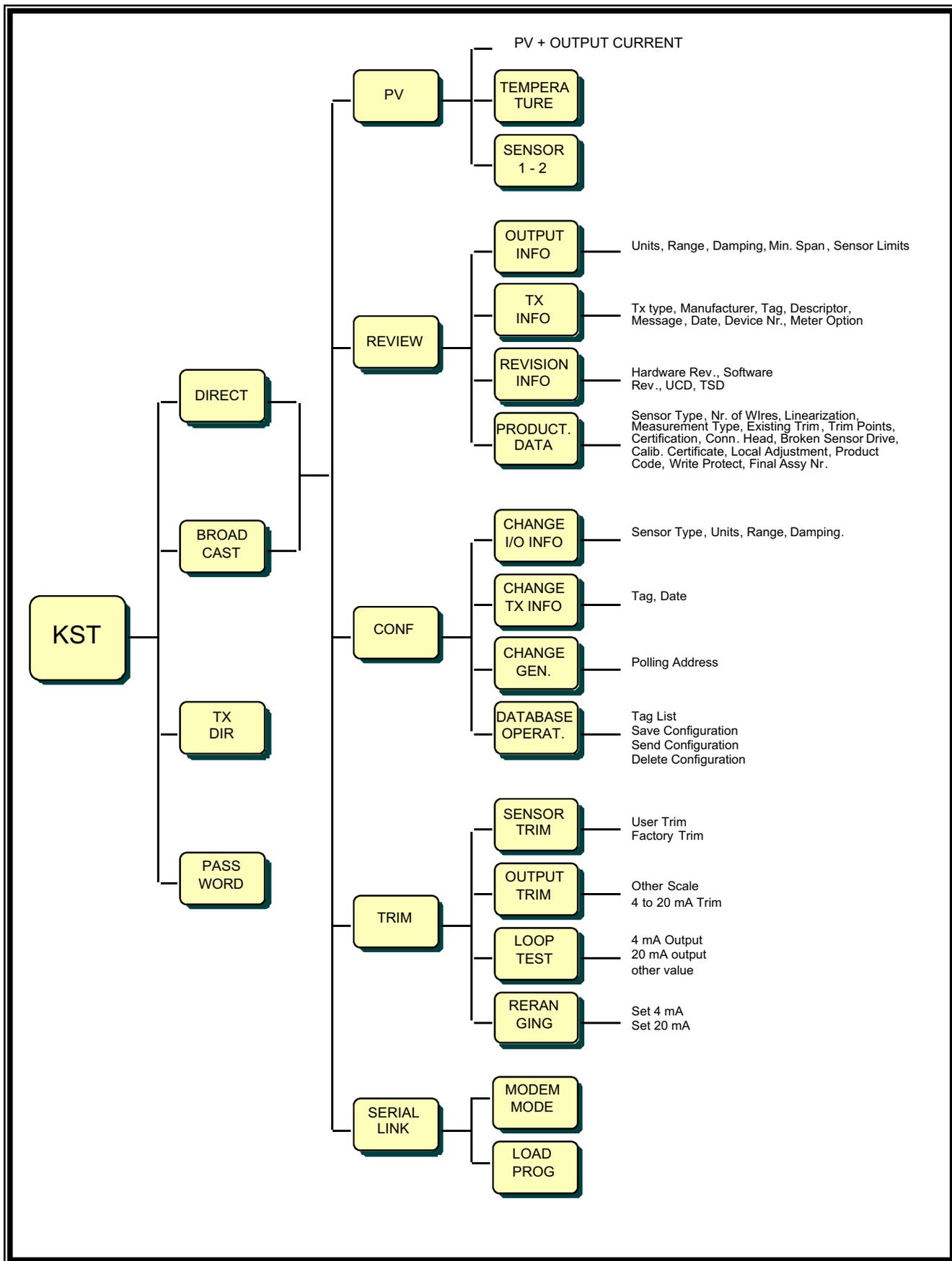


OPERATIONS GUIDE (For 652/653 S temperature transmitter)

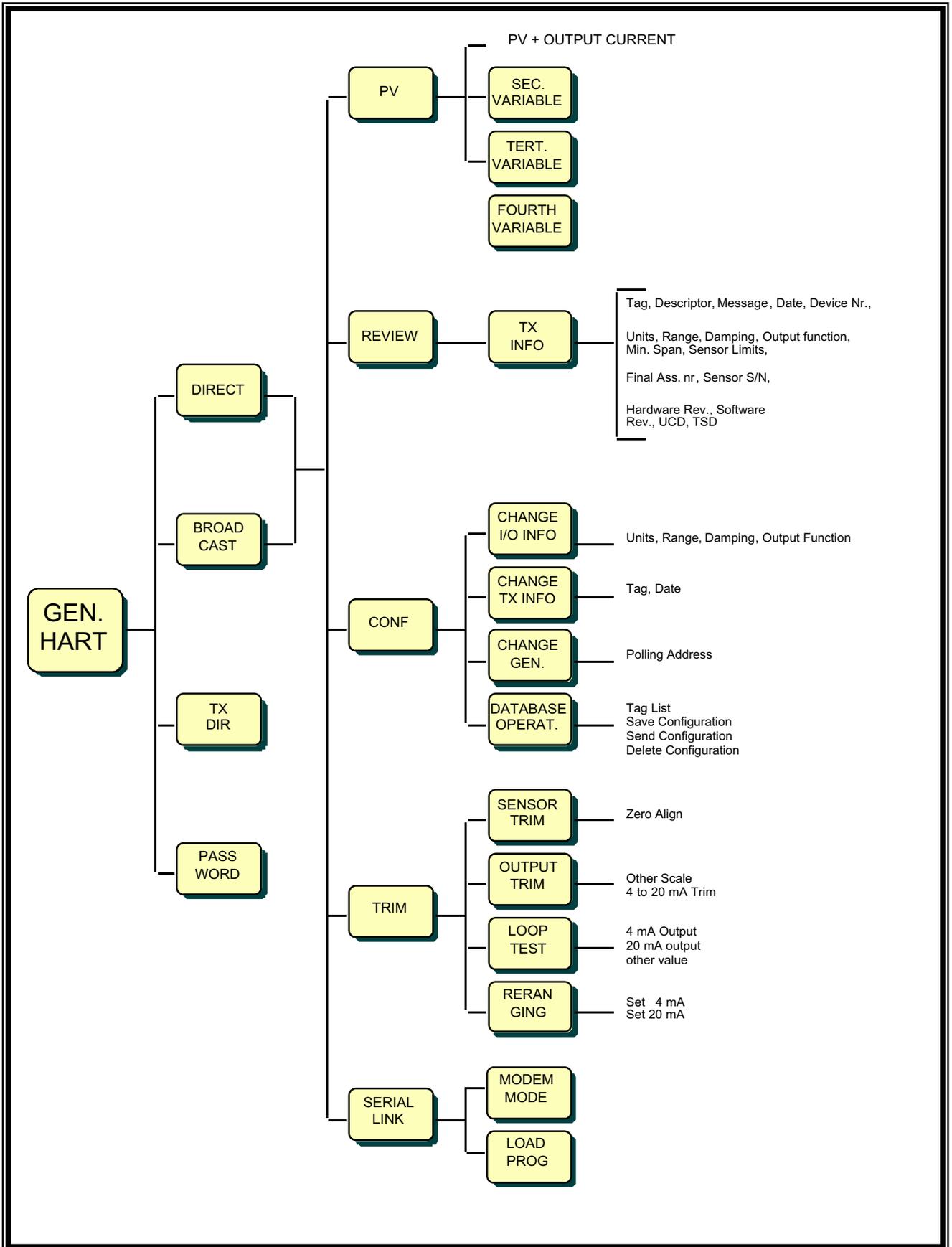


OPERATIONS GUIDE (For DPK pressure transmitter)





OPERATIONS GUIDE (For generic Hart transmitter)



APPENDIX "D"

List of data and parameters saved in the 691HT memory for a Generic HART Transmitter, for Deltapi K pressure and for KST Temperature Transmitter

DATA IN 691HT DATABASE MEMORY	
Tag Manufacturer Transmitter Type Code Device Number Flags PV Units Secondary Var. Units (a, d) Tertiary Var. Units (b, d) Fourth Var. Units (c, d) Message Descriptor Date URV/LRV Damping Value Transfer Function (d) Sensor Serial Nr. Sensor Units USL/LSL Minimum Span Alarm Selection Write Protect UCD/TSD Software Revision Hardware Revision Distributor Final Assembly Number	<p>For 600T and 600T EN Pressure and for 652/653 S Temperature transmitters, all database information are stored into 691HT database memory.</p>

NOTES:

a): for Deltapi K it indicates the Static Pressure Units
b): for Deltapi K it indicates the Sensor Temperature Units

c): for Deltapi K it indicates the Electronic Temperature Units
d): not available for KST

691HT TECHNICAL SPECIFICATION

Functional Specifications

Memory: The non-volatile (Flash) memory retains contents when the unit is powered down. An internal back up battery with a useful life of 10 years maintains information even if the batteries or rechargeable power pack fully discharge.

Power Supply: Rechargeable Nickel-Cadmium 4.8 V battery pack (optional)
 Maximum charging current 50 mA for 15 hours.
 Continuous run time : 30 hours approx. - disposable alkaline batteries
 10 hours approx. - optional rechargeable power pack
 Type AA 1.3V Alkaline batteries as standard

Performance specifications

Temperature limits: 0 and 50 °C (32 and 122 °F)

Transportation and storage temperature limits: -20 and +70°C (- 4 and +158 °F)

Humidity limits operates in 0-95% relative humidity under non-condensing conditions below 40°C (104°F) without error.

Hazardous Location Certification:

INTRINSIC SAFETY : ATEX Group II Category 1 EEx ia IIC T4 Certificato CESI 03 ATEX043

Physical specifications

Display : LCD - 4 rows 20 characters each

Keyboard: 25 keys- tactile mobile feedback embossed membrane

Connections: to the transmitter: 1.5 m (5 ft) leadset with insulated minigrabbers and alligator clips (provided)
 to the PC: 1.5 m (5 ft) leadset with 9-pin D type female connector (D9 to D25 Adaptor provided)
 to the optional battery charger : 5.5 mm. dia. socket; inner pin positive

Dimensions: 102 x 206 x 70 mm (4 x 8.1 x 2.8 in) (W x D x H)

Material: Case in ABS. Keyboard in Polycarbonate. Carrying case, with detachable shoulder strap (provided). Used to accommodate the Communicator, spare battery(ies), connection accessories, ect.

Mass: 1.4 kg. (3lbs) approx. including accessories

Option: Battery charger (220/230 Vac - European plug).



TROUBLE SHEET

WARRANTY REPAIR REPAIR ORDER

Rejection or discrepancy reports

Copy attached Not available

• IDENTIFICATION

Customer

Purchase order No.

Plant

Name of person to contact

Instrument tag No.

Model

Serial No.

• OPERATING CONDITIONS

Specify location, environmental conditions, type of service and approximate number of operating hours or date of installation if known.

[Empty box for operating conditions]

• REASON FOR RETURN

[Empty box for reason for return]

Trouble found during : Installation Commissioning Maintenance
At start up On service

Shipping information for the return of the equipment

Material returned for factory repair, should be sent to the nearest ABB Service Center, transportation charges prepaid by the Purchaser.

Please enclose this sheet duly completed to cover letter and packing list

Date

Signature

Originator

PRODUCTS & CUSTOMER SUPPORT

A Comprehensive Instrumentation Range

Analytical Instrumentation

- **Transmitters**
On-line pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.
- **Sensors**
pH, redox, selective ion, conductivity and dissolved oxygen.
- **Laboratory Instrumentation**
pH and dissolved oxygen meters and associated sensors.
- **Water Analyzers**
For water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.
- **Gas Analyzers**
Zirconia, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.

Controllers & Recorders

- **Controllers**
Digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.
- **Recorders**
Circular and strip-chart types (single and multi-point) for temperature, pressure, flow and many other process measurements.

Electronic Transmitters

- **Smart & Analog Transmitters**
For draft, differential, gauge and absolute pressure measurement. Also, liquid level and temperature.
- **I to P Converters and Field Indicators**

Flow Metering

- **Magnetic Flowmeters**
Electromagnetic, insertion type probes and watermeters.
- **Turbine Flowmeters**
- **Wedge Flow Elements**
- **Mass Flow Meters**
Transmitters, sensors, controllers and batch/display units.

Level Control

- **Submersible, Capacitance & Conductivity.**

Pneumatic Instrumentation

- **Transmitters**
- **Indicating Controllers**
- **Recording Controllers**

Customer Support

ABB provides a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

Italy

ABB SACE spa - Business Unit Instrumentation
Tel: +39 (0) 344 58111
Fax: +39 (0) 344 58278

United Kingdom

ABB Ltd
Tel: +44 (0)1480 475321
Fax: +44 (0)1480 470787

United States of America

ABB Inc.
Tel: +1 215-674-6000
Fax: +1 215-674-7183

Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.

In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of operating and maintenance records relating to the alleged faulty unit.



EC DECLARATION OF CONFORMITY

We: ABB SACE S.p.A.
Via Statale, 113
22016 Lenno (Como)
Italy

declares under our sole responsibility that the products:

600T EN Series (Transmitters, Hand Held Terminal, Field Indicator) in all the communication configurations (4÷20 mA + HART®, Profibus, Foundation Fieldbus, Safety)

are in conformity with the following standards:

EN 61000-6-3 (2001) Electromagnetic compatibility (EMC) - Generic standards - Emission standard for residential, commercial and light-industrial environments

according to: EN55022 (2001)

EN 61000-6-2 (2001) Electromagnetic compatibility (EMC) - Generic standards - Immunity for industrial environments

according to: EN 61000-4-2 (2001)
EN 61000-4-3 (2002)
EN 61000-4-4 (2001)
EN 61000-4-5 (2001)
EN 61000-4-6 (2001)

following the provisions of the EMC Directives 89/336/EEC and 93/68/EEC.

Lenno, 2nd January 2003

ABB SACE S.p.A.
BU Instrumentation Technical Manager

A. Moroni

ABB SACE S.p.A.

Business Unit Instrumentation

1001MKK00
Uffici Commerciali/Sales Office:
Via Statale, 113 - 22016 Lenno (CO) Italy
Tel. +39 0344 58 111 - Fax +39 0344 56 278
e-mail: abb.instrumentation@it.abb.com

Direzione e Uffici Amministrativi/Administration:
Via L. Lama, 33 - 20099 Sesto S. Giovanni (MI) Italy
Tel. +39 02 2414 1 - Fax +39 02 2414 3892
e-mail: sace.ssg@it.abb.com

Sede legale/Registered Office:
20135 Milano - Via C. Arconati, 1
Capitale Sociale: € 60.000.000 i.v.
Partita IVA/VAT n°: IT 00257710731
Registro delle imprese di Milano e Codice
Fiscale: 0109949 015 1
R.E.A. Milano: 1066547+

Unità produttive/Factories:
Lenno (CO)
Ossuccio (CO)
Sesto S. Giovanni (MI)

ABB has Sales & Customer Support
expertise in over 100 countries worldwide

www.abb.com/instrumentation

The Company's policy is one of continuous product
improvement and the right is reserved to modify the
information contained herein without notice.

Printed in Italy (11.2008)

© ABB 2008



ABB Ltd

Howard Road, St. Neots
Cambridgeshire, PE19 3EU
UK
Tel: +44(0)1480 475321
Fax: +44(0)1480 217948

ABB Inc.

125 E. County Line Road
Warminster, PA 18974
USA
Tel: +1 215 674 6000
Fax: +1 215 674 7183

ABB SACE

A division of ABB S.p.A.
Via Statale 113
22016 Lenno (CO) Italy
Tel: +39 0344 58111
Fax: +39 0344 56278

ABB Automation Products GmbH

Schillerstrasse 72
D-32425 Minden
Germany
Tel: +49 (0) 571 830 1691
Fax: +49 (0) 571 830 1368