Operating Manual

0656 FlexLim (Safe) system

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Notes

Contents

1 General information

1.1 About this manual

This manual is designed to explain the features and operation of the BROSA 0656 electronic system when used as an overload or weighing system. In addition, it is intended as a manual for qualified and authorised personnel which describes the calibration of a BROSA 0656 system.

The manual is an integral part of the BROSA 0656 electronic system and the FlexLim (Safe) operating system software from the manufacturer:

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The manual describes the functions, general settings and calibration as well as troubleshooting for the BROSA 0656 overload protection system using the FlexLim (Safe) operating system software.

It describes the possible uses of the system as well as the required qualification of the technical staff.

The manufacturer reserves the right to change the content and form of this manual without further notice. There is no distribution list for this manual.

The manufacturer accepts no liability for content or printing errors in this manual and for damages that directly or indirectly arise from the use of this manual.

1.2 Safety instructions and warning symbols

For the sake of clarity and readability, icons are used to alert readers to important information:

DANGER

Warning of an immediate danger. Neglect leads to serious injury or death

WARNING

Warns of possible danger. Neglect could result in serious injury or death.

CAUTION

Indication of a possible danger. Non-observance may result in minor injury or property damage.

ATTENTION

Indication of a potentially harmful situation. Non-observance could result in property damage to devices and equipment.

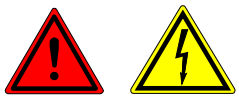
Indication of a possible risk of electric shock. Parts marked with this symbol must never be touched.

Indication of a section with additional information and useful tips.

The sections labelled with the icons shown above contain important information and deserve special attention as you read this manual. Failure to observe the icons or recommendations will result in a significantly increased potential for risk.

1.3 Warnings and important information

DANGER



Depending on the individual configuration, some systems can also be equipped with a 230V AC power supply (details can be found in the system documentation). This is indicated by a corresponding warning symbol on the voltage transformer and the relays. Although these parts are protected against direct contact, special caution should be exercised near them.

1.4 Purpose of the system

The BROSA 0656 electronic system is an overload protection and weighing system for crane systems, an important aid for the operation of cranes. The device provides the operating staff with all the information required for safe operation within target values when lifting. The system is designed and constructed to comply with all applicable safety standards.

WARNING

The system may not be used for purposes other than those mentioned above. Improper use of the system endangers the life of the operating staff and other persons and may result in damage to the machine or property.

It is crucial that the system is always in perfect condition. In systems that consist of a large number of electronic and mechanical components, the occurrence of errors can never be completely ruled out. Such errors constitute a potential security risk and must therefore be remedied promptly by qualified technical staff.

An overload protection system is no substitute for good judgement, for experienced operating staff or for the necessary safety regulations during operation and the system should therefore also not be misused for this purpose.

1.5 Qualification and responsibility of the operating staff

To ensure safe operation of the system and crane, calibration and adjustment of the system by a qualified technician is mandatory. The technician must meet the following requirements:

- He/She has the necessary authorisations and has been sufficiently trained.
- He/She has read and understood this manual or received appropriate instruction or training.
- He/She is familiar with the operation of the system.
- He/She knows the relevant safety standards and accident prevention regulations.

A person's knowledge regarding the operation of the system does not automatically mean that this person is authorised to operate the system.

WARNING

Responsibility for safe operation of the system and the crane lies with the operating staff. It must be ensured that the operating staff has understood all the information given here about operating safety and also follow it.

1.6 Disclaimer

The manufacturer assumes no liability for damage or injury resulting from impermissible or improper use of the system. This risk is the sole responsibility of the user.

The manufacturer has checked the contents of this document for compliance with the hardware and software described.

Nevertheless, deviations cannot be ruled out, and the manufacturer assumes no responsibility for complete compliance. The information in this publication is checked regularly and necessary corrections will be included in later issues.

2 System description

The BROSA 0656 electronic system together with the BROSA "Flexible Limiter" (FlexLim (Safe)) operating system software is a flexible overload protection system for crane systems. The system continuously monitors the various functions and operating conditions of a crane using a wide variety of external sensors (e.g. force sensors, angle sensors). An external display can be added to the system. The operator then receives permanent feedback (both visible and audible) about the operating status of the crane

during lifting operations. The outputs on the display (sensor data, calculated values, utilisation percentage values, etc.) are adapted to the existing crane system and the configuration of the application.

Optionally, the BROSA 0656 electronic system can be used as a weighing system in accordance with SOLAS. Handling essentially corresponds to use as an overload protection, which is why explicit mention of this is omitted in the following.

The BROSA overload protection system is based on the 0656 electronics platform with the following features:

- 8 (typ.) CANopen nodes (ID 11 - ID 18)
- 2 analogue outputs
- 8 digital inputs
- 8 digital outputs + 1 system error output
- RS232 interface
- RS485 interface
- PROFINET interface (slave)
- PROFIBUS interface (slave)
- CANopen interface (slave)

For additional technical details, see chapter 5

Each system can be adapted to the specific needs of a customer using BROSA's FlexLim Safe operating system software. As the name implies, FlexLim Safe flexibly allows for the creation of customised load limiting applications. Depending on the version, the system achieves SIL 2 (PLd)

The software consists of predefined modules (inputs, outputs, comparators, mathematical operators, etc.) that can be combined appropriately to achieve the desired functionality. Each module has a number of specific parameters which can be changed either directly

in the system (display) or by means of a PC connected via the RS232 interface. The function of these parameters is application-dependent and is explicitly listed in a separate software description.

The following sketches illustrate the system principle and the FlexLim program structure:

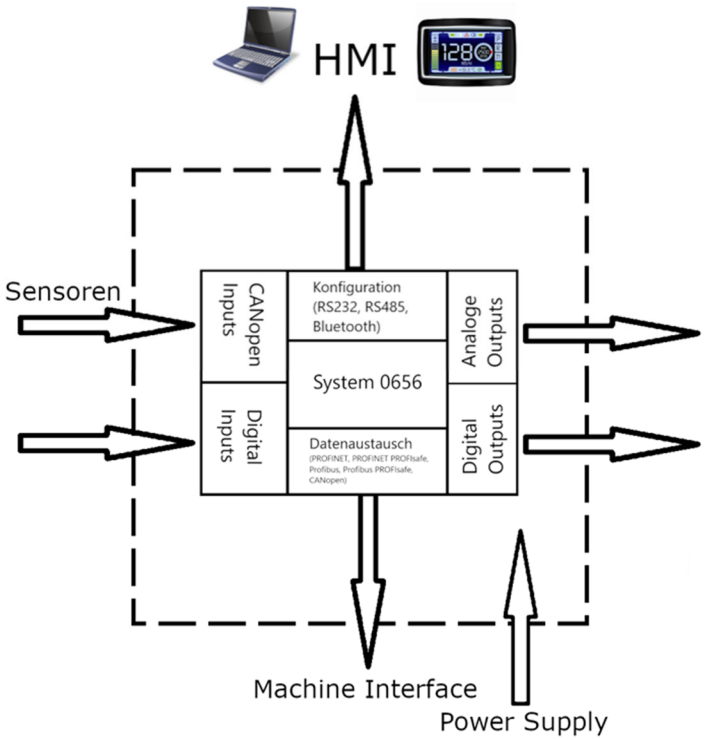


Figure 1: Standard system layout

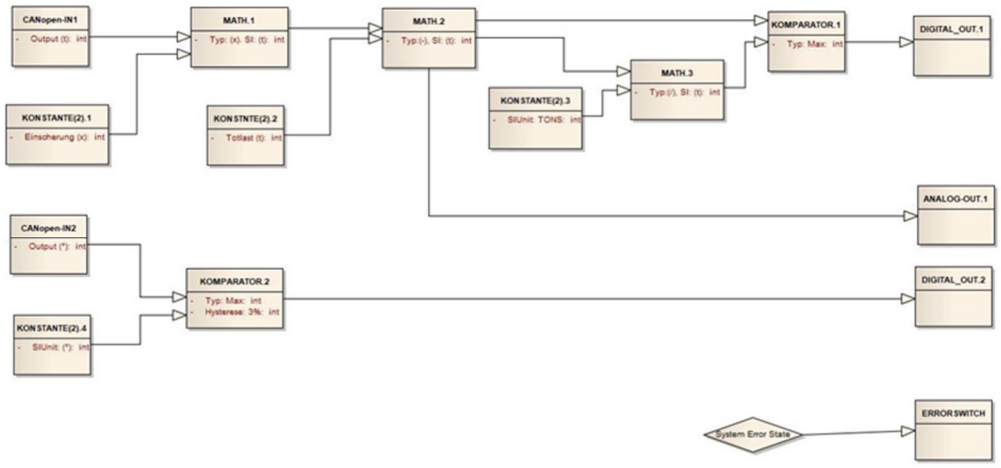


Figure 2: FlexLim program structure

3 System calibration and parameter setting

3.1 General

The system offers 2 different methods for calibration and setting of system parameters:

- PC with VT100 emulation (e.g. Putty in MS Windows) via the RS232 interface.
- Android app via Bluetooth (planned)

The menu structure differs depending on the interface used. Input and menu guidance also depend on the periphery used.

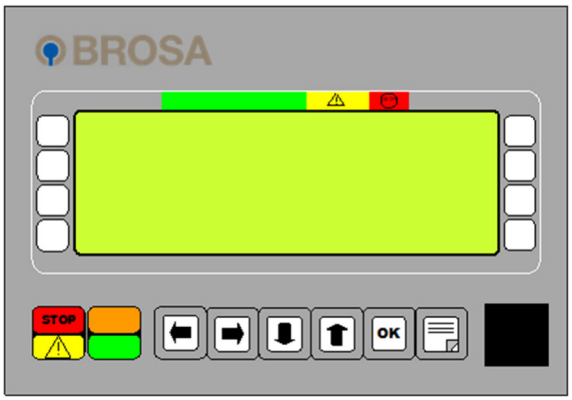
The selection menus for:

- CANopen inputs
- Digital inputs / outputs
- Constants (2) and (3)
- Load spectrum counter
- Comparators

are so-called dynamic menus. This means that the menus may be different depending on the system configuration. Only the options defined in the system configuration are displayed. For example, in a system configured with 3 CANopen inputs, only the inputs actually used by the program will be available for selection (though the BROSA 0656 system supports more channels on the software side). If there is no configuration available for the selected option, the system will indicate this by the "Nothing to select" indicator.

Each parameter can also be assigned its own units of measure. For example, in the block diagram above, the CANopen inputs are load sensors. They therefore record signals in tonnes [t]. Depending on the application, these could just as well be configured to output values in metres, kilonewtons or degrees. Although the parameter values can be changed at any time by changing to the machine setting input mode (see description below), the units of measure are application-specific. They can therefore only be set in the phase of program implementation.

3.2 External display 0680



An external display uses the built-in navigation keys to select menus and to enter parameter values.

Selecting the service menu

Press the "ESC" key to open the service menu.

Scrolling through the menu

The display can only show 4 lines at a time. If the menu consists of more lines, you can scroll up or down using the corresponding arrow keys.

Making a menu selection

Press the "ENTER" key. The menu then scrolls to the "select" option and a "1" is displayed in the first input field.

You can change this value to that of the menu to be selected by pressing the corresponding arrow keys (up or down).

Press the "ENTER" key to confirm your selection.

If the selected menu is incorrect, press the "ESC" key to return to the previous menu.

Entering a parameter value

Press the "ENTER" key. A "1" is displayed as a default in the first input field.

Change this by pressing the up and down arrow keys on the first digit of the parameter value.

The arrow key to the right moves the cursor to the next input field and a preset "1" is displayed.

Repeat this process with the remaining digits.

The left and right arrow keys can be used to move between the input fields.

Press the "ENTER" key to confirm the input value.

If you do not want to change the parameter value, press the "ESC" key to exit value entry and go to the next parameter or return to the previous menu.

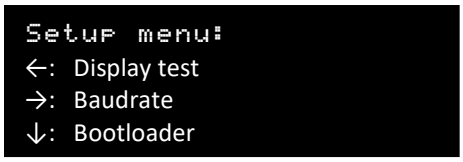
Display set-up

From display software V1.0.2, there is a "Set-up menu" to select the following:

- Display test
- Baud rate selection
- Bootloader mode

Selection of the "Set-up menu" display

Press the "ESC" key and turn on the display.

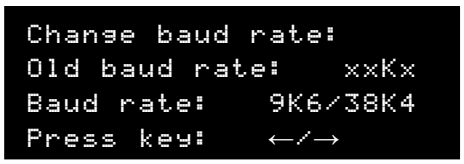


Display test

Press the left arrow key to scroll through the display test routine. The software version is displayed and the display goes through a test cycle.

Baud rate selection (conversion)

Press an arrow key to change the baud rate.



Press the arrow key to the left for 9600bd

Press the arrow key to the right for 38400bd

Note: This option changes the baud rate of the display. To ensure functioning communication with the system, the baud rate of the system must first be switched.

Bootloader

Only for internal application for BROSA.

3.3 4.3 "or 7" external display

The display is addressed via the CAN interface (CAN2). The values are sent to the display via defined COB-IDs and shown according to the programming of the display.

Display example

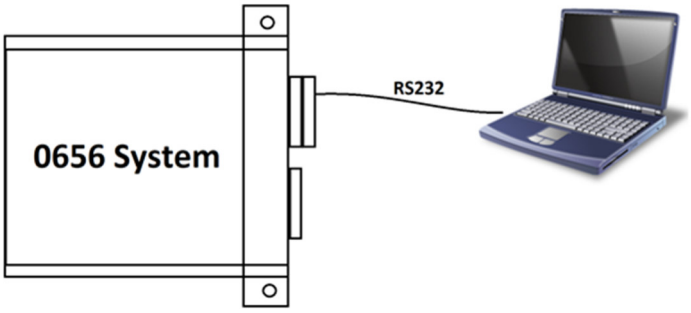
3.4 Computer with PuTTY terminal emulation

Required tools:

- Notebook with RS232 interfaces or USB with corresponding interface cable (USB to RS232)
- Terminal emulation program (e.g. PuTTY in MS Windows)

Connection of a PC to the 0656 electronic system

Connect a serial port of your PC to the 0656, as shown below:



Contacts:

Designation:	Plugs:	Contact:
RS232_TXD_OUT	MODICE30_L	FL3
RS232_RXD_IN	MODICE30_L	GL1

Configuration of the VT100 terminal

Most VT100-capable terminal emulations should be compatible with FlexLim. However, you must make sure that the following parameters are set correctly. (Please refer to the documentation of your emulation program to see which parameters are named and how to set them):

COM port: Set to the port to which the RS232 cable is connected.

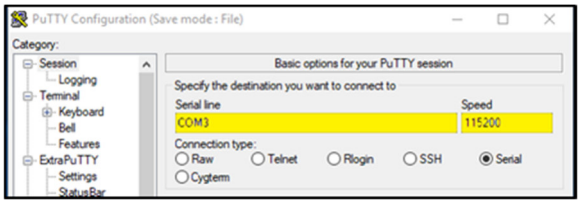
Terminal emulation: You may need to specify this explicitly. If so, specify VT100.

Baud rate: 115200 bps

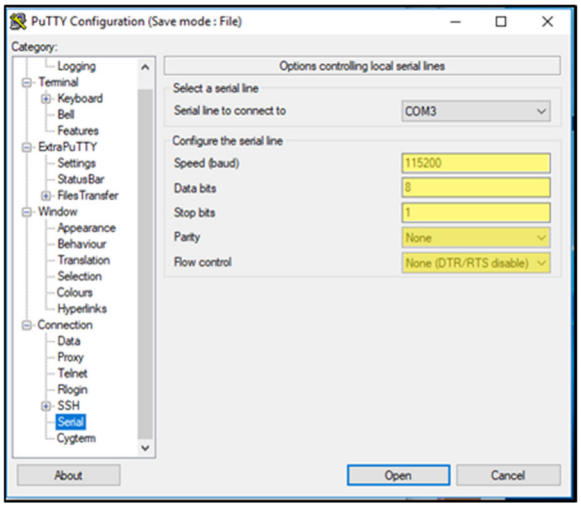
Data bits: 8
Parity: None
Stop bits: 1
Flow control: None

You need a terminal program for configuration. The following examples were created with the free terminal program PuTTY.

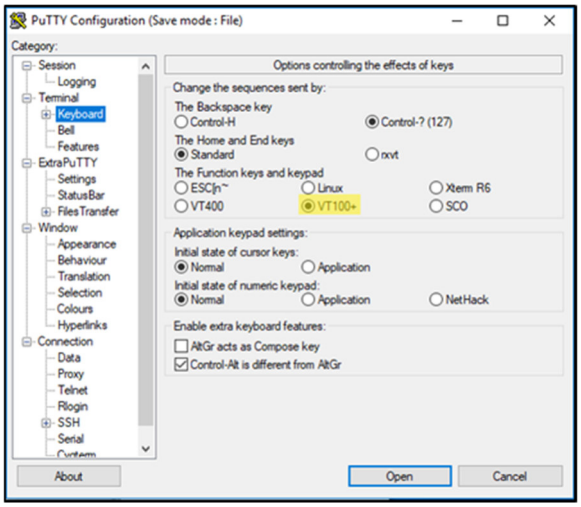
Selection of the connected
COM port



Set as shown



Select VT100 terminal emulation



Selecting the service menu

Press the "ESC" key to open the service menu.

Making a menu selection

Select the desired menu by pressing the corresponding number on the numeric keypad.

Press "ENTER" twice to select the menu corresponding to the input.

If the selected menu is incorrect, press the "ESC" key to return to the previous menu.

Entering a parameter value

Enter the full parameter value on the numeric keypad.

Press the "ENTER" key twice to confirm.

If you do not want to change the parameter value, press the "ESC" key to exit value entry and go to the next parameter or return to the previous menu.

4 General System Information (VT 100)

The following illustrations are based on the display of a terminal program. The illustration may therefore differ from yours.

4.1 Menu structure

Open the service menu as described above (depending on the terminal used). The following menu then appears:

```
1. System
2. Machine set-up
Selection:
```

4.1.1 System

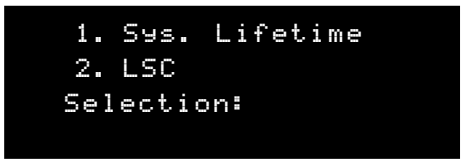
```
1. System information
2. Protocols
3. Service
4. System restart
5. Language
6. Metrics
Selection:
```

4.1.2 System information

```
<ProductName>
<Partno>   : V1.0.0
2014-08-14 : <UserId>
Firmware   :  vX.X.X.X
FW slave   :  vX.X.X
BSCT vers  : vX.X.X
```

Issue of system information as well as the software version numbers and user ID of the application manufacturer.

4.1.3 Protocols

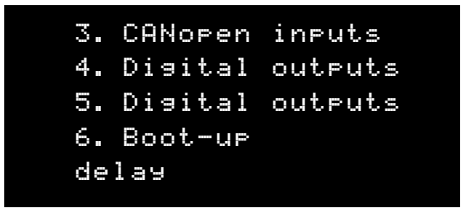


Choice between load spectrum counters and system lifetime

System lifetime

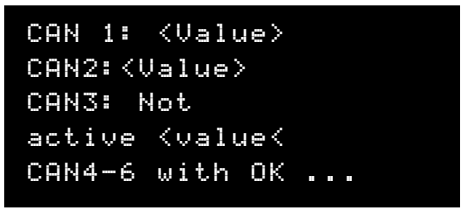
Display of the previous operating time

4.1.4 Service



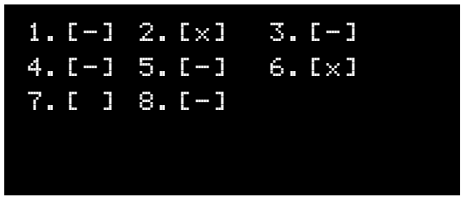
Selection between display of the CANopen and digital inputs as well as the states of the digital outputs. The service display can also be used to switch to bootloader mode.

CANopen inputs:



Displays the current sensor data.

Digital inputs:



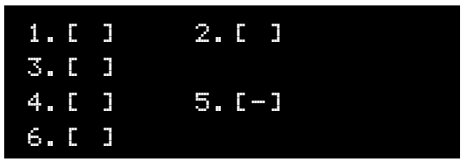
Shows the sensor data displayed on the digital inputs.

[-] Not active

[x] Input high

[ ] Input low

Digital outputs + system error:



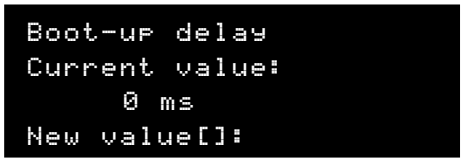
Displays the states of the digital outputs.

[-] Not active

[x] Input high

[ ] Input low

Boot-up delay:



Defines a delayed start of the slave controller.

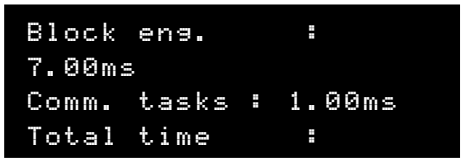
4.1.5 System restart

The system will be reinitialised in 5 seconds (counting back).

4.1.6 Language

Select the desired language.

4.1.7 Metrics



Notes on the performance of the overall system.

5 Parameters for calibration and service applications

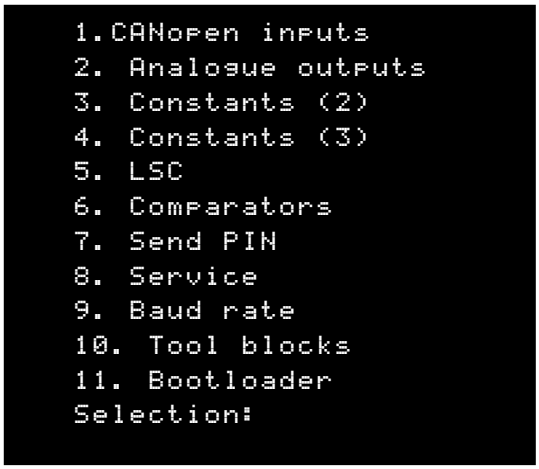
WARNING

Certain menus are protected by a personal identification number. These are safety-critical menus (settings made here have a decisive influence on the safety and functionality of the system!). Access is limited to qualified staff for this reason.

The manufacturer cannot be held responsible for the use and / or careless disclosure of the PIN code. The customer must ensure that the PIN is only issued to authorised specialist staff.

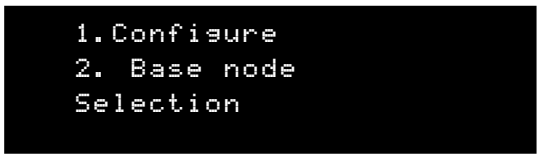
5.1.1 Machine set-up

Enter the PIN number of the system. The following menu will then be displayed.



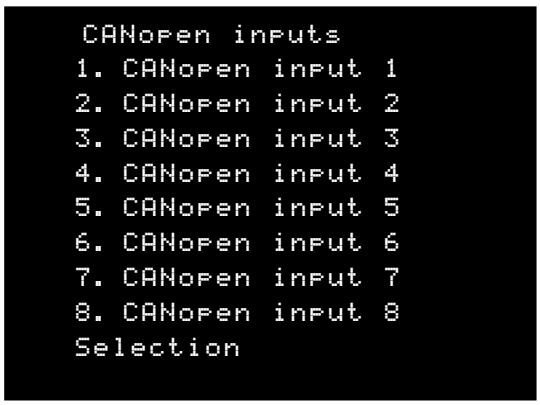
Make your selection

5.1.2 CANopen inputs

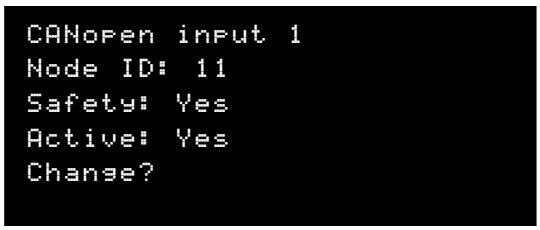


Make your selection

5.1.3 Configuration



Configured CANopen sensors can be selected in this screen. If a sensor is selected, status information is displayed and there is the option of assigning the node a new free node ID.



Selected example sensor:

Node ID: Currently configured node ID

Safety: Yes => The input expects a CANopen safety sensor

No => The input expects a CANopen sensor

Active: Yes => A CANopen sensor with the expected settings was found.

Change? : <ENTER> => New node ID can be selected.

Important: The node ID must be configured and must not be assigned.

For more information on changing the Node ID during servicing, see chapter 5.1.9 Service

```
CANopen input 1
Current ID: 11
Free ID: 12
New ID    :
```

Change example

5.1.4 Analogue outputs

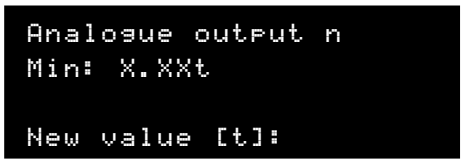
```
Analogue outputs:
   1. Analogue output 1
   2. Analogue output 2
   Selection
```

Select the desired analogue output.

```
Analogue output n
Min: X.Xbar = X.XmA
Max: XX.Xbar = X.XmA
Change?
```

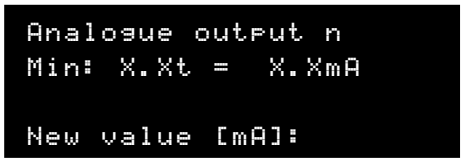
The minimum and maximum signals that the output channel provides are displayed along with the physical values that represent them.

Press "OK" to change. To exit entry and return to the previous menu, press the "ESC" key.

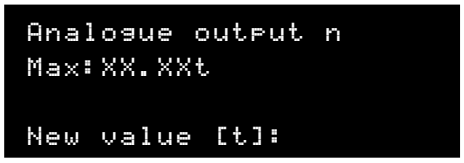


Enter a new value corresponding to the minimum signal in the specified unit of measure (in this case tonnes) and then press "OK" to accept the entry.

You can also press "ESC" to skip the entry. The current value then remains unchanged.

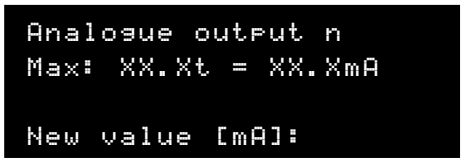


Enter a new signal value and press "OK" to accept the entry or press "ESC" to skip the entry. The set value then remains unchanged.



Enter a new value corresponding to the maximum signal in the specified unit of measure (in this case tonnes) and then press "OK" to accept the entry.

You can also press "ESC" to skip the entry. The current value then remains unchanged.



Enter a new signal value (in this case in mA) and press "OK" to accept the entry or press "ESC" to skip the entry. The set value then remains unchanged.

```
Analogue output n
Min: X.Xbar =  X.XmA
Max:XX.Xbar = XX.XmA
Change?
```

The system returns to the overview. Check that the displayed values are correct and then press "ESC" to return to channel selection (2.2).

Note: The minimum and maximum values for the signal form the absolute limit values for the analogue output.

Example: For an analogue output configured as follows:

```
Min:   2.0t =  4.0mA
Max:  10.0t = 20.0mA
```

No signal greater than 20mA and less than 4mA can be supplied even if the input exceeds 10t or falls below 2t.

5.1.5 Constants (2)

```
Constants (2)
0. Constant (2) 0
1. Constant (2) 1
2. Constant (2) 2
3. Constant (2) 3
4. Constant (2) 4
5. Constant (2) 5
6. Constant (2) 6
9. Constant (2) 9
Selection:
```

Select the constant to be changed. Only the constants that are actually used in the program are offered for selection.

```
Constant (2) 1
Current value: 10.00t
New value [t]:
```

The current value of the constant is displayed. Enter a new value in the specified unit of measure (in this case tonnes) or press "ESC" to leave the value unchanged and return to the previous menu.

5.1.6 Constants

The same procedure applies here as for "Constants (2)" (2.3).

5.1.7 Comparators

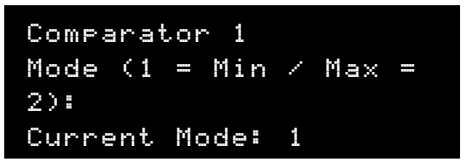
A comparator compares two values and triggers an event (usually a relay) if the first value is greater than (mode = max) or less than (mode = min) the second value. The system manual contains a list of comparators with the associated inputs and the events that trigger them. Since a comparator is usually assigned to each relay, they generally have the same index number (comparator 3, for example, would trigger relay 3). The comparator first triggers as soon as its limit value is exceeded, but returns to the previous state only when the first limit value exceeds the limit value plus the hysteresis percentage.

```
Comparators
1. Comparator 1
2. Comparator 2
3. Comparator 3
6. Comparator 6
7. Comparator 7
11. Comparator 11
12. Comparator 12
Selection:
```

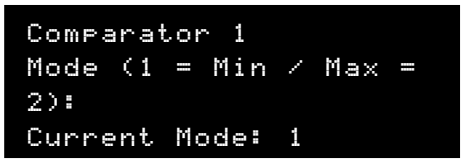
Select the comparator to be changed

```
Comparator 1
Mode (1 = Min / Max =
2): Current mode: 1
Hysteresis: 10.0%
Change?
```

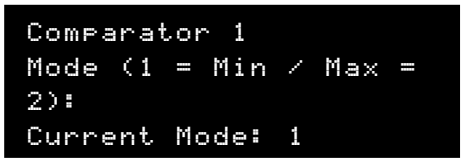
Press "OK" to change. To exit entry and return to the previous menu, press the "ESC" key.



Enter the new "Min" or "Max" comparator mode (1 or 2) or press "ESC" to leave the mode unchanged and go to the next menu.



Enter the new hysteresis in percent or press "ESC" to leave the value unchanged and return to the comparator overview.



The system displays the new comparator parameters. Check that the entry is correct and then press "ESC" to return to the comparator selection menu (2.7).

5.1.8 Changing the PIN

The personal identification number for the system can be changed here. Please note that this PIN is essential for accessing the system settings. The user is responsible for ensuring that the number is neither lost nor gets into unauthorised hands.

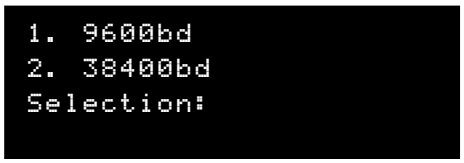
Enter the new number or leave the old PIN unchanged by pressing the "ESC" key and return to the previous menu.

5.1.9 Service

See the "Service" section.

5.1.10 Baud rate

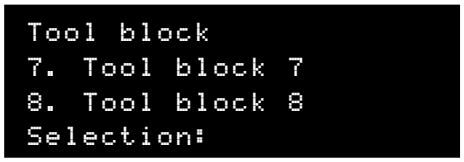
If there are problems communicating with the external display via the RS 485 interface, the baud rate can be adjusted.



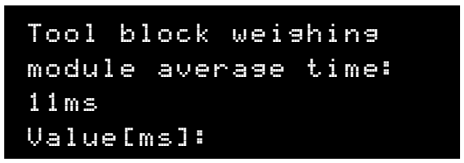
Select the desired baud rate.

Comment: This option only changes the baud rate of the system. To ensure proper communication between the system and the external display, the baud rate of the external display must also be switched.

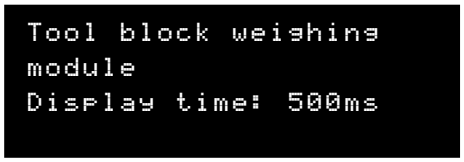
5.1.11 Tool block



Selection of the tool block to be edited

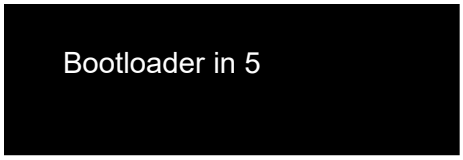


Enter a new average. Transfer the previous value by pressing "ESC".



Enter a new display time. Transfer the previous value by pressing "ESC".

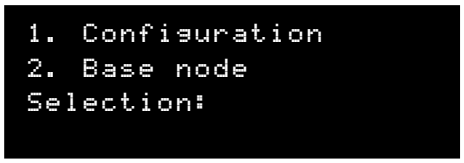
5.1.12 Bootloader



The system will enter Bootloader mode in 5 seconds (counting down). As soon as the system is in Bootloader mode, an exclamation mark is sent.

5.1.13 Integration of new sensors during replacement

If a defect occurs on a CANopen sensor, it is possible to replace it and integrate the sensor via the "Base node" menu item in the service menu.

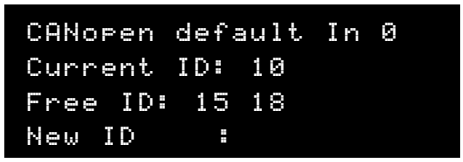


Depending on the system configuration, the sensors are named ID 11-18.

The base node is defined with node ID 10. The spare sensor supplied by BROSA must also be preconfigured with node ID 10 so that it can be configured to the node ID to be replaced via the controller.

The display shows the node IDs which are currently not used. If you change several sensors in a system, the system administrator must know which sensor he/she has just replaced. Please note that only one sensor with node ID 10

may be in the network. It is therefore advisable to connect the sensors individually and to repeat the step if necessary. The desired node ID can now be set in the "New ID" line. However, only the IDs listed as "Free ID" are allowed.

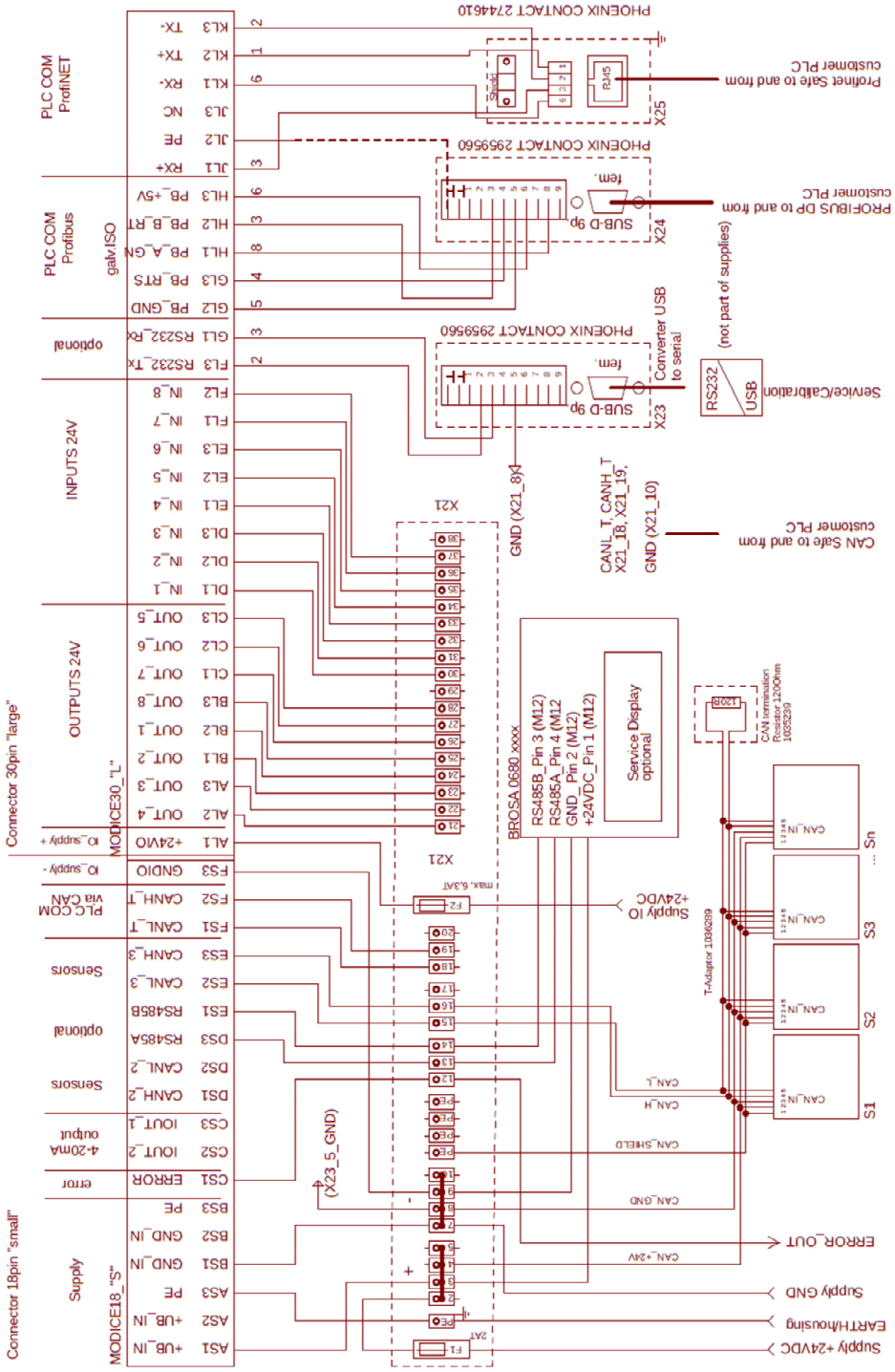


DANGER

It is imperative to ensure that the replaced sensor receives the correct node ID.

6 Technical data of 0656 electronic system

Designation	System electronics type 0656
Supply voltage	24V DC (10…30V DC)
Analogue outputs	2x 4…20mA
Digital inputs	8 x 24V
Digital outputs	8 x switching capacity typ. 24V/ 500 mA
Interfaces	PROFIBUS (PROFIsafe) slave PROFINET (PROFIsafe) slave CANopen (safety) slave Bluetooth RS 485 RS 232
Housing	Cinch MODICE SE
Dimensions:	134.6 x 153.2 x 52.2 (LxWxH) in mm
Electrical connection	Plug with crimps (0.5 mm²)
Protection class	IP67, IP69K
Operating temperature	-40°C to +80°C
Short circuit protection	Yes
Pol	Yes
EMC	CISPR 25 / EN 55025 DIN ISO 11452-4 DIN ISO 11452-5 DIN ISO 11452-2 EN 61000-4-2 EN 61000-4-4
Figure	



Wiring example

7 List of error codes and troubleshooting

If a critical error occurs, the system is locked and displays a corresponding error code on the display (internal, external or PC).

Note: Depending on the configuration, a critical error in the system may cause the communication between higher-level systems and the 0656 electronic system to be interrupted.

The following sections provide a list of error codes with possible causes and remedies.

7.1 CANopen input

Error code E 11X (where X is the configured CANopen input)

Example 1: E 111: Configured CANopen input 1.

Example 2: E 117: Configured CANopen input 7.

Error	Missing heartbeat message.
Possible causes	1. Cable between sensor and electronics is damaged or there is a ground fault. 2. Electrical faults on the CANopen line. 3. Water in one of the distribution boxes or connections. 4. Damage to the sensor itself. 5. The electronics platform (0656) is damaged.
Possible remedy	1. Check the cables and connections. Replace if necessary. 2. Sensor replacement. 3. Exchange of electronics.

Error code E 12X (where X is the configured CANopen input)

Error	An SRDO communication (CANopen Safety) error has occurred.
Possible causes	1. Cable between sensor and electronics is damaged or not connected. 2. Electrical faults on the CANopen line. 3. Damage to the sensor itself. 4. The electronics platform (0656) is damaged.
Possible remedy	1. Check the cables and connections. Replace if necessary. 2. Sensor replacement. 3. Exchange of electronics.

Error code E 13X (where X is the configured CANopen input)

Error	CANopen sensor reports a detected error with the help of an emergency message.
Possible causes	1. See CANopen sensor error table.
Possible remedy	1. Check the sensor. 2. Sensor replacement.

Error code E 15X (where X is the configured CANopen input)

Error	Error of the CANopen stack
Possible causes	1. The limit values are too narrow. 2. Damage to the sensor itself.
Possible remedy	1. Correction of the "lower limit" for the sensor in the corresponding input menu. 2. Sensor replacement.

7.2 2D curve

Error code E C1X (where X is the channel of the 2D curve)

Error	The input value is outside the 2D curve.
Possible causes	1. The values of the 2D curve are too narrow. 2. Incorrect value of the input block obtained.
Possible remedy	1. Correction of the "table values" for the input value. 2. Check the value of the input block.

7.3 Multifunctional block (weighing)

Error code E 191 (where X is the channel of the multifunction block)

Error	If the value from the SNR curve is undershot, this error is set when the SNR test is activated.
Possible causes	1. SNR value less than the default value of the curve.
Possible remedy	2. SNR value less than the default value of the curve.

7.4 System errors

Error code E XAX (where only A is relevant)

Error	EEPROM contains incorrect data
Possible causes	1. Defective parameter values (EEPROM) 2. Power failure during calibration
Possible remedy	1. Reload program from BSCT.

Change history

Version	Date	Changes	Name
1.0	04.06.05	Temporary edition	TS
1.1	14.07.05	Content corrected / extended	JO / WZ
1.2	09.02.06	Logos, company name adapted	JO
1.3	31.05.07	Modification according to FlexLim V2.5.1	TS
2.2	15.08.14	Extensions for FlexLim (Safe)	WZ / RS
2.3	05.07.19	Changeover to 0656	FG / Wz