

Manual

Display Unit

STM 702

Data sheet 4112
Stand 01.11.2005

S.I. Instruments
256 South Rd. Hilton
South Australia 5033
Ph (08) 8352 5511

info@si-instruments.com
www.si-instruments.com



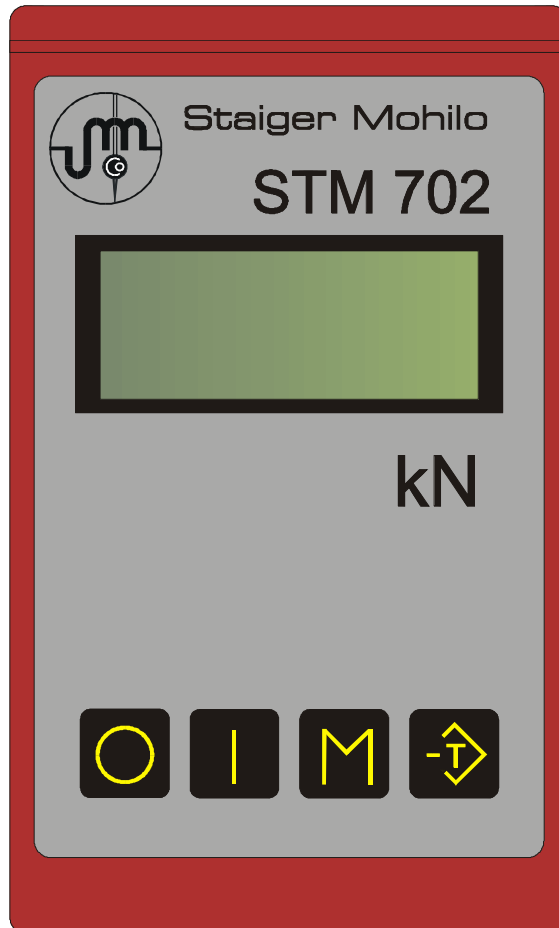
Dr. Staiger, Mohilo+Co GmbH
Maierhofstraße 35, D-73547 Lorch
Telefon (07172) 184-0,
Telefax (07172) 184-500
E-Mail: info@staiger-mohilo.de
Internet: [http:// www.staiger-mohilo.de](http://www.staiger-mohilo.de)

Operating Instructions no. 1534
STM 702

1. FIELD OF APPLICATION	3
2. LIST OF ITEMS SUPPLIED	3
3. TECHNICAL SPECIFICATION	4
4. DESCRIPTION OF THE DISPLAY UNIT	5
5. OPERATING INSTRUCTIONS	6
5.1. KEYBOARD FEATURES	6
5.2. DESCRIPTION OF DISPLAY	7
5.3. COMMISSIONING AND MEASUREMENT	7
6. SERIAL INTERFACE	8
7. PROGRAMMING AND CALIBRATION.....	9
7.1. KEYBOARD FUNCTIONS IN MODE SET-UP	9
7.2. PROGRAMMING	10
7.2.1. <i>Symbols</i>	10
7.2.2. <i>SET-UP Menu</i>	11
7.2.3. <i>Calibration</i>	13
7.2.4. <i>Programming of the Serial Interface</i>	14
8. CALIBRATION EXAMPLES	15
8.1. CALIBRATION BY PUTTING LOAD ONTO A FORCE TRANSDUCER	15
8.2. CALIBRATION BY ENTERING A KNOWN TRANSDUCER SENSITIVITY.....	16
ANNEX 1	17
ANNEX 2	18

1. Field of Application

The programmable Display Unit STM 702 is especially designed for connecting sensors with strain-gauge (SG) four-arm bridges, mainly force transducers or load cells. The Display Unit runs on batteries and is primarily for use in conjunction with force transducers as a small and handy force measuring instrument particularly in mobile application.



2. List of Items Supplied

- Display Unit STM 702 with 2 pieces 1.5 V alkaline batteries (size AA)

Optional extras:

- STM702.05 Storage case containing
2 pcs. NC rechargeable batteries
Plug-in charging device
- XKC 111 Interface cable for downloading data to a computer
- XKC 047 6pin plug, loose

3. Technical Specification

Input		for up to 2 SG full bridge transducers (350 Ohms) switched in parallel
- sensitivity (=S)	mV/V	ca. 0.8...2.5
- Excitation	VDC	ca. 2V
Display		LCD, 4 1/2 digits
- height of characters	mm	15.2
- display range		dependent on calibration and scaling display range -19999 to 19999 position of decimal point user-selectable user-selectable 1, 2, or 5
- discrimination of display		user-selectable 1, 2, or 5
- display resolution (for a noise-induced display error of 1 part)	parts	for a transducer sensitivity of 2 mV/V: 10000 for a transducer sensitivity of 1 mV/V: 5000
- modes of display		instantaneous value (= average over 0.5 sec.) peak hold display of overload, underload display of low voltage
- display rate	1/s	2
- scaling points for linearization		up to 5
internal resolution for 2mV/V	parts	ca. 25 000 parts for averaging over 0.1s ca. 125 000 parts for averaging over 0.5s
noise	parts	ca. 10 parts internally for averaging over 0.1s ca. 20 parts internally for averaging over 0.5s
maximum rate of measurement	1/s	10 (average of 0.1s)
taring		entire display range
serial interface RS 232		8 bit data capacity, 1 stop bit, Baud rate 2400 ...9600 10 measured values per sec.
Power supply		
- supply voltage	VDC	2,4...3 (2 NC rechargeable/primary batteries Size AA)
- current demand	mA	ca. 35
- operating time for rechargeable batteries 750mAh	h	ca. 15 (RS232 active) ca.20 (RS232 inactive)
Ambient conditions		
- operating temperature range	°C	0...+50
- storage temperature range	°C	-20...+70
Errors		
- display error for S=2mV/V		
instantaneous value	0,5 s %S	0.05
peak hold	%S	0.5
- measured values through serial interface	%S	0.5
- temperature coefficient of the instantaneous value per 10K	%S	0.02
- zero drift	$\mu\text{V}/10\text{K}$	< 1 (corresponding to ca. 7 parts internally for averaging over 0.1 sec. or ca. 35 parts internally for averaging over 0.5 sec.)
External configuration		
- keyboard		membrane-type keyboard
- transducer connectors		6-pin circular connectors
- output serial interface		9-pin SUB-D socket
- dimensions (W x H x D)	mm ³	95 x 158 x 33
- weight	g	200
- enclosure protection		IP40

*) S = full-scale value

4. Description of the Display Unit

The unit includes a microprocessor that controls the entire process of conditioning the measured values. The measuring signal applied is fed to an integrated analogue-to-digital converter. The converter takes 10 measurements per second with an averaging time of 0.1sec each. The read-out value is updated every 0.5 sec. by further averaging 5 measured values.

The display is a 4 1/2-digit LCD. The display range is -19999 to 19999 and is adapted to the values to be measured in the course of calibration. Zero can be adjusted (tare). There is an overload and underload indication which warns of any exceeding of the rated force range.

The Display Unit can be scaled and calibrated using the keyboard after the programming interlock (switch 'SET-UP') has been disabled.

Power is supplied from 2 Mignon batteries. When the supply voltage is low, all non-active decimal points will flash. When there is another drop in battery voltage, the unit will automatically switch off.

When the unit is switched off, the parameter set-up is stored and is used as the default set-up effective when the unit is switched on again. There is one exception: Whenever gross display is effective at the time of switching off, the tare memory will be erased.

- the instantaneous value with or without tare
- the peak hold, user-reset table to the current instantaneous value to be measured in 1 or in 4 to 4 ranges of measurement, respectively.

There is a serial interface for down-loading the non-averaged instantaneous values to a computer.






After the programming interlock has been disabled, the following quantities can be set for each range of measurement:

- value on display, decimal place, sign, display discrimination (count by 1, 2, or 5) and the limits of overload and underload.
 - calibration either by loading a connected force transducer with a well-known force (load) including linearization with up to 5 nodal values or by entering rated sensitivity S of the transducer.
- and irrespective of the range of measurement:
- the set-up of the serial interface.

5. Operating instructions

7.1. Keyboard Features

Keyboard functions are released by pressing a key shortly or for a longer duration. Short key-strokes shall take 0.3 sec. and long key-strokes 3 sec. at least. Any time a long key-stroke is exerted, the function allotted to the short key-stroke will be executed first.

Key	Function
 (On) short	<ul style="list-style-type: none"> • Switch on • Switch the display to read out values without/with tare in display modes instantaneous value and peak hold • confirmation of the selected measuring range and change-over to measurement
 (On) long	<ul style="list-style-type: none"> • change-over to menu "selection of measuring range"
 (Menu) short	<ul style="list-style-type: none"> • Switch the display modes <ul style="list-style-type: none"> - instantaneous value - peak hold • Selection measuring range
 (Tare) short	<ul style="list-style-type: none"> • in mode instantaneous value: taring, i.e. resetting the display to zero • in mode peak hold: re-setting the peak hold to the instantaneous value currently present
 (Off) short	<ul style="list-style-type: none"> • Switch off

7.2. Description of display

display	description
X X X X X	instantaneous value untared
← X X X X X	value tared
X X * X X X	Peak hold
○ ○ ○ ○	Overload indication
∪ ∪ ∪ ∪	Under load indication
X * X * X * X * X	Low battery indication
r A X	Measuring range
⚡ X X X X	Display overflow

* flashing decimal point

⚡ flashing digit 1

7.3. Commissioning and measurement

Connect the pertaining transducer with the Display Unit by means of its connector. After having been switched on, the Display Unit is in its range selection menu. The range selection menu will read out 'rA n' (n=1 ... 4) to indicate the range which was effective when the instrument was switched off last time. Press key 'M' to change to some other range of measurement. After the selected range of measurement has been acknowledged by pressing key 'I', the unit will change over to mode "measurement". The instantaneous value will be on display. If only one range of measurement can be programmed, the unit will immediately start mode "measurement" after the unit has been switched on. The accuracy of measurement as specified earlier is achieved and maintained after approx. 2 minutes of operation.

Depending on the set-up of the measurement taken last, the unit reads out either the measured untared value (gross) or the tared value (net). A tared value is marked by a small arrow shown above the sign.

6. Serial Interface

Every 0.1 sec. the type RS 232 serial interface transmits the following telegram in ASCII code as long as the CTS input is switched to ON (+0.3V ... +15V)*:

Byte	meaning
1	B for measured value without taring N for measured value with taring (reset to zero)
2	sign positive: space negative: minus sign
2 3 4 5 6 7 8	measured value, 5 digits including decimal point. Byte 8 will be empty if there is no decimal point.
9	OA line feed
10	OD carriage return

Pin configuration of the 9-pin SUB D socket

pin	signal
1	do not use (internal connection)
2	do not use (internal connection)
3	TxD
4	do not use (internal connection)
5	GND
6	internal Vcc (5V), decoupled by 2,2k Ω
7	do not use (internal connection)
8	CTS
9	do not use (internal connection)

*) Note:

When data shall be transmitted without applying the On signal to the CTS, continuous transmission of data can be achieved by a jumper from Pin 6 to Pin 8 at the 9-pin SUB D plug of cable XKC111. Remove wire connection of Pin 8 before.

7. Programming and Calibration

The Display Unit can be programmed and calibrated only after the program interlock has been disabled. Disabling is by switching the SET-UP switch which is located on the keyboard pc board and can be accessed through a hole in the battery compartment only. Use a small screwdriver to switch the 'SETUP' switch. You need not remove the batteries to this end.













Note: In the SETUP mode, calibration settings can be changed.

The SET-UP switch is hidden behind a seal when this unit has been calibrated with specific force transducers or load cells. This status of calibration gets lost as soon as the seal is removed.

Press „I“ to switch the unit on. The display will read out 'Set'. In mode SETUP the unit can be switched off by pressing key 'O' only when you have selected the uppermost menu level.

7.1 Keyboard Functions in Mode SET-UP

key	symbol	in	function
 (On)	 		<ul style="list-style-type: none"> for switching the unit on <p>In programming / calibration mode:</p> <ul style="list-style-type: none"> for changing to a higher menu level or for changing to a higher menu level and taking over a set-up or number. For approx. 1 sec, the following box is on display: <div style="text-align: right;">  </div>
 (Menu)	 —		<p>When navigating within a menu:</p> <ul style="list-style-type: none"> for navigating to a menu position and returning to the 1st position after the last one has been left. <p>When entering a number:</p> <ul style="list-style-type: none"> for navigating to the digit to be changed which will then flash. Returns to leftmost character after the rightmost has been left .
 (Tare)			<ul style="list-style-type: none"> for changing to next lower menu level <p>Within a calibration cycle:</p> <ul style="list-style-type: none"> for proceeding to the next action <p>When entering a number:</p> <ul style="list-style-type: none"> for counting figures over
 (Off)			<ul style="list-style-type: none"> for switching the unit off <p>Off can be carried out at the uppermost menu level only.</p> <div style="text-align: center;">   </div>

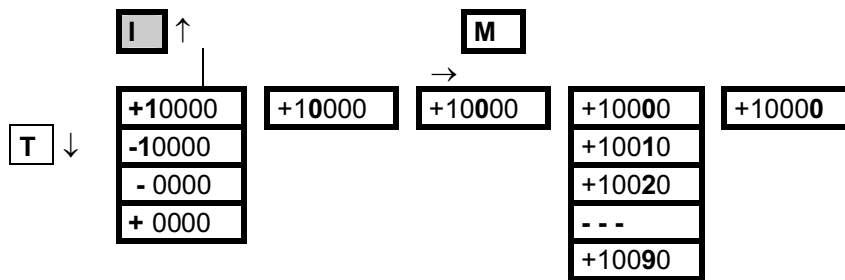
7.2. Programming

7.2.1. Symbols

In describing how to program the unit, the following symbols are used:

XXXXXX	non-volatile (steady) display
XXXXXX	1s volatile display, duration is indicated wherever necessary
T	↓ Navigating in a menu down to the next lower level
I	↑ The selected parameter is stored. Navigating in the menu up to the next higher menu level
M	→ Navigating within a menu to the right (in a cycle)

How to enter numbers:

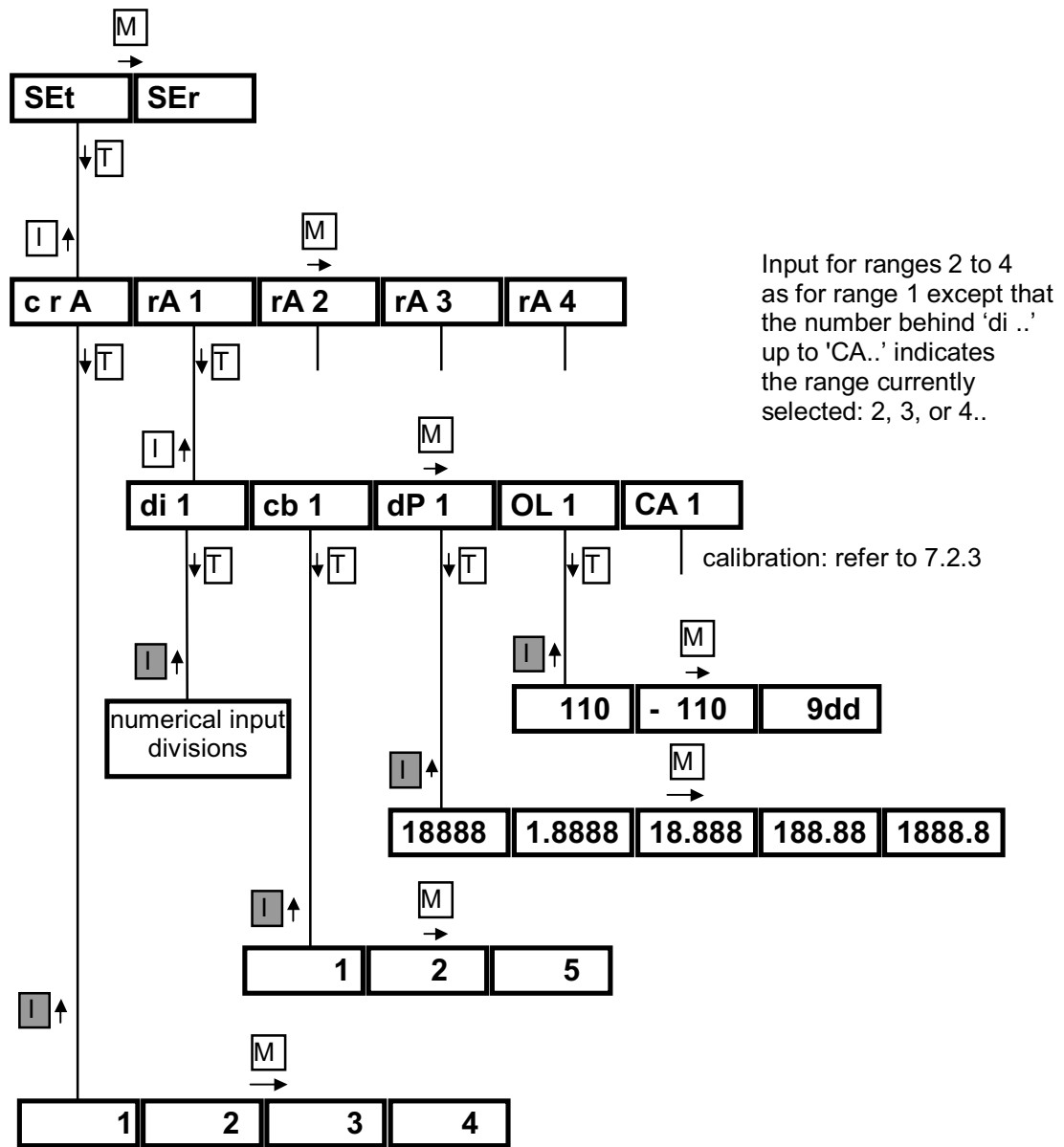


The leftmost character is rotated through +1, -1, -(0), and +(0). (0) is not read out.

The figures which can be entered for the last digit depend on the selected discrimination of the display. E.g., increments of 5 allow only '0' and '5' to be entered for the last digit.

The digit in **bold print** is the digit selected for being changed. It will flash.

7.2.2. SET-UP Menu



SEt - SET-UP and calibration **SEr** - serial interface

c r A (count of range) number of ranges 1 to 4

rA 1 (range) ranges 1 to 4
rA 4

di 1 (divisions) maximum number (MAX) of divisions (display resolution) for full scale (<= 10 000).
 Do not mix up with the numerical value on display. The value on display is further weighted with display discrimination.

Dr. Staiger, Mohilo + Co GmbH

Example:

Measuring value, display divisions (dd): 1000

Display discrimination (count by): 5

Display: 5000 with a discrimination of 5 in the last digit

The display divisions entered for MAX are needed to determine the thresholds for the display of overload and for calculating the internal linearization table when carrying out calibration by entering rated sensitivity S.

cb 1 (count by) display discrimination (count by 1, 2, or 5)

dP (decimal point) decimal point

OL 1 (overload)	selection	display of underload for display divisions	display of overload for display divisions
	9 dd	> MAX + 9	< -9
	110	> 110% of MAX	< -10% of MAX
	- 110	> 110% of MAX	< -110% of MAX

MAX - maximum number of display divisions = display divisions at full scale

CA 1 calibration menus

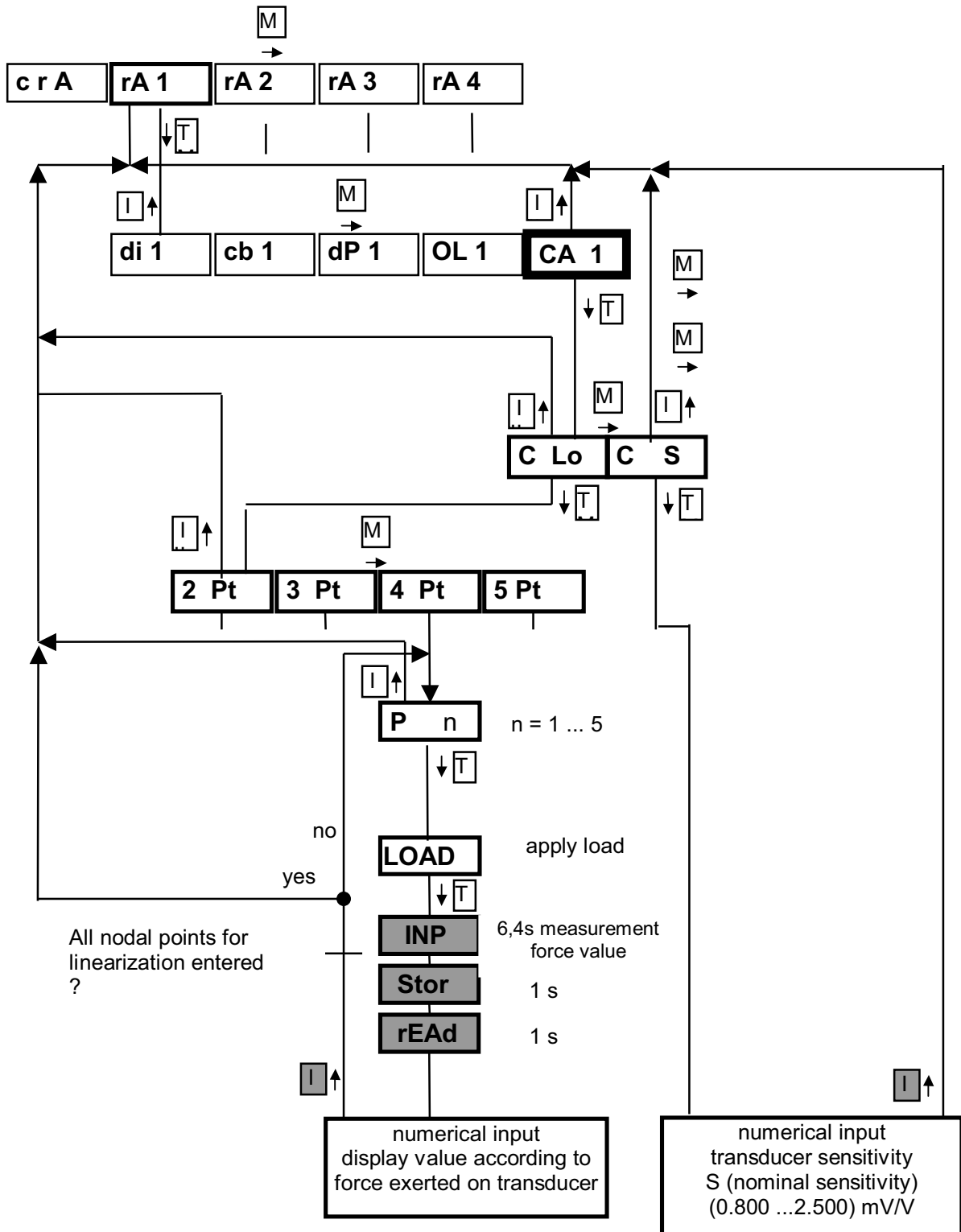
...

CA 4

7.2.3. Calibration

The point to start from is menu 'CA n' for the selected interface.

The number of display division for MAX, display discrimination and the place of the decimal point must be set at any rate. When an incorrect number of display divisions has been selected, calibration by entering sensitivity as well as the overload and underload limits will be incorrect. The decimal point and display discrimination are needed for displaying the force value when entering the display value.



C Lo Calibrate through load - Calibration by applying a load to the force transducer

Attention,
 measuring accuracy is dependent on the rated sensitivity **S** of the transducer and the difference of loads used for calibration. The stated error of the Display Unit is complied with when transducers with $S \geq 2 \text{ mV/V}$ are used and the difference mentioned above corresponds to the rated load of the transducer. When the difference is smaller or for $S < 2 \text{ mV/V}$, measuring uncertainty will increase in proportion.

C S Calibrate through entry [of] factor of nominal sensitivity

n P_n Points number of nodal points (calibration points) 2 to 5, i.e. a characteristic with up to 3 break points (4 straight line segments) can be calibrated. For 2 points this characteristic is a straight line. This mode of calibration may be used to linearize a "hunched" characteristic.

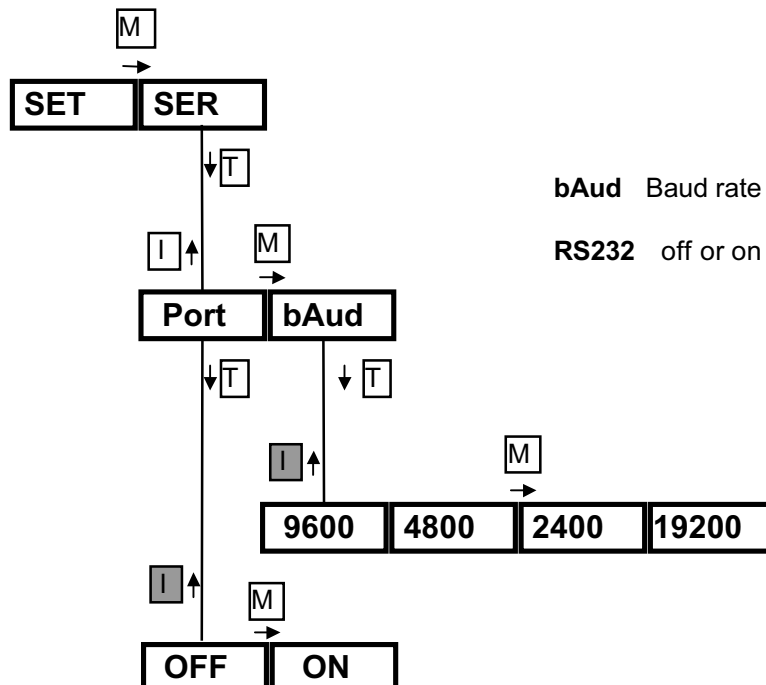
P n Point n - current point of calibration

INP Input [of] internal measuring value

rEAd Read display value for entering the display value assigned to the exerted force

Attention,
 the difference between two adjacent points must meet the condition $\leq 5000 \text{ divisions} / (\text{mV/V})$.

7.2.4. Programming of the Serial Interface



8. Calibration Examples

8.1. Calibration by Putting Load onto a Force Transducer

Example No 1:

known load = rated load: 120 kN

transducer sensitivity S: 1,8 mV/V

channel to be calibrated: 2

desired display: 120.00 kN

The unit shall be so adjusted that it signals overload at a load of 10% above rated load (e.g. compressive force) and at 110 % of negative rated load (e.g. tensile force).

Calibration procedure:

1. Navigate to SET-UP menu, switch unit on display of 'Set'
2. Press 'T' to navigate to range setting display of 'c rA'
Press 'M' to select 'rA n' and press 'M' to set to range display of 'rA 2'
3. Press 'T' to go to 'di 2' and to select the maximum permissible display discrimination.
Applied to the above example:
 - For S=1,8 mV/V the maximum settable number of divisions is 9000 due to the maximum possible discrimination of 5000 parts / mV/V.
This results in a possible step width of: $12000 / 9000 = 1,33$

Rounding up to the nearest bigger value in the 1 - 2 - 5 series yields a step width of 2 parts resulting in $120000 / 2 = 6000$ divisions. I.e., you have to enter 6000 for the number of divisions and 2 for the step width if you want a load of 120 kN to be displayed with maximum resolution.

Press 'M' and 'T' for entries and acknowledge with 'I' display of 'di 2'
4. Press 'M' to set display discrimination (step width) to 'cb 2'.
Press 'T' and 'M' to enter figure '2' and acknowledge with 'I'. display of 'cb 2'
5. Press 'M' to navigate to setting the decimal point display of 'dP 2'
Press 'T' and 'M' to shift the position of the decimal point in the number 18888 on display such that the decimal point is in its proper place (188.88 in the given example).
Press 'I' to acknowledge.
6. Press 'M' to navigate to the display of overload 'OL 2'. Press 'T' if you want to change the setting: Set to '-110' as required in our example. Press 'I' to acknowledge.
7. Press 'M' to navigate to the calibration menu. display of 'CA 2'
(Press 'M' one more time if you wish to return to the initial setting 'di 2'.)
8. Press 'T' and 'M' to make your choice of either 'C Lo' (known force) or 'C S' (known nominal sensitivity).
9. Mode 'C Lo'(known force):
Start from 'C Lo' and press 'T' to enter the number of nodal points (known loads) available. In our example calibration is carried out with two known loads which results in a straight line determined by 2 points. display of '2 Pt'

You may apply the loads in any order. One of either loads can be implemented by totally unloading the transducer (load = 0 kN). For the number of display divisions between load points the following precondition shall be met: number of divisions $\leq 5000 / \text{mV/V}$.

After having entered the number of points with 'M', press 'T' to prepare for entering the 1st load value: display of 'P 1'

Pressing of 'T' will change the display into 'LoAd' thus prompting the user to put on the 1st load. Wait for 6.4 s to let the initial mechanical transient effect die down and press 'T' to determine the force value. First INP, Stor, rEAd are displayed temporarily and thereafter a number is read out. Overwrite it with the actual value of load 1 (decimal point, step width as stated above). Press 'I' to acknowledge the force value.

The unit will then prompt the user to put on the 2nd load . display of 'P 2'
For entering the second value, proceed as explained above.

After all entries for all points have been made, the unit will jump to 'rA 2'. Calibration can now be continued for any other range following the routine described above, or the user may press 'I' - 'Set' to shut down calibration. Reset the SET-UP switch to the measuring mode.

8.2. Calibration by Entering a Known Transducer Sensitivity

Apply this method only when you are not able to provide for precisely known loads. Accuracy is less as compared with the method of known loads. It is necessary for the user to assess possible measuring errors caused by the conditions of installation, cable effects, drifting of transducer parameters, temperature effects, etc. and to correct sensitivity, if need be.

Example No 2:

Same parameters as in example No 1 but without any known load being available.

Calibration procedure:

Up to point 8 as for example No 1

Point 9. Method 'C S' (known sensitivity)

A 2-point calibration (2 Pt) can be carried out only.

Start from 'C S' and press 'T' to immediately prepare for entering the numerical value of rated sensitivity (1.800 in this example). Press 'T' or 'M' to enter the value, press 'I' to acknowledge. The unit will jump to 'rA 2'. Proceed as described for example No 1 (point 8.1).

Dr. Staiger, Mohilo + Co GmbH

Annex 2

STM702 - connecting of 6pin plug

contact	configuration
1	- supply voltage (yellow)
2	+supply voltage (brown)
3	-
4	+ measurement signal (green)
5	- measurement signal (white)
6	-
Cable shield	Cable shield

S.I. Instruments
256 South Rd. Hilton
South Australia 5033
Ph (08) 8352 5511

info@si-instruments.com
www.si-instruments.com