

Operating instruction booklet

- Translation of the original instruction -

Sequence controller

AST11-1
AST11-1-S
AST11-2
AST11-2-S

390041 A
390041 B
390042 A
390042 B



NOTICE ALL DOCUMENTATIONS !

Before beginning work **this operating instruction booklet and the enclosed safety instructions** (no. 016000, pink-colored booklet) have to be read through carefully. Always follow the instructions during operation. Give this operating instruction booklet and the appropriate safety instructions to the operator.

Contents

1	DEFINITION OF SIGNAL WORDS AND SYMBOLS	8
2	SAFETY INSTRUCTIONS	9
3	INTENDED USE.....	9
4	SCOPE OF DELIVERY	10
5	SHORT DESCRIPTION	10
6	HARDWARE DESCRIPTION	11
6.1	Views of the AST11	11
6.1.1	Front Panel.....	11
6.1.2	Rear View.....	12
6.1.3	Connection panel	13
6.2	Interface Description	14
6.2.1	Fuse	14
6.2.2	Voltage Supply	14
6.2.3	Ethernet.....	14
6.2.4	Screwdriver	14
6.2.5	I/O Interface.....	14
6.2.6	Multifunctional Serial Interface	15
6.2.7	Feeder Port	16
6.2.8	Emergency-Stop 2 Channel	16
6.2.9	F-Controller Port.....	17
7	COMMISSIONING	18
7.1	Dimension Sheet.....	18
7.2	Assembly Instructions	19
7.3	Example for screwdriving systems	22
7.4	Minimum bending Radius of Screwdriver Cable	23
7.5	Information on programming the Sequence Controller	23
7.6	Functioning of the Sequence Controller AST11	23
7.6.1	Operation as Stand-Alone unit with a handheld Screwdriver	23
7.6.2	Operation with a higher level controller	23
7.6.2.1	Operation with a handheld Screwdriver	23
7.6.2.2	Operation with a stationary Screwdriver.....	24
7.6.2.3	Selection and Start of a Screwdriving Program via I/O interface	24
7.6.2.4	Standard Communication higher level controller – AST11.....	24
7.6.2.5	Standard Communication higher level controller – Emergency Stop 2 Channel.....	25
7.6.3	Connection on a master controller via the Fieldbus (optional)	26
7.6.3.1	Profibus DP / Profinet.....	26
7.6.3.2	General Information.....	26
7.7	Connection on a master controller via the Fieldbus (optional)	27
7.7.1	Profibus DP / Profinet.....	27
7.7.1.1	General Information.....	27
7.7.1.2	Hardware configuration	27
7.7.1.3	Software	28
8	INSTRUCTIONS FOR THE SEQUENCE CONTROLLER	36
8.1	General.....	36
8.2	Operating Elements.....	36
8.2.1	Functional Display (LEDs).....	36
8.2.2	Keypad Layout	37
8.2.2.1	Function Keys.....	37
8.2.2.2	Numerical Keypad and ESC-key.....	37
8.2.2.3	Menu and Cursor Keys.....	37
8.2.3	Menu Structure.....	38
8.2.4	Menu Functions.....	39
8.2.5	Description of the Menus.....	39
8.2.5.1	Menu System Info	39

8.2.5.2	Menu Process Data.....	39
8.2.5.3	Menu Setup.....	40
8.2.5.4	Menu Screwdriving Sequence.....	45
8.2.5.5	Menu Test	46
8.3	Operation via the web interface.....	50
8.3.1	Requirements	50
8.3.1.1	Hardware.....	50
8.3.1.2	Software	50
8.3.1.3	Connection to the sequence controller AST11	50
8.3.2	Preparing to use the web interface.....	50
8.3.2.1	Setting the sequence controller AST11	50
8.3.2.2	Setting the browsers/operating systems	50
8.3.3	Menu Structure.....	51
8.3.4	Description of the menu	52
8.3.4.1	Start.....	52
8.3.4.2	System Info → Tool Data.....	53
8.3.4.3	System Info → System Data.....	54
8.3.4.4	Process Data → Screwdriving Sequences	55
8.3.4.5	Process Data → Statistics	56
8.3.4.6	Process Data → Graphic.....	57
8.3.4.7	Process Data → Final Values.....	58
8.3.4.8	Setup → General Settings	59
8.3.4.9	Setup → Time.....	60
8.3.4.10	Setup → F-Control.....	60
8.3.4.11	Setup → Password.....	60
8.3.4.12	Setup → Serial Device.....	61
8.3.4.13	Setup → Extensions	64
8.3.4.14	Screwdriving sequence	64
8.3.4.15	Tools → Manuals.....	68
8.3.4.16	Tools → Additional Programs	68
8.3.4.17	Tools → Fieldbus.....	69
8.3.4.18	Tools → Update.....	69
9	F-FUNCTION	70
9.1	General.....	70
9.2	Functionality	70
9.2.1	General.....	70
9.2.2	Operation with supervision of number of screw-joints per part	71
9.2.3	Operation without the supervision of number of screw-joints per part	71
9.3	Menu Functions for the F-Function	72
9.3.1	Settings	72
9.3.1.1	Activate.....	72
9.3.1.2	Reset Button.....	72
9.3.1.3	Part Clearance	72
9.3.1.4	Programs.....	72
9.3.2	Diagnostic Functions	73
9.4	Interfaces.....	73
10	SETTINGS	74
10.1	Description of the adjustable parameters.....	74
10.1.1	Parameters of the System Settings.....	74
10.1.2	Special parameters for fieldbus systems (optional).....	76
10.1.2.1	Profibus	76
10.1.2.2	Profinet.....	76
10.1.2.3	Ethernet IP	76
10.1.2.4	Ethercat.....	76
10.2	Default Values	77
10.2.1	System Settings	77
10.2.2	Special parameters for fieldbus systems (optional).....	77
11	SCREWDRIVING STRATEGIES AND COMMANDS.....	79

11.1	Screwdriving Strategies.....	79
11.1.1	Fasten / Loosen to Torque	79
11.1.2	Extended Fasten to Torque.....	80
11.1.3	Fasten / Loosen to Angle	81
11.1.4	Fasten / Loosen to external Stop-Signal	83
11.1.5	Friction value package (optional)	84
11.1.5.1	Friction value measurement.....	84
11.1.5.2	Fasten to differential torque.....	85
11.1.5.3	Fasten dependent on friction value	87
11.2	Commands	90
11.2.1	Display values	90
11.2.2	Save values.....	90
11.2.3	Statistic.....	90
11.2.4	Print.....	90
11.2.5	Waiting time.....	90
11.2.6	Hold position.....	90
11.2.7	Wait for input	91
11.2.8	Set output.....	91
11.2.9	Reset output.....	91
12	DOCUMENTATION	92
12.1	Final values	92
12.2	Curve Representation	93
12.3	Statistic.....	94
12.4	Print output.....	94
13	MAINTENANCE AND SERVICING	97
13.1	Updating the software	98
13.1.1	Main control and touch display.....	98
13.1.2	Power element	98
13.2	Replace the filter mat of the sequence controller	98
13.3	Spare parts.....	100
14	ERROR DISPLAY AND TROUBLESHOOTING	101
14.1	System error.....	101
14.1.1	MINIMAT–EC-Servo Screwdriver.....	101
14.1.2	Power unit	101
14.1.3	Main controller.....	102
14.1.4	Communication	103
14.2	Error in the screwing sequence.....	103
15	TROUBLE SHOOTING.....	105
16	REQUIRED ACCESSORIES	106
16.1	Power Cable.....	106
17	OPTIONAL EQUIPMENT	106
17.1	Motor Cable for MICROMAT®-E.....	106
17.2	Extension for MICROMAT-E Motor Cable.....	106
17.3	Plug	106
17.4	Fieldbus modules	107
17.4.1	Profibus	107
17.4.2	Profinet.....	107
17.4.3	EtherCAT.....	107
17.4.4	EtherNet/IP	107
17.5	Toolbox.....	108
17.6	Standfuß.....	108
17.7	Barcode scanners	108
17.8	Printer connector.....	108
17.9	Hardware-Module.....	108
17.10	Optional software packages.....	110
17.10.1	Friction value software package.....	110
17.10.2	GRAPH10 – Superimposed graph display	111

17.10.3	DataLogger.....	112
17.10.4	TC30-PC Statistics	113
17.10.5	DEPRAG ASTxx Serial Remote	114
18	TECHNICAL DATA.....	115
19	GLOSSARY	116
20	EG-CONFORMITY DECLARATION.....	120
21	SERVICE LOCATIONS AND AUTHORIZED PARTNERS	121

List of figures

Figure 1:	Front view AST11	11
Figure 2:	Rear view	12
Figure 3:	Connection panel AST11-1	13
Figure 4:	Connection of feeder port.....	16
Figure 5:	Dimension sheet.....	18
Figure 6:	Screwdriving system	22
Figure 7:	Burst	25
Figure 8:	Burst	26
Figure 9:	Hardware configuration of Profibus DP	27
Figure 10:	Hardware configuration of Profinet	28
Figure 11:	Operating Elements.....	36
Figure 12:	Menu structure at the display	38
Figure 13:	Menu Structure Web interface.....	51
Figure 14:	The home page	52
Figure 15:	Start page.....	52
Figure 16:	Tool data	53
Figure 17:	System data	54
Figure 18:	System data, lower part of the page.....	55
Figure 19:	Screwdriving program	56
Figure 20:	Screwdriving program with displayed parameter values	56
Figure 21:	Statistics	57
Figure 22:	Downloading curve data	57
Figure 23:	Screwdriver results	58
Figure 24:	General settings	59
Figure 25:	General settings - lower part of the page	59
Figure 26:	Date / Time	60
Figure 27:	Setup F-Control	60
Figure 28:	Change password	60
Figure 29:	Printer settings	61
Figure 30:	Selection of fieldbus	61
Figure 31:	Settings for fieldbus, EtherCAT example.....	62
Figure 32:	Settings for fieldbus, EtherNet/IP example.....	62
Figure 33:	Settings for fieldbus, Profibus example	62
Figure 34:	Settings for fieldbus, ProfiNet example	62
Figure 35:	Settings for Program selection via barcode.....	63
Figure 36:	Activating options	64
Figure 37:	Screwdriving sequence – empty program	65
Figure 38:	Screwdriving sequence	66
Figure 39:	Manuals	68
Figure 40:	Additional programs	68
Figure 41:	Fieldbus	69
Figure 42:	Update	69
Figure 43:	Screwdriving Application to torque	79
Figure 44:	Expanded screwdriving to Torque	80
Figure 45:	Screwdriving to Angle.....	81
Figure 46:	Loosening on Angle.....	82
Figure 47:	Fasten / Loosen to external Stop-Signal	83
Figure 48:	Friction value measurement	84
Figure 49:	Screwing on differential torque	85
Figure 50:	Screwing applications depending on friction	87
Figure 51:	Power unit on the rear housing wall	99
Figure 52:	Filter mat on the housing rear wall	99
Figure 53:	Fieldbus module, power supply and connection cable	107
Figure 54:	GRAPH10E	111
Figure 55:	DataLogger.....	112
Figure 56:	TC30-PC Statistics	113
Figure 57:	DEPRAG ASTxx Serial Remote	114

List of tables

Table 1:	Pin assignment I/O interface	14
Table 2:	Pin assignment multifunctional serial interface	15
Table 3:	Pin assignment feeder port	16
Table 4:	Pin assignment emergency-stop 2 channel	17
Table 5:	Pin assignment F-controller.....	17
Table 6:	Program choice	24
Table 7:	Modules and UDT's for the control	28
Table 8:	Directory of the modules	29
Table 9:	Description - Interface parameters (FB15)	29
Table 10:	Description – Data structure of the control signals (UDT51)	30
Table 11:	Description – Data structure of the status signals (UDT52)	31
Table 12:	Description – Error Codes	32
Table 13:	Description – Data structure of the screw data (UDT33).....	34
Table 14:	LEDs.....	36
Table 15:	Menu and Cursor Keys.....	37
Table 16:	Errors of F-function.....	71
Table 17:	Adjustable parameters	76
Table 18:	Configurable Profibus parameters.....	76
Table 19:	Configurable Profinet parameters	76
Table 20:	Configurable Ethernet IP parameters.....	76
Table 21:	Default Values	77
Table 22:	Default values for Profibus	77
Table 23:	Default values for Profinet	77
Table 24:	Default values for Ethernet IP	78
Table 25:	Structure of the data set.....	92
Table 26:	Print parameters.....	95
Table 27:	System error MINIMAT–EC-Servo screwdriver.....	101
Table 28:	System error - power unit.....	102
Table 29:	System error - Master control unit.....	102
Table 30:	System error – Communication	103
Table 31:	Fault in the screwing sequence	104
Table 32:	Troubleshooting.....	105
Table 33:	Technical Data	115

1 Definition of signal words and symbols

The signal words and symbols used in the technical documentation (safety instructions, operating instruction booklet, etc.) have the following meaning:



DANGER

Indicates an **immediate danger** which causes serious injuries or even death if not avoided.



WARNING

Indicates a **threatening danger** which can cause serious injuries or even death if not avoided.



CAUTION

Indicates a **danger or unsafe procedure** which can cause injuries to a person or material damages if not avoided.



NOTICE

Indicates a **potentially dangerous situation** which can cause damage to the product or its surroundings if not avoided.



IMPORTANT

Indicates tips and other useful information.

In each case the symbol used does not replace the safety text. The text must always be read fully. In some cases other symbols will be used with the signal words.

2 Safety instructions

Reading the enclosed safety instruction booklet no. 016000 (pink-coloured booklet) is essential for working with the equipment.



WARNING

Fires, electric shocks and other injuries, or damages to components can be caused if the safety guidelines are ignored.



WARNING

Risk of fatal injury due to electrocution!

Disconnect the electric equipment from the power supply before starting any work on the tool (e.g. installation, changing of accessories or machine tools, removal of covers prior to longer downtimes, maintenance works, etc.).

Switch off the mains switch and pull out the mains plug!

3 Intended use

The sequence controller AST11 is designed exclusively for fittings in industrial use. And must only be operated with DEPRAG MICROMAT–EC screwdrivers and DEPRAG MINIMAT–EC screwdrivers (stationary and handheld) of the series 320Exx19, 320Exx22, 320Exx27 and 320Exx36.

The system is especially suitable for application requiring the highest demand of quality, flexibility and documentation.

Use beyond its intended use is considered unauthorized and therefore improper. Furthermore, DEPRAG is not liable for damage resulting from the misuse of the instrument; the user alone is liable.

The correct use of the instrument includes compliance with all operating, maintenance and repair instructions.



IMPORTANT

Please contact your DEPRAG Representative, our international service centers or contact DEPRAG SCHULZ GMBH u. CO. directly if you have any questions.

4 Scope of Delivery

Check that the shipment is complete and that there have been no damages in transit.

Quantity	Designation	Part no.
1	AST11-1 Sequence controller	390041 A
	AST11-1-S Sequence controller	390041 B
	AST11-2 Sequence controller	390042 A
	AST11-2-S Sequence controller	390042 B
1	Patch cable (AST11 to PC connecting cable)	831902
1	Plug (Interface GX6)	385476 A
1	Quick-Start instructions for the Operation of...	014090xx
1	Safety Instruction	016000

5 Short Description

The sequence controller AST11 is a sequence controller with integrated performance electronics to operate DEPRAG MICROMAT-EC screwdriver or MINIMAT-EC screwdrivers (stationary and handheld).

The AST11-1/-S can be operated with screwdrivers of the series 320Exx19 and 320Exx22 and 320Exx27.

The AST11-2/-S can be operated with screwdrivers of the series 320Exx36.

The sequence controller already includes standard screwdriving programs for tightening to torque and loosening to angle. Parameters can be directly altered to suit screwdriving tasks using the sequence controller's keypad. The AST11 allows free programming of your screwdriving sequences for hand-held or stationary screwdriving tools. If required, further screwdriving programs can quickly and easily be set-up using the already existing basic program.

Fast access to the 16 programmable screwdriving programs is enabled by the integrated display- and operating unit.

To set parameters and access additional control functions, simply use any common web browser or the integrated key pad. Additional software is not required. The web interface and the display are available in several languages to select from.

Several communication options, especially for stationary use, enable connection via ethernet, fieldbus, PLC input-outputs and RS232.

The AST11 displays the screwdriving results of the last 7 production days. The screwing applications can be analyzed and evaluated using the statistic and curve representations.

Extensive diagnostics possibilities help detect possible faults in the screw driving sequence, at the screwdriver or at the sequence controller.

Combination with an automated DEPRAG screw feeder is also possible.

6 Hardware Description

6.1 Views of the AST11

6.1.1 Front Panel

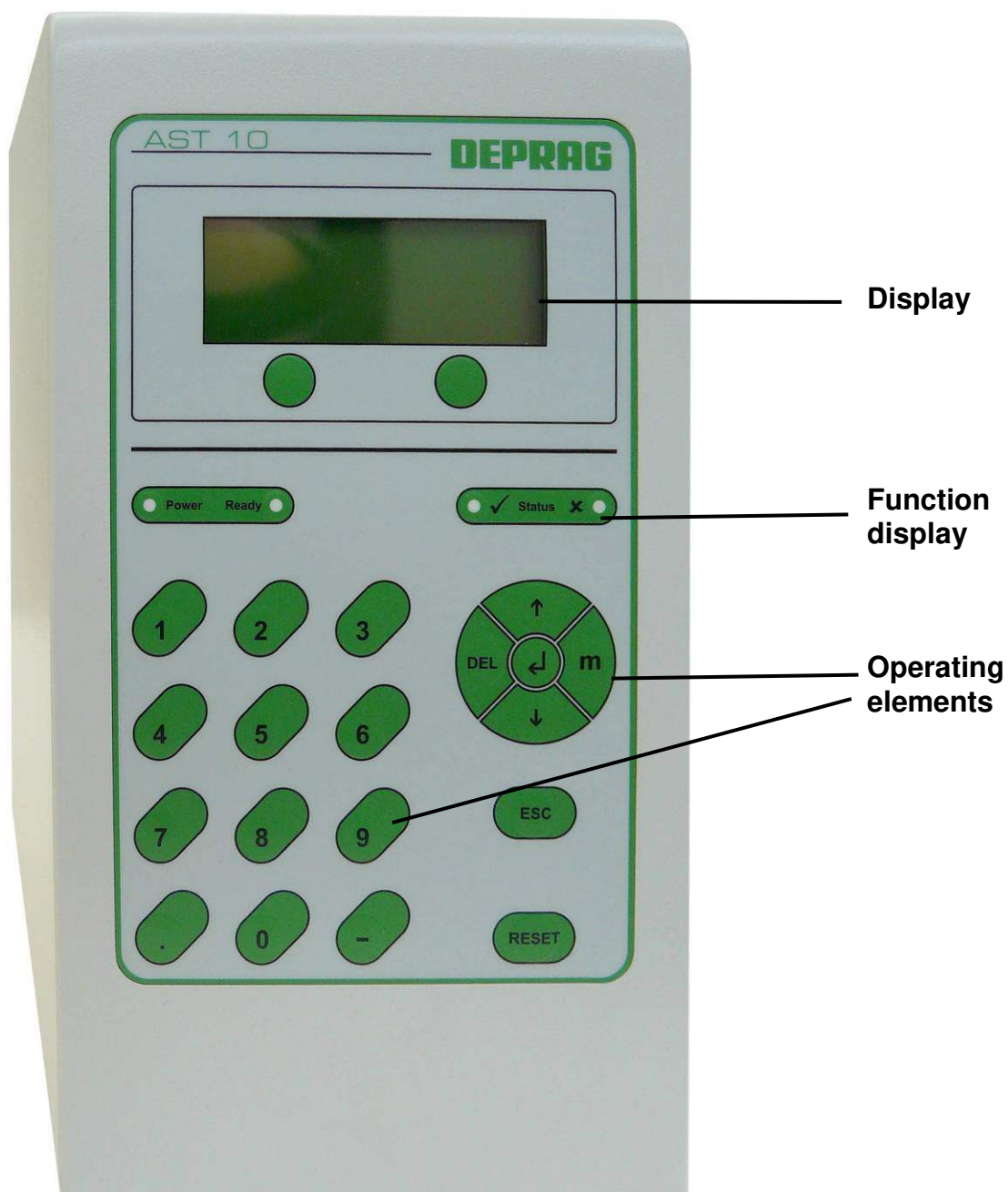


Figure 1: Front view AST11

6.1.2 Rear View

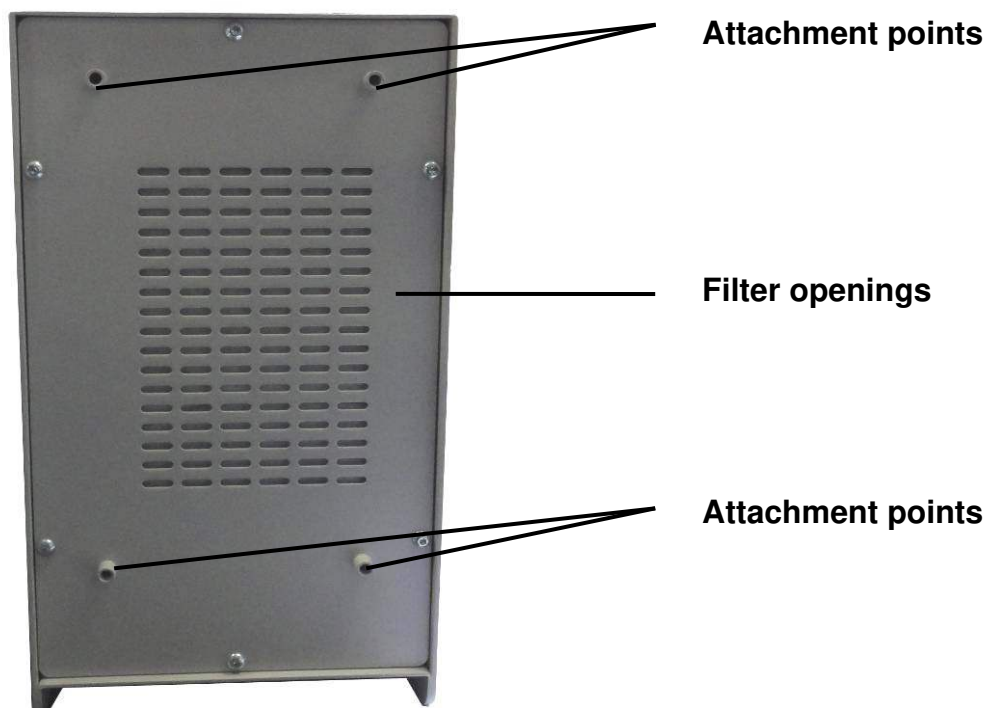


Figure 2: Rear view

To ensure the air exchange, the filter openings must not be covered up.
The inside filter can be replaced.

6.1.3 Connection panel

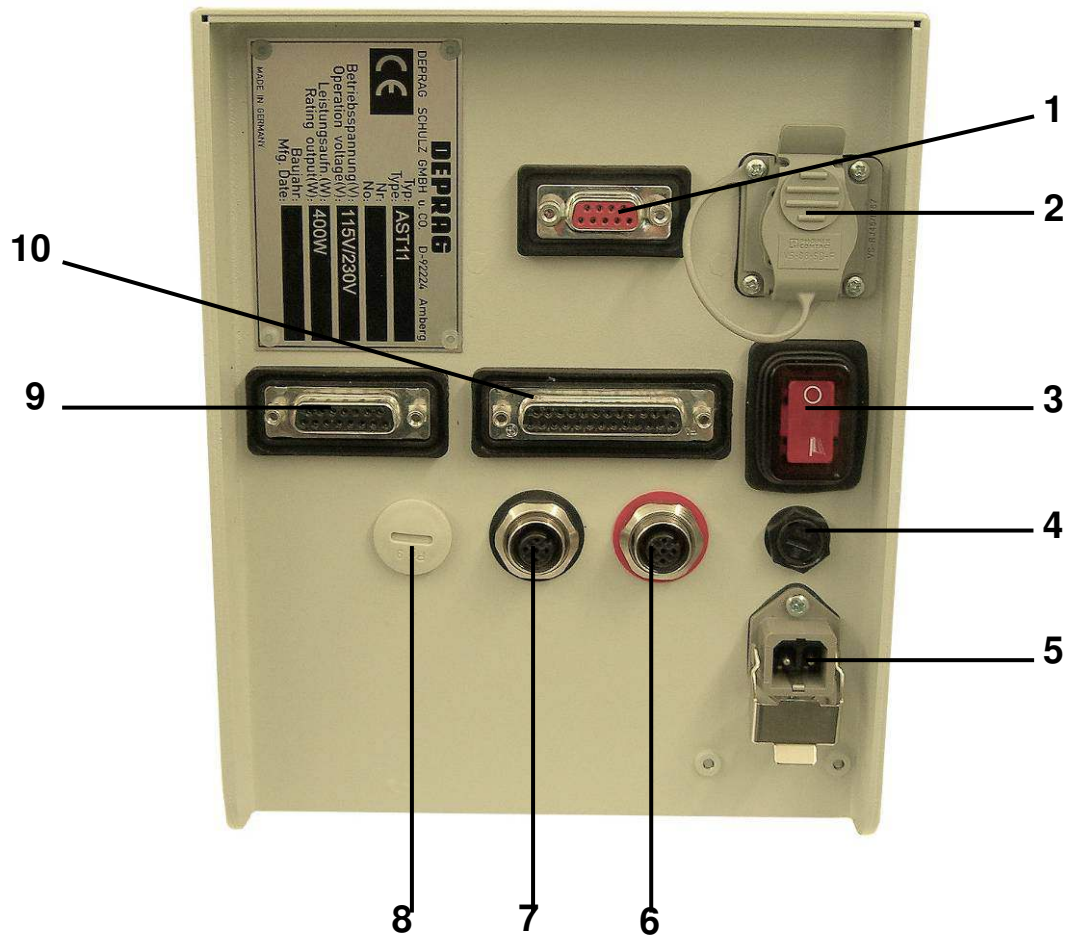


Figure 3: Connection panel AST11-1

- 1 multifunctional serial interface GX10 for connection of:
printer
barcode scanner or
fieldbus
- 2 ethernet GX9
- 3 main switch
- 4 fuse
- 5 voltage supply GX2
- 6 F-Controller port GX7
- 7 feeder port GX8
- 8 emergency stop port GX11 (not shown, only by type AST11-1-S and AST11-2-S)
- 9 screwdriver port GX1
- 10 I/O interface GX6

6.2 Interface Description

6.2.1 Fuse

Description: Main Fuse

Size: 2 A

Type: M2/250E, 20x5 mm Glasrohr

6.2.2 Voltage Supply

Description: GX2

Connector: Hirschmann STASEI 200

Voltage: 230/115 V, 50/60 Hz

6.2.3 Ethernet

Description: GX9

Connector: female connector RJ45

6.2.4 Screwdriver

Description: GX1

Connector: SUB-D 15-pole (socket)

6.2.5 I/O Interface

Description: GX6

Connector: SUB-D 25-pole (socket)

Pin	Description	Used for:
1	Input 1	Start
2	Input 2	--
3	Input 3	Program Selection
4	Input 4	Program Selection
5	Input 5	Program Selection
6	Input 6	Program Selection
7	Input 7	Reload
8	Input 8	Start Release
9	Input 9	External Stop
10	Input 11	Reset Error
11	Input 12	Release Part
12	Output 1	System O.K.
13	Output 2	Screw Joint O.K.

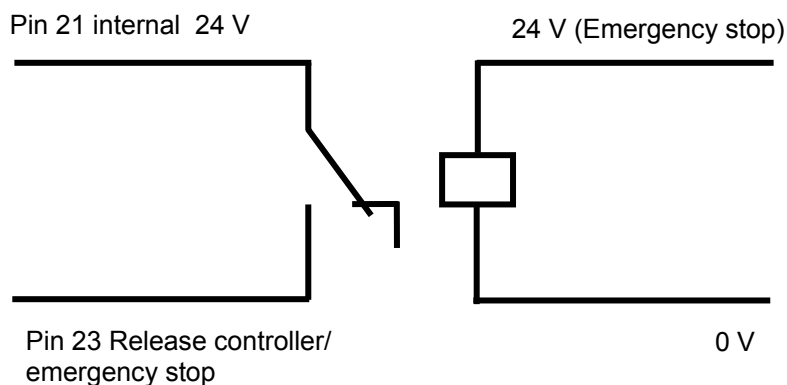
Pin	Description	Used for:
14	Output 3	Screw Joint NOT O.K.
15	Output 4	ready
16	Output 7	Change Part
17	Output 8	--
18	Input	GND external
19	Input	24 V external
20	Output	GND internal
21	Output	24 V internal
22	--	--
23	Input	Release controller / emergency stop
24	Input	n.c.
25	--	--

Table 1: Pin assignment I/O interface

To use the I/O-ports the integrated I/O module of the AST11 has to be supplied with 24 V DC. For this the following variants are permissible:

- Supply of the I/O module externally by pins 18 and 19
- Supply of the I/O module by the internal 24V of the AST11. To do this a contact has to be built between pins 20 and 18, and between pins 21 and 19, respectively.

As a precondition to start a screwdriving program a 24 V signal has to be provided at input 'Release controller / emergency stop'. For this signal the internal voltage of the AST11 has to be used. This can be done by a direct contact or by a relay controlled e. g. by a PLC (pin 21 to pin 23, see drawing).



If a relay is used, when the sequence controller is switched on the signal 'Release controller / emergency stop' must have a delay of at least 1 second after switching on the 115/230V supply. When an emergency-Stop has been activated, the signal has to be activated with a delay of at least 4 seconds.

When using hardware-module 385521 A (Safe torque off, see [17.9 Hardware-Module](#)), the internal voltage of the AST11 has to be provided permanently at input 'Release controller / emergency stop' (contact pins 21 and 23).

6.2.6 Multifunctional Serial Interface

Description: GX10

Connector: SUB-D 9-pole (socket)

This interface can be used in conjunction with a printer as a serial printer interface, in combination with an external fieldbus module as a fieldbus interface or in combination with a barcode scanner.

Pin	Description
1	--
2	TX
3	RX
4	--
5	GND
6	--
7	--
8	--
9	--

Table 2: Pin assignment multifunctional serial interface

Port adjustment when used as printer port:

- 9600 – 115200 baud selectable
- 8 data bits
- 1 stop bit
- no parity
- no protocol

Port adjustment when used with barcode scanner:

- 9600 – 115200 baud selectable
- 5 – 8 data bits selectable
- 1 – 21 stop bits selectable
- parity selectable
- no protocol

6.2.7 Feeder Port

Description: GX8

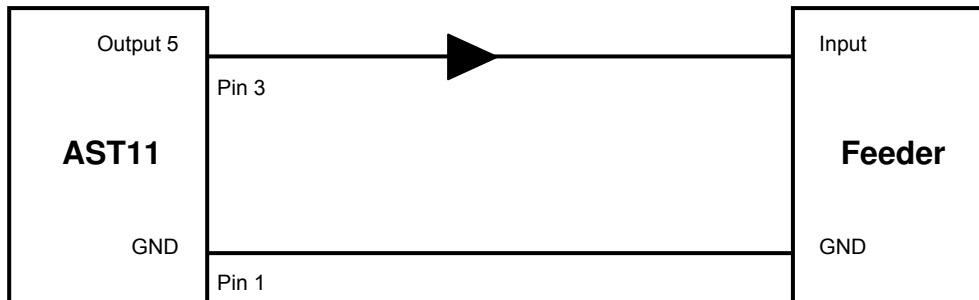
Connector: Binder Round-Connector Series 763, M12-4pole

Color: black

Pin	Description	Used for:
1	Output	GND
2	Output	24 V
3	Output 5	Reload
4	--	

Table 3: Pin assignment feeder port

Potential connected:



Potential free:

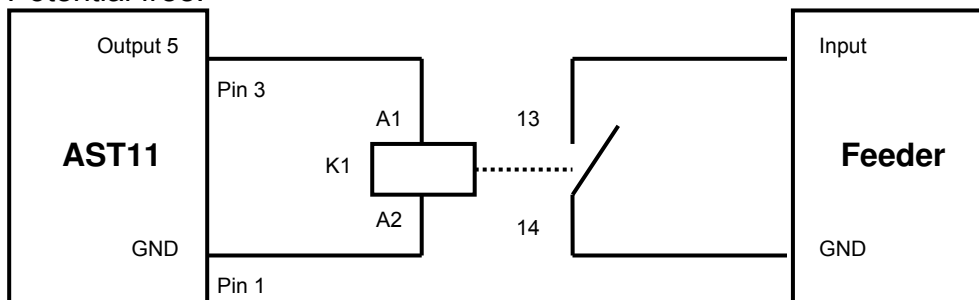


Figure 4: Connection of feeder port

6.2.8 Emergency-Stop 2 Channel

The emergency stop 2 channel module is integrated as standard in the types 390041 B and 390042 B. The AST11 types 390041 A and 390042 A can be converted to include this module, see [17.9 Hardware-Module](#).

Description: GX11

Connector: Binder Round-Connector Series 763, M12-4pole (male)

Color: black

Pin	Description	Used for:	
1	Contact	Relay A1 (+24 V)	
2	Contact	Relay A2 (GND)	
3	Contact	Normally Closed Contact terminal 2	potential-free contact
4	Contact	Normally Closed Contact terminal 1	

Table 4: Pin assignment emergency-stop 2 channel



IMPORTANT

The relay must only be switched on without any load!

Pay attention to the signal sequence (see [7.6.2.5 Standard Communication higher level controller – Emergency Stop 2 Channel](#)) !

6.2.9 F-Controller Port

Description: GX7

Connector: Binder Round-Connector Series 763, M12-4pole

Color: red

Pin	Description	Used for
1	Output	GND
2	Output	24 V
3	Output 6	Magnetic Valve
4	Input 10	Part Presence Sensor

Table 5: Pin assignment F-controller

7 Commissioning

7.1 Dimension Sheet

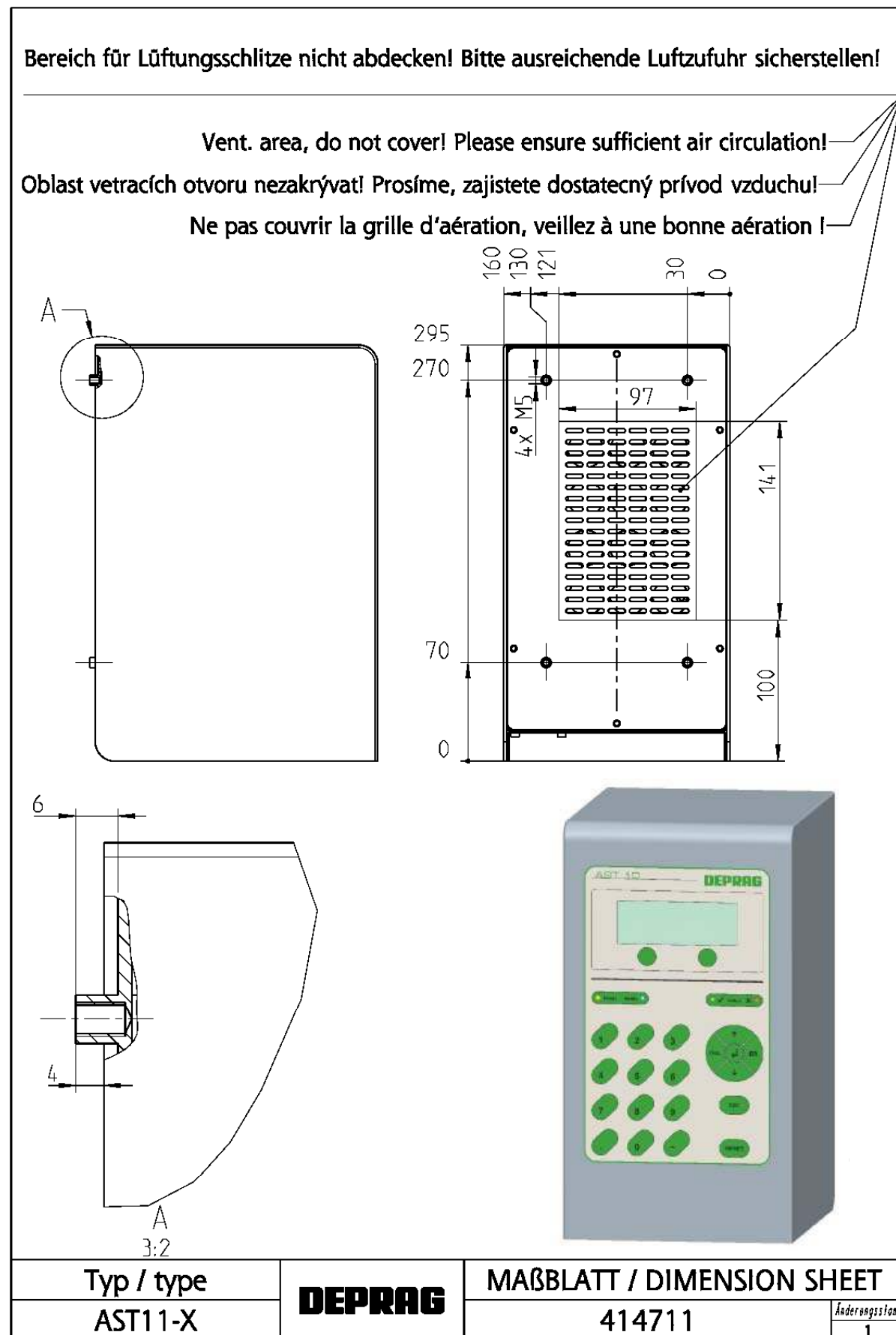


Figure 5: Dimension sheet

7.2 Assembly Instructions



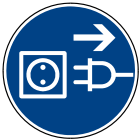
WARNING

Risk of fatal injury due to electrocution!

Switch off the AST11 sequence controller at the main switch and remove the mains plug before connecting the screwdriver!

Commissioning should be done only by trained personnel.

For the initial start-up proceed as indicated in the brief instructions 014090 "Quick-Start Instructions for the Operation of the Sequence Controller AST11 with 320E... EC-screwdriver"



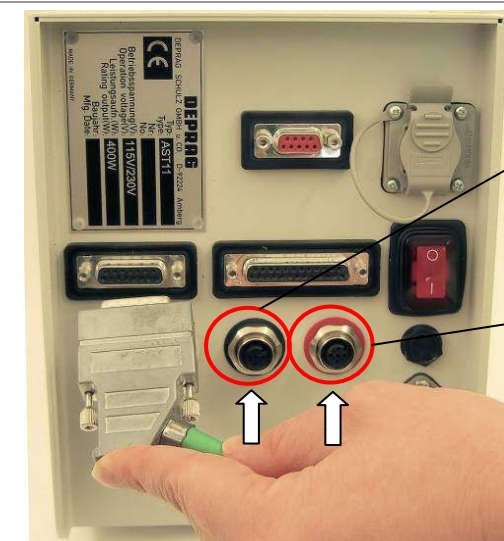
CAUTION

Injuries from electricity or damages on the device

Prior to connecting to the power, compare the layout design of the sequence controller AST11 with the in-house power supply (also refer to [18 Technical Data](#))

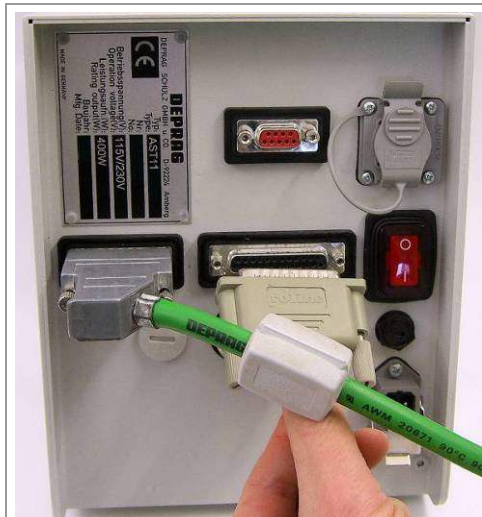


Connect the EC-screwdriver (to the GX1 interface) and screw on the retaining screw tightly.



Optional:
Connect the screw feeder / start release signal, if there is a screw feeder.
(Interface GX8)

Optional:
Connect the F-control, if there is an F-control.
(Interface GX7)



Optional:
Connect the plug of I/O-interface and screw on the retaining screw tightly.
(to the GX6 interface)



ATTENTION

Sequence controller not functioning!



The interface GX6 must always be occupied.

When the I/O interface is not in use plug in the connector 385476 A.



Optional:
Multifunctional serial printer to connect a printer, barcode scanner or fieldbus module, see [17](#)
[Optional Equipment](#)
(Interface GX10)

	Connect the sequence controller AST11 to the power supply (GX2 interface). Plug the power cable into the power socket.
	Switch on the sequence controller AST11 using the main switch.

More information about the interface assignment can be found under [6.1.3 Connection panel](#) and [6.2 Interface Description](#)



Read the Operating Instruction /Safety Guidelines.
Please read and heed the enclosed operating instructions for the individual actuators and sensors.

7.3 Example for screwdriving systems

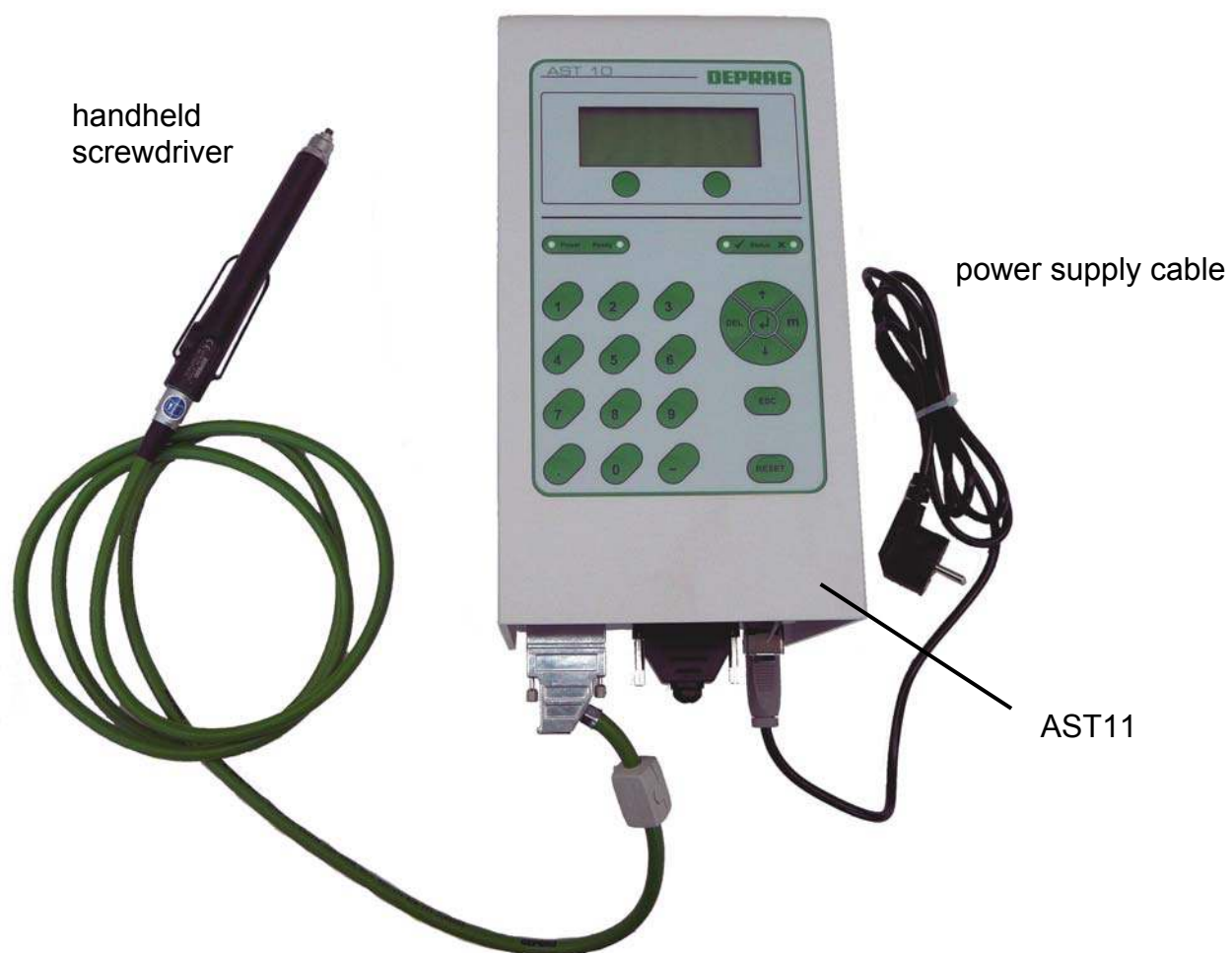


Figure 6:Screwdriving system

7.4 Minimum bending Radius of Screwdriver Cable



ATTENTION

Non-observance will cause damage to the screwdriver cable!

Observe minimum bending radius of screwdriver cable.

At constant motion:

- Minimum bending radius 90 mm

At singular motion:

- Minimum bending radius 45 mm

Please make sure that there is no mechanical load on the cables during operation.

To assure best possible contact, the connections of the cable to the sequence controller and the screwdriver must be solid.

7.5 Information on programming the Sequence Controller

The sequence controller AST11 is already pre-configured upon delivery.

A functioning screw assembly program is already available for the enclosed EC screwdriver. The screw assembly programs and settings must however be adjusted to the present application case.

Default settings and parameter changes of the screw assembly programs can be done directly on the sequence controller AST11, refer to [8.2.5.4 Menu Screwdriving Sequence](#).

The web interface must be used to modify or create new screw assembly programs refer to [8.3.4.14 Screwdriving sequence](#).

7.6 Functioning of the Sequence Controller AST11

7.6.1 Operation as Stand-Alone unit with a handheld Screwdriver

When manually screwdriving, the start of a screwdriving application occurs depending on screw type via contact pressure or via the start button. The program indicated in the Set-up → "Type of program choice" menu is started. Program 16 always starts if the program switching has been actuated either via key or switch lever.

7.6.2 Operation with a higher level controller

7.6.2.1 Operation with a handheld Screwdriver

When manually screwdriving, the start of a screwdriving application occurs depending on screw type via contact pressure or via the start button. The program indicated in the Set-up → "Type of program choice" menu is started.

- If "Inputs" is selected and a program is entered via the inputs of the I/O interface then this program will be started (see [7.6.2.3 Selection and Start of a Screwdriving Program via I/O interface](#)).
- If "Fieldbus" is selected and a program is entered via the fieldbus then this program will be started.

Program 16 always starts if the program switching has been actuated either via key or switch lever.

7.6.2.2 Operation with a stationary Screwdriver

The start signal starts screw assembly on spindle screwdrivers. The program indicated in the Setup → "Type of program choice" menu is started.

- When "Inputs" is selected and a program is entered via the inputs of the I/O interface then this program will be started (see [7.6.2.3 Selection and Start of a Screwdriving Program via I/O interface](#)).
- When "Fieldbus" is selected and a program is entered via the fieldbus then this program will be started.

7.6.2.3 Selection and Start of a Screwdriving Program via I/O interface

Use the inputs 3 to 6 of the I/O interface to select programs in accordance with the following table:

Program	Input 6	Input 5	Input 4	Input 3
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

Table 6: Program choice

7.6.2.4 Standard Communication higher level controller – AST11

Signal sequence of a screwdriving cycle:

Basic prerequisites:

- signal High to input 'Release controller' – pin 23
- presence of the program selection (may be present continuously, but it is evaluated only when the start signal is applied)

Communication:

1. Indicator on output Ready, signal on HIGH? Sequence controller is ready for screw assembly.
2. Enter signal HIGH on input program start
3. Indicator on output Ready, signal on LOW? Screw assembly has started.
4. Indicator on outputs OK and NOT OK, one of the signals on HIGH? Screw assembly has finished.
5. Signal LOW on input program start, if required alter bit pattern for program pre-selection
6. Wait for output Ready, signal on HIGH? Sequence controller is ready for screw assembly again.
7. Continue according to item 1 – new screwdriving cycle

With the program launch, the Ready signal and OK / not OK is set on low level. The following high-level of OK or not OK signals the end of screwdriving cycle.



IMPORTANT

The start signal must be at least 150 ms on LOW between two screw assemblies.

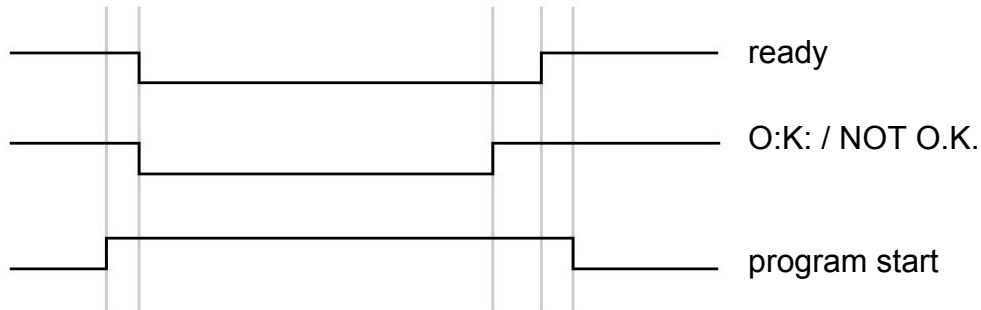


Figure 7: Burst

7.6.2.5 Standard Communication higher level controller – Emergency Stop 2 Channel

Basic requirements:

- AST11 type 390041 B or 390042 B or the controller has to be equipped with the hardware-module 385521 A ([17.9 Hardware-Module](#))
- While the sequence controller is booting the relay must be energized (Emergency-Stop high) in order to enable the screwdriver to initialize itself



IMPORTANT

The relay must only be switched on without any load!

Only after 100 ms past switching on the relay the Program-Start must be set!

Communication:

Screwdriving cycle without Emergency-Stop-Situation:

1. Request a Ready-Signal – Pin 15 high and Normally Closed Contact low
2. Signal high to input Program-Start – Pin 1
3. Request a OK or NOT OK – Pins 13 und 14
4. Request a Ready-Signal – Pin 15 high
5. Set Signal low to input Program-Start
6. Continue according to point 1 – new screwdriving cycle

With the program launch, the Ready signal as well as OK / not OK is set on low level. The following high-level of OK or Not OK signals the end of screwdriving cycle.

Emergency STOP situations:

1. Set Emergency-Stop-Signal to low (as long as the Emergency-Stop is active the Normally Closed Contact is on high-level)
2. Set Program-Start to low (can be set at the same time with point 1)
3. OK / NOT OK and Ready change from low to high
4. In order to reset the Emergency-Stop-Situation, set Emergency-Stop to high
5. Request a Ready-Signal high and Normally Closed Contact low

6. 100 ms after setting Emergency-Stop to high, the Program-Start can be set to high in order to start a new screwdriving cycle.

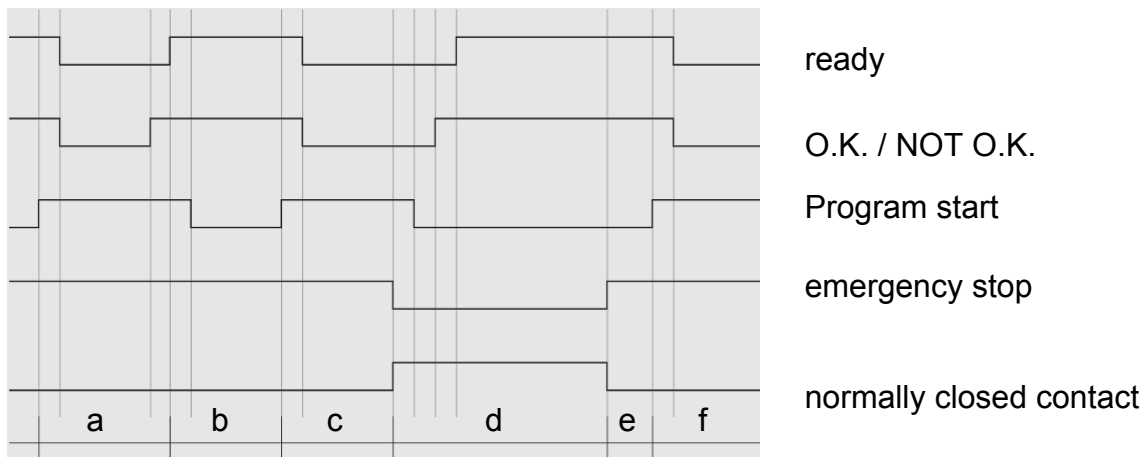


Figure 8: Burst

Burst-explanation:

- a) Complete screwdriving cycle
- b) Waiting-time between two screwdriving cycles
- c) New screwdriving cycle
- d) Emergency-Stop-Situation (Set and Reset)
- e) Waiting time of 100 ms before the new screwdriving cycle
- f) New screwdriving cycle

7.6.3 Connection on a master controller via the Fieldbus (optional)

7.6.3.1 Profibus DP / Profinet

The device files for the Profibus and Profinet can be downloaded through the AST40 sequence controller's web interface (see [8.3.4.17 Tools → Fieldbus](#))

7.6.3.2 General Information

All the required program modules to connect the Profibus and Profinet to a Siemens S7 – control unit can be found in the software package DEPRAG_AST40PNDP.zip.



IMPORTANT

The modules must only be used for S7 – control units with an integrated Profibus master or Profinet interface.

7.7 Connection on a master controller via the Fieldbus (optional)

7.7.1 Profibus DP / Profinet

The device files for Profibus and Profinet may be downloaded via the web interface of the AST11 (see [8.3.4.17 Tools → Fieldbus](#)).

7.7.1.1 General Information

All the program modules necessary for Profibus or Profinet connection to a Siemens S7 - controller are available in the DEPRAG_AST11PNDP.zip software package.



IMPORTANT

The modules must be used only for S7 - controllers with integrated Profibus master or Profinet interface.

7.7.1.2 Hardware configuration

7.7.1.2.1 Profibus DP

Slot	DP ID	Order Number / Designation	I Address	Q Address	Comment
1	128	64 Bytes Out		256...319	
2	128	64 Bytes Out		320...383	
3	128	64 Bytes Out		384...447	
4	128	32 Bytes Out		448...479	
5	64	64 Bytes In	256...319		
6	64	64 Bytes In	320...383		
7	64	64 Bytes In	384...447		
8	64	32 Bytes In	448...479		
9					

Figure 9: Hardware configuration of Profibus DP

7.7.1.2.2 Profinet

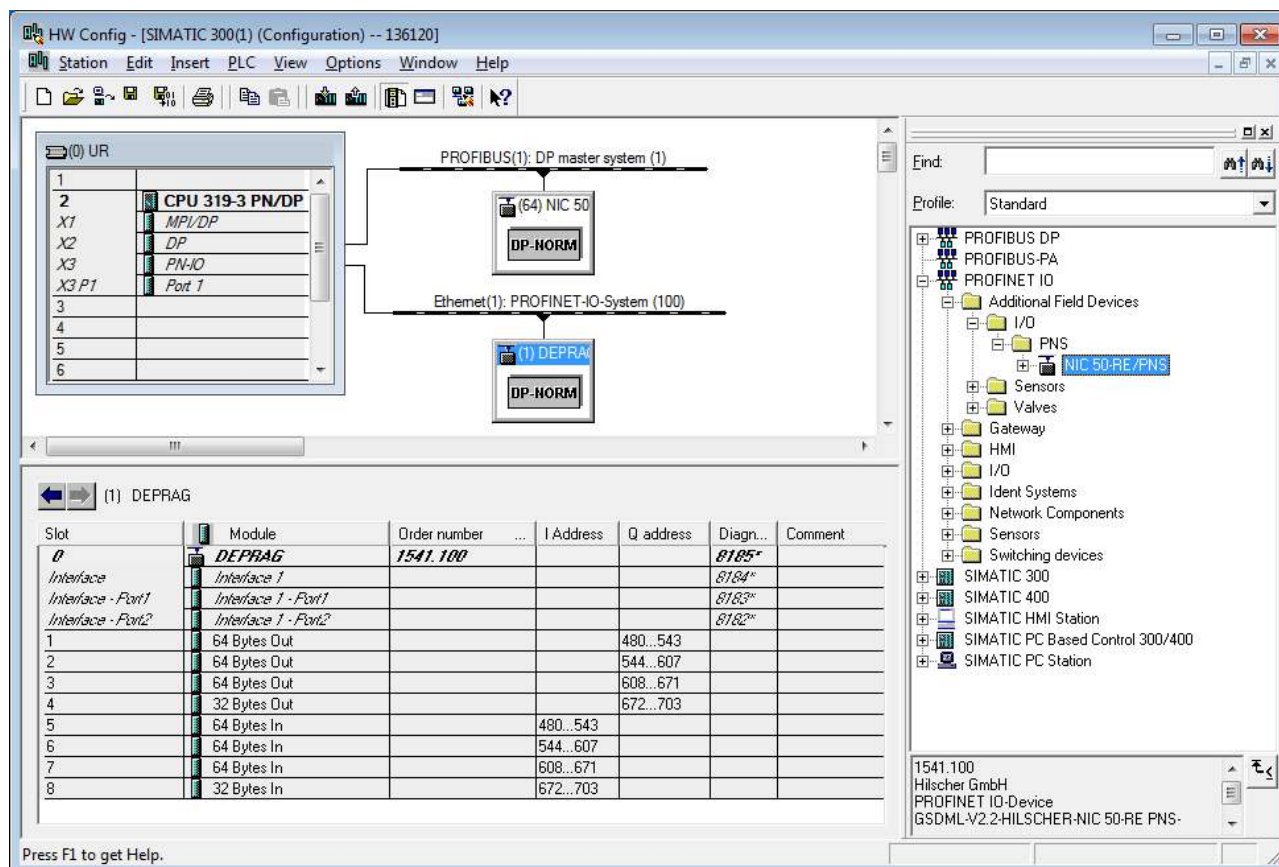


Figure 10: Hardware configuration of Profinet

7.7.1.3 Software

The following modules or UDT's are required to control the AST11 via the Profibus or Profinet:

Module	Name	Description
FB15	AST11	Control module for the AST11 sequence controller This module must be loaded for each AST11 sequence controller (with each new instance data block respectively)
DB50	IDB_AST11DP	DB instance for FB15 (e.g. Profibus)
DB51	AST11_Interface	Data module for the interface parameters of FB15
DB52	IDB_AST11PN	DB instance for FB15 (e.g. Profinet)
UDT51	AST11_Control	Data structure of the control signals
UDT52	AST11_State	Data structure of the status signals
UDT53	AST11_Data	Data structure of the screw data

Table 7: Modules and UDT's for the control

Object name	Symbolic name	Created in la...	Size i...	Type	V...	Name (He...	Unlinked	Author	Non Retain	Standard block	Last interface change	DI
Systemdaten	---	---	---	SDB	---	---	---	---	---	---	---	---
DB1	CYCL_EXC	STL	818	Organization Block	0.1	---	---	---	---	---	10/22/2012 12:48:4...	---
FB15	AST11	STL	1562	Function Block	1.0	---	---	DEPRAG	---	---	07/22/2014 12:50:4...	---
DB50	IDB_AST11DP	DB	660	Instance data block for FB 15	0.0	---	---	DEPRAG	---	---	07/22/2014 12:50:4...	---
DB51	AST11_Interface	DB	184	Data Block	0.1	---	---	---	---	---	07/22/2014 12:52:2...	---
DB52	IDB_AST11PN	DB	660	Instance data block for FB 15	0.0	---	---	DEPRAG	---	---	07/22/2014 12:50:4...	---
UDT51	AST11_Control	STL	---	Data Type	0.1	---	---	---	---	---	07/22/2014 07:37:5...	---
UDT52	AST11_State	STL	---	Data Type	0.1	---	---	---	---	---	07/22/2014 12:51:4...	---
UDT53	AST11_Data	STL	---	Data Type	0.1	---	---	---	---	---	07/22/2014 12:11:2...	---
VAT_AST11DP	VAT_AST11DP	---	---	Variable Table	0.1	---	---	---	---	---	07/28/2014 02:58:5...	---
VAT_AST11PN	VAT_AST11PN	---	---	Variable Table	0.1	---	---	---	---	---	07/28/2014 02:56:4...	---
SFB4	TON	STL	---	System function block	1.0	TON	---	SIMATIC	---	---	08/09/1996 08:21:4...	---
SFC14	DPRD_DAT	STL	---	System function	1.0	DPRD_DAT	---	SIMATIC	---	---	12/13/1995 05:11:4...	---
SFC15	DPWR_DAT	STL	---	System function	1.0	DPWR_DAT	---	SIMATIC	---	---	12/13/1995 05:11:4...	---

Table 8: Directory of the modules

7.7.1.3.1 Description - Interface parameters (FB15)

Designation	Type	Data type	Description
I_Addr1	IN	INT	Input address from the hardware configuration e.g. 256
I_Addr2		INT	Input address from the hardware configuration e.g. 320
I_Addr3		INT	Input address from the hardware configuration e.g. 384
I_Addr4		INT	Input address from the hardware configuration e.g. 448
O_Addr1		INT	Output address from the hardware configuration e.g. 256
O_Addr2		INT	Output address from the hardware configuration e.g. 320
O_Addr3		INT	Output address from the hardware configuration e.g. 384
O_Addr4		INT	Output address from the hardware configuration e.g. 448
Control	OUT	Structure of UDT 51	Data structure of the control signals (see 7.7.1.3.2 Description - Data structure of the control signals (UDT51))
State		Structure of UDT 52	Data structure of the status signals (see 7.7.1.3.3 Description - Data structure of the status signals (UDT52))
Data		Structure of UDT 53	Data structure of the screw data (see 7.7.1.3.5 Description - Data structure of the screw data (UDT53))

Table 9: Description - Interface parameters (FB15)

7.7.1.3.2 Description - Data structure of the control signals (UDT51)

Designation	Data type	Description
Start	BOOL	Start signal for the AST11 When the state of the start signal changes from "low" to "high", the pre-selected screwdriving program is started on the AST11 – sequence controller. The start signal must be present until the screwdriver operation has ended.
Stop	BOOL	Stop signal for the AST11 When the status of the stop signal changes from "low" to "high" then the screwdriving program in the AST11 – sequence controller is stopped. The stop signal must be set after each screwdriving operation unless the signal AutoStop is set.
AutoStop	BOOL	AutoStop signal for the AST11 When the AutoStop signal is set, after each screwdriving operation the stop signal is automatically set for the AST11.
Reload	BOOL	Reload signal for the AST11 When the status of the reload signal changes from "low" to "high" then a reload impulse is sent to the connected feeder.
StartRelease	BOOL	Start release for the AST11 When the status of the start release changes from "low" to "high" then the AST11 – controller is approved for screw assemblies (ready signal changes from "low" to "high")
ProgIn2	BOOL	Input 2 for the screwdriver program This input can be sensed in the screwdriver program of the AST11 – sequence controller in order to stop or continue the screwdriver operation program.
FC_PART_SENSOR	BOOL	F-Function: Input part sensor When the part sensor is connected the status of the signal FC_PART_SENSOR changes from "low" to "high"
FC_RELEASE_PART	BOOL	F-Function: Input part release When the status of the signal FC_RELEASE_PART changes from "low" to "high" then the part is released
FC_ERROR_RESET	BOOL	F-Function: Input reset error By altering the status of the signal FC_ERROR_RESET from "low" to "high" pending errors can be acknowledged
DataSaved	BOOL	Data saved With the help of this signal it is indicated to the AST11 – sequence controller that the current screw data has been saved in the PLC. If this signal is set, the AST11 – sequence controller withdraws the "Data available" signal.
ResetPower-unit	BOOL	Reset power unit By altering the status of the signal ResetPowerunit from "low" to "high" the power unit will be rebooted
ExtStop	BOOL	External stop By altering the status of the signal ExtStop from "low" to "high" an external stop is transmitted to the AST11
ResetMaintenance	BOOL	Reset Warnung Wartungszähler erreicht By altering the status of the signal ResetMaintenance from "low" to "high" the message „next maintenance is due“ is reset
ProgramNo	INT	Screwdriver program The user must enter the desired screwdriver program of the AST11 sequence controller here. Possible input values: 1 – 16

Table 10: Description – Data structure of the control signals (UDT51)

7.7.1.3.3 Description - Data structure of the status signals (UDT52)

Designation	Data type	Description
SystemOk	BOOL	System OK This signal indicates that the AST11 – screwdriver controller has started up and is ready.
Ready	BOOL	Ready This signal indicates that the AST11 – screwdriver controller is ready for screwdriver operation.
Ok	BOOL	Connection Ok After making proper connection, this signal has the "high" state
NOk	BOOL	Connection NOk After failing to make a proper connection, this signal has the "high" state
FC_PART_ACTIVE	BOOL	Status of the F-Function: Part active This output is set on the AST11 when the F-Function is activated and a part is active
FC_CHANGE_PART	BOOL	Status of the F-Function: Change part This output is set by the AST11 when the F-Function is activated and the part should be changed
ProgOut8	BOOL	Output 8 on screwdriving program In the screwdriving program of the AST11 sequence controller this output can be set or reset and read on the PLC.
DataAvailable	BOOL	Data available This signal indicates that there is new screwdriving data available. It is restored by the AST11 when the signal "DataSaved" from the PLC program is set or a new screwdriving sequence is started.
ComError	BOOL	Error This signal indicates that in the component FB15 an error has occurred. The detailed error code is found in the parameter "Error Code".
Heartbeat	BOOL	Heartbeat signal This signal is indicated during constant changes between the functions of the AST11 sequence controller
ExtStop	BOOL	External stop This signal mirrors the hardware input "External stop"
SystemStatus	INT	System status This parameter indicates the system status of the AST11. (for possible status values see 14.1 System error)
ErrorCode	WORD	Error Code This parameter indicates the internal errors in the module. ((for possible status values, see below 7.7.1.3.4 Description – Error Codes)

Table 11: Description – Data structure of the status signals (UDT52)

7.7.1.3.4 Description – Error Codes

Error	Description
FF00	Error in the input address range Cause: The interface parameter I_AddrX (X=1-4) does not have a value or has one that is ≤ 0 .
FF01	Error while reading the input module 1 (I_Addr1) Possible causes: - An incorrect input module has been entered in the hardware configuration. Input module 1 must be configured with "64 bytes in". Incorrect start address of the input module 1 at the interface parameter I_Addr1
FF02	Error while reading the input module 2 (I_Addr2) Possible causes: - An incorrect input module has been entered in the hardware configuration. Input module 2 must be configured with "64 bytes in". Incorrect start address of the input module 2 at the interface parameter I_Addr2
FF03	Error while reading the input module 3 (I_Addr3) Possible causes: - An incorrect input module has been entered in the hardware configuration. Input module 3 must be configured with "64 bytes in". Incorrect start address of the input module 3 at the interface parameter I_Addr3
FF04	Error while reading the input module 4 (I_Addr4) Possible causes: - An incorrect input module has been entered in the hardware configuration. Input module 4 must be configured with "32 bytes in". Incorrect start address of the input module 4 at the interface parameter I_Addr4
FF10	Error in the output address range Cause: The interface parameter O_AddrX (X=1-4) does not have a value or has one that is ≤ 0 .
FF11	Error while writing to the output module 1 (O_Addr1) Possible causes: - An incorrect output module has been entered in the hardware configuration. Output module 1 must be configured with "64 bytes out". Incorrect start address of the output module 1 at the interface parameter O_Addr1
FF12	Error while writing to the output module 2 (O_Addr2) Possible causes: - An incorrect output module has been entered in the hardware configuration. Output module 2 must be configured with "64 bytes out". Incorrect start address of the output module 2 at the interface parameter O_Addr2
FF13	Error while writing to the output module 3 (O_Addr3) Possible causes: - An incorrect output module has been entered in the hardware configuration. Output module 3 must be configured with "64 bytes out". Incorrect start address of the output module 3 at the interface parameter O_Addr3
FF14	Error while writing to the output module 4 (O_Addr4) Possible causes: - An incorrect output module has been entered in the hardware configuration. Output module 4 must be configured with "32 bytes out". Incorrect start address of the output module 4 at the interface parameter O_Addr4
F100	Timeout error in the fieldbus communication

Table 12: Description – Error Codes

7.7.1.3.5 Description - Data structure of the screw data (UDT53)

Designation	Data type	Description
fd_Prog	INT	Program number The program number of the screwdriver program started previously is output here.
fd_Status	INT	Screw status The screwdriver status is output here in detail. (for possible values of the status, see 14.2 Error in the screwing sequence)
fd_Time	REAL	Screw fixing time The screw fixing time (in seconds) necessary of the program started previously is output here.
fd_Step1	DINT	Step number of the Data backup (1) The step number of the AST11 – program in which data backup (1) was done is output here
fd_Torque1	REAL	Torque value of the Data backup (1) The torque value of the data backup (1) is output here
fd_Angle1	DINT	Angle value of the Data backup (1) The angle value of the data backup (1) is output here
fd_Step2	DINT	Step number of the Data backup (2) The step number of the AST11 – program in which data backup (2) was done is output here
fd_Torque2	REAL	Torque value of the Data backup (2) The torque value of the data backup (2) is output here
fd_Angle2	DINT	Angle value of the Data backup (2) The angle value of the data backup (2) is output here
fd_Step3	DINT	Step number of the Data backup (3) The step number of the AST11 – program in which data backup (3) was done is output here
fd_Torque3	REAL	Torque value of the Data backup (3) The torque value of the data backup (3) is output here
fd_Angle3	DINT	Angle value of the Data backup (3) The angle value of the data backup (3) is output here
fd_StepNOK	DINT	Step number of the Data backup for an incorrect or improper screw joint The step number of the AST11 – program in which data backup for an incorrect or improper screw joint was done is output here
fd_TorqueNOK	REAL	Torque value for an incorrect or improper screw joint The torque value of an incorrect or improper screw joint is output here
fd_AngleNOK	DINT	Angle value for an incorrect or improper screw joint The angle value of an incorrect or improper screw joint is output here
fd_TorqueUnit	INT	Unit of torque The unit of torque set in the AST11 is output here: Possible values are: 0 = N·m 1 = N·cm 2 = ft·lb 3 = In·lb 4 = kg·m 5 = kg·cm

FC_STATUS	INT	F-Function: Status Here the status of the last screw assembly of the AST11 started using F-Function is shown: Possible values: 0 = OK 1 = too short 2 = too long 3 = part missing 4 = change part
FC_COUNTER_TARGET	INT	F-Function: Target screw assemblies Number of OK-screw assemblies until the component is finished
FC_COUNTER_CURRENT	INT	F-Function: Current screw assemblies Current number of OK-screw assemblies

Table 13: Description – Data structure of the screw data (UDT33)

7.7.1.3.6 Data backup

The 'Save values' command can be used as often as desired in the screwdriver operation, but however, only the last three values are saved. In case of an error or a failure, the values are always saved.

The value last saved is always available in the range fd_Step3 / fd_Torque3 / fd_Angle3.

When using the "Save values" command multiple times in the screwdriver program, the previous values are shifted upwards (fd_Step3 → fd_Step2 → fd_Step1).

If an error occurs during the screwdriver operation, the screw fixing values of the incorrect step are saved in the range fd_StepNOK / fd_TorqueNOK / fd_AngleNOK.

Example:

01. Fasten to Torque

02. Save Values

fd_Step3

03. Fasten to Torque

04. Save Values

fd_Step3 → fd_Step2
fd_Step3

05. Loosen to Angle with torque supervision

fd_StepNOK

06. Save Values

fd_Step2 → fd_Step1
fd_Step3 → fd_Step2
fd_Step3

07. Fasten to Torque

08. Save Values

fd_Step2 → fd_Step1
fd_Step3 → fd_Step2
fd_Step3

8 Instructions for the Sequence Controller

8.1 General

The sequence controller can be programmed by using the WEB-Interface or by the integrated numeric keypad, whereby the programming choices on the keypad are more limited.

The sequence controller can be operated as a stand-alone unit or it can be operated by a PLC.

8.2 Operating Elements

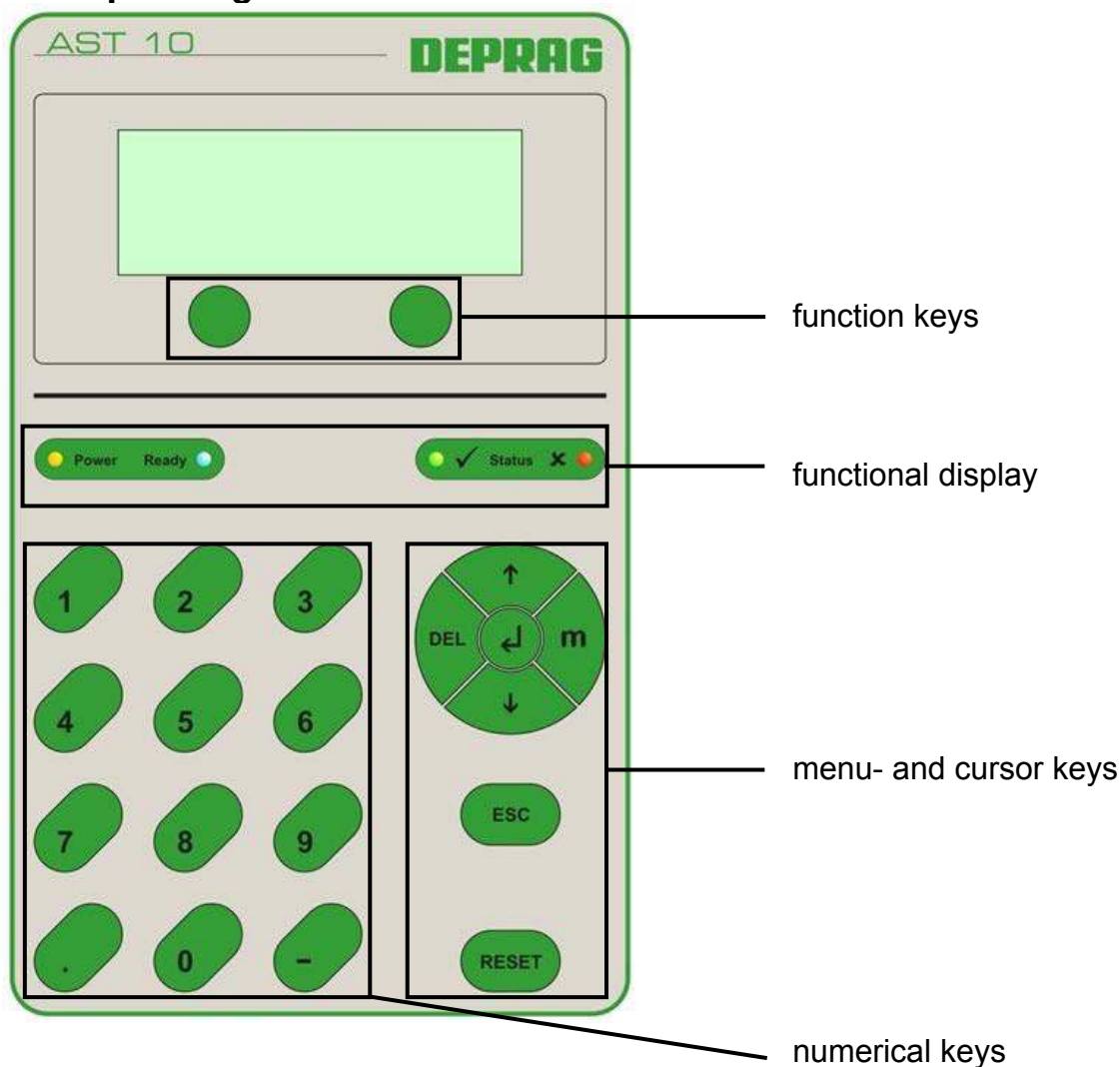


Figure 11: Operating Elements

8.2.1 Functional Display (LEDs)

The LED's located below the display notify the user about the operating status of the sequence controller:

Color	Description	Meaning
yellow	Power	all voltage are O.K.
blue	ready	the sequence controller is ready
green	Status ✓	last screw assembly was O.K.
red	Status ×	last screw assembly was not O.K.

Table 14: LEDs

8.2.2 Keypad Layout

8.2.2.1 Function Keys

In automatic mode, the function keys have the following functions:

left function key: manual reloading of a screw when operated with feeder

right function key: part approval when using the F-Function, if this function has been enabled in the relevant menu.

In different menu items the function keys are assigned to different functions. The display shows which functions are assigned to function keys, e.g. in the menu item speed test to start and stop the test run and to enter the desired speed.

8.2.2.2 Numerical Keypad and ESC-key

Use the numerical keypad to input number values (such as nominal speed), to set a parameter or to perform a test. Always confirm any numerical input with RETURN-key.

Use the ESC-key to interrupt your input; the original value remains intact.

8.2.2.3 Menu and Cursor Keys

The menu keys have the following functions:

m	in automatic mode, the main menu can be called up with this key
DEL	use the DEL-key to remove incorrect numerical inputs.
ESC	use the ESC-key to change into the next higher menu-level, to exit the individual menus or to cancel an input.
RESET	use the RESET-key to reset an error, which occurred while operating in the F-function, if the corresponding menu allows such a reset.
↑ ↓	navigation in the menu, the up- and down- keys move the cursor either up or down
Enter	use the ENTER-key to change to the selected menu item

Table 15: Menu and Cursor Keys

8.2.3 Menu Structure

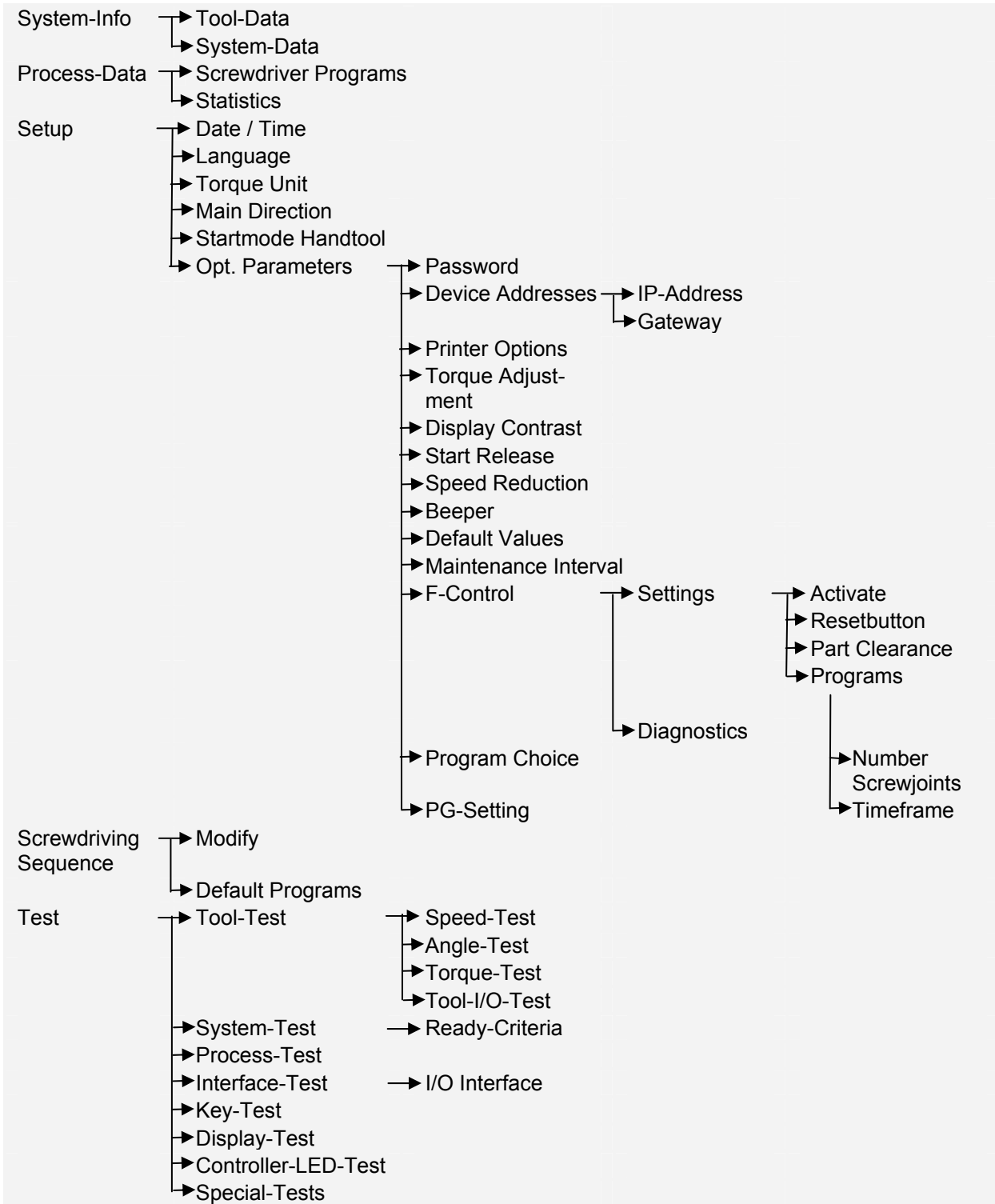


Figure 12: Menu structure at the display

8.2.4 Menu Functions

All sub-menus, where values can be changed or which causes the interruption of the automatic operation, are protected by a password.

If the password is set to 0000, then all menus are freely accessible!

The password may be changed in the menu item SETUP.



Important

The following settings are implemented at delivery:
Password: 0000



ATTENTION

Some menu points will interrupt the automatic cycle, which means the screw assembly cycle cannot be continued!

The following menus interrupt the automatic cycle:

- Setup
- Screwdriving Sequence
- Test

Please assure by setting passwords that only authorized personnel can make changes.

8.2.5 Description of the Menus

8.2.5.1 Menu System Info

The menu system info displays general data of the sequence controller and the connected screwdriver. The data can be displayed during equipment operation, without interrupting the automatic sequence.

8.2.5.1.1 Tool Data

The tool data include all important information about the connected driver, such as screwdriver model, serial number, torque limits, etc.

8.2.5.1.2 System Data

The system data contain basic sequence controller settings, such as language, IP address, MAC address, main direction, etc.

8.2.5.2 Menu Process Data

The menu process data supplies data for the screwdriving process. The data can only be displayed, but not changed. The data can be displayed during equipment operation, without interrupting the automatic sequence.

8.2.5.2.1 Screwdriving Programs

The menu item Screwdriver Programs displays the parameters of the individual screwdriving programs. After inputting the required program number, use the cursor keys to switch between the individual parameters within the programs.

Use the function keys to directly change from and to the individual programming steps.

8.2.5.2.2 Statistics

To use the statistics display, make sure to include the command STATISTICS in the screwdriver program.

The data will not be saved permanently. When the AST11 is switched off, the data will be deleted.

8.2.5.2.2.1 Show

First, input the program number to display the statistics. Then you can select between display of torque or angle.

The last 100 values are used to calculate the statistics.

The following values are shown:

- Number of Data Sets
- Average
- Standard Deviation Actual
- Standard Deviation in Percentage
- CP-Value
- CPK-Value

Use the cursor keys to switch between the individual display values.

The left function key allows the deletion of the statistics of an individual program.

The right function key allows the inputting of limit values for the CP- and CPK-Value calculation.

If no limit values are entered +/- 15% of the average values are used for limits.

8.2.5.2.2.2 Delete

It is possible to either delete the complete statistics for all programs (left cursor key) or only the statistics for individual programs (right cursor key).

8.2.5.3 Menu Setup

Use the setup menu to input general sequence controller adjustments.

8.2.5.3.1 Date / Time

The current system time as well as system date will be displayed. Use the left function key to change time and date. Proceed using the following steps:

- Press key CHANGE, a blinking cursor appears over the date
- Input the current day, confirm with ENTER key, the current day will be displayed and the blinking cursor appears over the month.
- Input current month, confirm with ENTER key, the current month will be displayed and the blinking cursor appears over the year.
- Input current year, confirm with ENTER key, the current year will be displayed and the blinking cursor appears over the hour area of the time.
- Input current time (hour), confirm with ENTER key, the current time (hour) will be displayed and the blinking cursor appears over the minute area of the time
- Input current time (minute), confirm with ENTER key, the current time (minute) will be displayed and the blinking cursor appears over the seconds area of the time
- Input current time (seconds), confirm with ENTER key, the current time (minute) will be displayed

Use the left function key to accept the changes.

8.2.5.3.2 Language

The system allows the selection between different languages.

Use the cursor keys to select the required language and confirm your selection with the ENTER-key. To leave the menu without making any changes, use the ESC-key.

8.2.5.3.3 Unit

Several different measuring units are available.

Use the function keys for selection and the ENTER key to accept the selection. Use the ESC-key to exit the menu without making any changes.

8.2.5.3.4 Main Direction

Use this area and the cursor keys to select between "Right" or "Left" main direction. The basic setting is RIGHT. Use the ENTER key to accept the selection. Use the ESC-key to exit the menu without making any changes.

8.2.5.3.5 Startmode Handtool

It can be selected to use external start (start and program choice by e.g. PLC) with the handtool.

8.2.5.3.6 Optional Parameters

8.2.5.3.6.1 Password

The password can be changed using the left cursor key or even deleted, using the right cursor key.



ATTENTION

If a password is deleted, then all menus are freely available!

The following menus interrupt the automatic cycle:

- Setup
- Screwdriving Sequence
- Test

Please assure by setting passwords that only authorized personnel can make changes to the corresponding menus.

To change the password, input a four-digit password and confirm entry with the ENTER-key. It is necessary to input the password twice and if both entries are identical, then the password will be accepted. The password may be any combination of digits between 0000 and 9999.

8.2.5.3.6.2 Device Addresses

IP-Address:

When the IP-Address is changed, the system starts-up new!

To change the IP-Address:

- use the function key “Modify?”
- input the four numerical blocks individually
- confirm your entry with the ENTER-key
- input the four numerical blocks for the net mask
- confirm this entry with the ENTER-key

The right function key accepts the input.

Immediately thereafter, the system will be automatically rebooted and the display shows “AST11 Reboot System”.

Gateway:

When the gateway is changed, the system starts-up new!

To change the gateway:

- use the function key “Modify?”
- input the four numerical blocks individually
- confirm your entry with the ENTER-key

The right function key accepts the input.

Immediately thereafter, the system will be automatically rebooted and the display shows “AST11 Reboot System”.

8.2.5.3.6.3 Printer Options

There is a selection possibility for different print options. Use the cursor key to make the selection and the ENTER-key to confirm the selection. Use the ESC-key to exit the menu without making any changes.

8.2.5.3.6.4 Torque Correction Factor (TQ-Adjustment)

Use this area to input an individual value, which adapts the torque to an external measurement.



ATTENTION

When inputting a correction factor, the factory-made calibration will be changed.

(The torque established by this factor is only valid for the torque, which was obtained by the input factor.)

To change the value, proceed as follows:

- Use the left function key “Modify?”
- input value
- confirm entry with ENTER-key.

Use the right function key “SET?” to save your entry.

8.2.5.3.6.5 Display Contrast

Use the two function keys to change the contrast of the display. Confirm changes with the ENTER-key.

8.2.5.3.6.6 Start Release

The enable start allows, if activated, that the screwdriving cycle only starts after the input Start Release (I/O interface GX6, Pin 8) has received a „high“ signal. If no signal was given then the sequence controller is not ready.

The enable start may be activated or deactivated. The basic setting is “deactivated”.

Make a selection with the cursor-keys and use the ENTER-key to confirm your selection. Use the ESC-key to exit the menu without making any changes.

8.2.5.3.6.7 Speed-Reduction

When driving a fastener to a preset torque, the option „speed reduction“ is activated at 80% of the maximum torque.

The „speed reduction“ option can be activated or deactivated.

At delivery, the „speed reduction“ is activated.

The deactivation of the automatic „speed reduction“ option may lead to higher imprecisions of the torque value!

Use the cursor keys for selection. The respective selection is activated with the Enter key. Use the ESC key to exit the menu without making any changes.

8.2.5.3.6.8 Beeper

The end of a tightening process can be indicated by an audible signal. Several options can be selected.

To select the between the signal options, use the cursor keys. Confirm your entry with the Enter key. Use the ESC-key to exit this menu without making any changes.

8.2.5.3.6.9 **Default Values**

Use this menu area to reset the setup-adjustments of the sequence controller to the original values (see [10.2 Default Values](#)).

8.2.5.3.6.10 **Maintenance Interval**

In this menu the maintenance intervals can be set (see also [10.1.1 Parameters of the System Settings](#)). The maintenance intervals can only be entered in steps of thousands.

To change the value, proceed as follows:

- Use the left function key “Modify?”
- input value
- confirm entry with ENTER-key.

Use the right function key “SET?” to save your entry.

8.2.5.3.6.11 **F-Function (only visible with handheld Screwdrivers)**

see separate chapter [9 F-Function](#)

8.2.5.3.6.12 **Program Choice**

Here you can set the mode for program choice (see also [10.1.1 Parameters of the System Settings](#)).

If “fixed setting” is selected then in the following menu item (PG-Setting) a value for the program number can be entered.

To select the between the signal options, use the cursor keys. Confirm your entry with the Enter key. Use the ESC-key to exit this menu without making any changes.

8.2.5.3.6.13 **PG-Setting (only visible with handheld Screwdrivers)**

If “fixed setting” (previous menu item “Program Choice”) is selected then in this menu item a value for the program number can be entered.

To change the value, proceed as follows:

- Use the left function key “Modify?”
- input value
- confirm entry with ENTER-key.

Use the right function key “SET?” to save your entry.

8.2.5.4 Menu Screwdriving Sequence

8.2.5.4.1 Modify

Use the menu item “Screwdriving Sequence → Modify” to adjust the parameters of the individual screwdriving program. At first, the system asks for the program number to be input. Thereafter, the cursor allows to select between the individual parameters within one program.

Use the function-key to switch from one to the next program step.

To input a numerical value, use the ENTER-key, then input the value and again press the ENTER-key. Only numbers, which are within an allowable range of the driver, are accepted.

To change the selection values, use the ENTER-key, then use the cursor key to select the required value and again use the ENTER-key to confirm the change.

Use the ESC-key to interrupt an input; the previous valid values remain. Again, use the ESC-key to exit the menu.

Now, use the two function keys to save or not save the changes!

left function key: the changes will be saved, the values will be reconfirmed and if necessary, the system will return to the menu to adjust the parameter

right function key: all changes will be disregarded, the program remains unchanged.

8.2.5.4.2 Default Programs

Use the menu item “Default Programs” to generate the programs 1 and 16 as standard programs.

The programs will be generated as follows:

Program 1: one-step tightening to torque with driver-dependent standard values

Program 16: one-step loosening to angle with driver-dependent standard values.



ATTENTION

Generating default programs will overwrite programs 1 and 16.
All other programs will be invalid!

8.2.5.5 Menu Test

8.2.5.5.1 Tool Test

8.2.5.5.1.1 Speed Test

The mode “speed test” allows the testing of the speed outside of the program sequence.

The two function keys can control the speed test.

Proceed as follows:

- input nominal speed:
- use left function key „Nominal Value“; a blinking Cursor occurs
- input nominal speed and confirm entry with the ENTER key
- To run driver, use right function key “START”; Driver rotates at specified speed
- To stop driver, use right function key “STOP”; Driver stops

Exit the menu item „Speed Test“ with the ESC-key.

8.2.5.5.1.2 Angle Test

To verify the angle measurement, simply rotate the screwdriver. The current angle is displayed. Use the right function key “RESET” to reset the angle value to “0”. Exit the menu item „Angle Test“ with the ESC-key.

8.2.5.5.1.3 Torque Test

The menu item “Torque Test” allows the verification of the torque measurement, even outside of program sequences. A one-step standard program will be created using the input torque value, which in turn can be verified through a tightening process on a measuring platform. The two function keys may control the torque test.

Proceed as follows:

- Insert the nominal torque:
- Press the left function key “Nominal Value”; a blinking Cursor occurs.
- Input nominal torque and confirm entry with the ENTER-key.

To activate the driver, press the function key “START”; the driver starts the tightening program.

Press the STOP-key to turn the driver off.

To exit the torque-test menu at any time, simply press the ESC-key.

8.2.5.5.1.4 Tool I/O Test (only visible with handheld Screwdrivers)

Use the menu item "Tool I/O Test" to test the LED's and buttons on the screwdriver.

Use the cursor-keys to switch between the individual LED's and buttons.

The status of the button will be displayed; the LED's may be turned on or off by the ENTER-key.

To exit the Driver I/O Test menu at any time, simply press the ESC-key

8.2.5.5.2 System Test

8.2.5.5.2.1 Ready-Criteria

The menu item „Ready-Criteria“ displays all parameters, which influence the ready status of the sequence controller.

The status of the parameters is updated only when calling the menu.

Use the cursor-keys to switch between the individual values.

8.2.5.5.3 Process Test

Use the „Sequence Test“ to check the function of each step in a Screwdriver Program.

To control this test, use the two function keys and proceed as follows:

- Input program number
- Press the Key „PROG“, a blinking Cursor occurs
- Input program number and confirm input with the ENTER-key
- Start the sequence with the key „START“, the first step of the program is processed
- Use the key „NEXT“ to start the next step
- Use the key „STOP“ to stop the process at any time

The current programming step is displayed on the upper right corner. To exit the process-test menu at any time, simply press the ESC-key.

8.2.5.5.4 Interface Test

8.2.5.5.4.1 I/O-Port

Use the menu item I/O–Port to verify the I/O-conditions. Use the numerical keys 0 to 7 to activate or deactivate each individual output.

Exit the I/O–Test mode with the ESC-key.

Description of each step in the display:

Inputs:

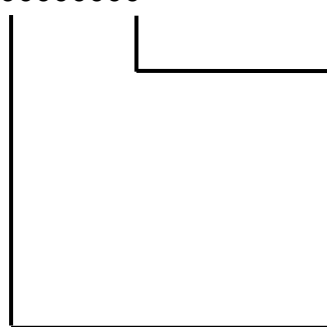
000000000000



- Input 1: Start
- Input 2: --
- Input 3: Program Selection
- Input 4: Program Selection
- Input 5: Program Selection
- Input 6: Program Selection
- Input 7: Reload
- Input 8: Start Release
- Input 9: External Stop
- Input 10: Part Sensor
- Input 11: Reset Error
- Input 12: Release Part

Outputs:

00000000



- Output 1: System O.K.
- Output 2: Assembly O.K.
- Output 3: Assembly NOT O.K.
- Output 4: Ready
- Output 5: Reload
- Output 6: Magnetic Valve
- Output 7: Change Part
- Output 8: --

8.2.5.5.5 Display-Test

In the menu item „Display-Test“, all test areas will be completely dark. This allows the operator to see whether all pixels of the displays are functional!

To exit the display-test menu at any time, simply press the ESC-key.

8.2.5.5.6 Key Test

The „Key Test“ displays the last actuated key. This menu item allows that all keys are tested in regard to their functionality.

To exit the key-test menu at any time, simply press the ESC-key.

8.2.5.5.7 LED-Test

Use this „LED-Test“ function to verify that all LED's on the sequence controller are functional. Use the cursor keys to select between the individual LED's.

Use the ENTER-key to turn the individual LED's on or off. To exit the LED-test menu at any time, simply press the ESC-key.

8.2.5.5.8 Special Tests

These test functions are exclusively for internal use and only accessible to DEPRAG service personnel.

8.3 Operation via the web interface

8.3.1 Requirements

8.3.1.1 Hardware

The web interface operates on any common PC or Notebook with a network card or a WLAN card.

8.3.1.2 Software

The web interface can be used with any common operating system, such as MS Windows, Linux, OS X... and it functions with all common, current browsers.

8.3.1.3 Connection to the sequence controller AST11

The PC on which the web interface is operating can either be connected with the sequence controller AST11 or via a common network.

Cross cables as well as uncrossed cables can be used for the direct connection; the sequence controller AST11 recognizes them automatically and adjusts the connection respectively.

8.3.2 Preparing to use the web interface

In order to use the web interface, the sequence controller AST11 as well as the browser must be set in a manner that a TCP/IP connection between both can be established and the data exchange released.

8.3.2.1 Setting the sequence controller AST11

A set IP address must be set at the sequence controller AST11 (also refer to [8.2.5.3.6.2 Device Addresses](#) and brief description "Quick-Start Instructions for the Operation of Sequence controller AST11"). They must be issued by the administrator of the local network. At the time of delivery the following values are preset:

IP Address:	10.10.25.100
Subnet mask	255.255.0.0
Gateway:	10.10.20.9

8.3.2.2 Setting the browsers/operating systems

The browser must have free access to the sequence controller AST11, meaning;

- the IP address of the sequence controller AST11 must be reachable.
- the HTTP protocol must not be deactivated
- a possible proxy for the IP address of the sequence controller AST11 (or local addresses general) must be deactivated.

Furthermore, the browser cookies must accept the sequence controller AST11 and JavaScript must be activated. In case of doubts contact your responsible EDV representative.

8.3.3 Menu Structure

The menu has the following structure:

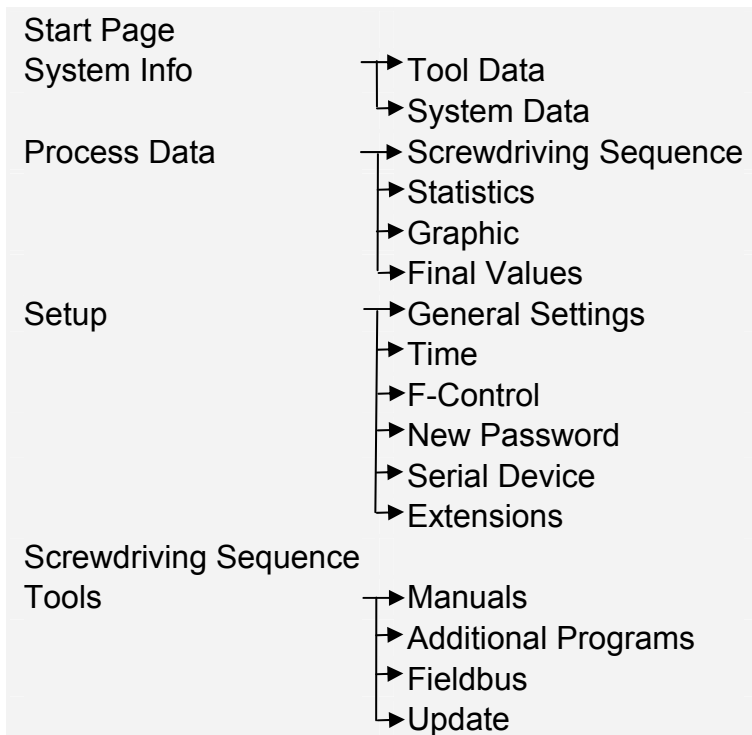


Figure 13: Menu Structure Web interface

8.3.4 Description of the menu

8.3.4.1 Start

To access the web interface, enter the IP address of the sequence controller AST11 (also refer to [8.2.5.3.6.2 Device Addresses](#)) into the address bar of the browser and press the enter key (e.g. "http://10.10.25.108"). The browser connects to the sequence controller AST11 and loads the home page.

Figure 14: The home page

If you intend to perform changes, enter the password. The standard password at the time of delivery is "0000". If you only want to view data, without changing them, you will not need a password and leave the input fields empty.

Click the login button or press the enter key.

Subsequently the home page is displayed.

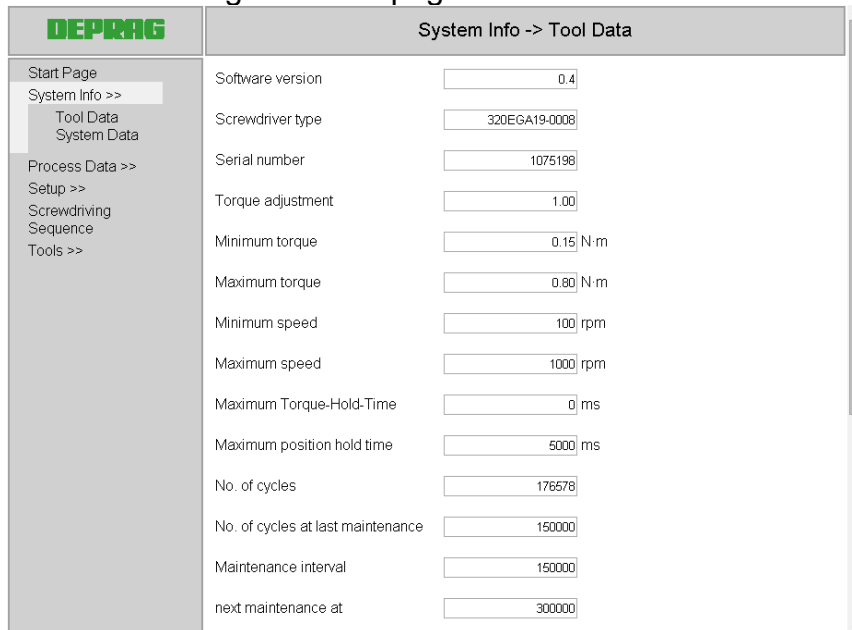
Figure 15: Start page

The start page shows the versions of the main control, the power element and the screwdriver logistics. On the left side is the main menu, which is used to access the individual pages of the web interface.

If you enter a valid password then all pages are accessible. Otherwise, the pages on which changes can be made are hidden.

8.3.4.2 System Info → Tool Data

This page displays the most-important data of the connected Screwdriver. These data cannot be changed on this page.



System Info -> Tool Data	
Start Page	Software version: 0.4
System Info >>	Screwdriver type: 320EGA19-0008
Tool Data	Serial number: 1075198
System Data	Torque adjustment: 1.00
Process Data >>	Minimum torque: 0.15 N·m
Setup >>	Maximum torque: 0.80 N·m
Screwdriving Sequence	Minimum speed: 100 rpm
Tools >>	Maximum speed: 1000 rpm
	Maximum Torque-Hold-Time: 0 ms
	Maximum position hold time: 5000 ms
	No. of cycles: 176578
	No. of cycles at last maintenance: 150000
	Maintenance interval: 150000
	next maintenance at: 300000

Figure 16: Tool data

The following data is displayed:

- Software version: version of the screwdriver logic
- Screwdriver type: name of the screwdriver type
- Serial number: individual serial number of the screwdriver
- Torque settings: screwdriver specific value to adapt the torque calculation to special cases
- Minimum torque: smallest possible torque
- Maximum torque: largest possible torque
- Minimum rotation speed: smallest possible rotation speed
- Maximum rotation speed: largest possible rotation speed
- Maximum torque hold time: longest possible time that the screwdriver can maintain a constant torque
- Number of cycles: number of screwdriving procedures of the screwdriver
- Number of cycles at last maintenance: number of screwdriving procedures of the screwdriver at the time of the last maintenance
- Maintenance interval: interval describes the number of screwdriving procedures until the next maintenance is due
- Next maintenance: the next maintenance of the screwdriver is due when the specified number of screwdriving procedures has been reached

8.3.4.3 System Info → System Data

This page shows the screwdriver independent adjustments of the sequence controller. These data cannot be changed on this page.

System Info -> System Data	
Version of main unit	1.0
Version of power unit	4.2
Serial number	1190841
Date	15.12.2014 (day.month.year)
Time	12:57:21 (hour.minute:second)
IP-Address	10.10.25.193
Netmask	255.255.0.0
Gateway	10.10.20.9
MAC-Address	00:17:9C:00:15:39
Torque unit	N·m
Main direction	right
Speed reduction	active
Start release	inactive
Beeper	never

Figure 17: System data

The following data is displayed:

- Version of main unit: software version of the main unit
- Version of power unit: software version of the power unit
- Date: the date set in the sequence controller
- Time: the time set in the sequence controller
- IP-Address: IP address of the sequence controller
- Netmask: bitmask of the sequence controller network element
- Gateway: IP address of the gateway set in the sequence controller
- MAC Address: hardware address of the Ethernet port
- Torque unit: the set torque unit
- Main direction of rotation: set direction of rotation for a standard screwdriving application
- Speed reduction: automatic decrease of the speed at 80% of the target torque
- Start release: control of the 'Ready'-state by a higher level controller
- Beeper: Setting for the signal sound at the end of the screwdriving application
 - always
 - only O.K.
 - only NOT O.K.
 - never

Figure 18 shows the lower part of the system data configuration page. The settings are as follows:

Parameter	Value
Gear transmission ratio	1.00
Efficiency	100 %
Direction Change	inactive
Handheld with External Start	inactive
Type of program choice	Fixed Setting
Program (1 - 15):	1
Delay interrupt	1 * 100 ms
Device on Serial Interface	Printer
Baud rate	9600
Print-String	@date_iso @time PG: @prog ST: @step TQ: @torque AN: @angle @errortext

Figure 18: System data, lower part of the page

- Print options
 - values of O.K. and NOT O.K. assemblies
 - only values of O.K. assemblies
 - only values of NOT O.K. assemblies
- Offset gear: If the screwdriver is equipped with an external ancillary transmission, this area indicates the corresponding values for the offset gearing; otherwise, the standard values are displayed.
 - Gear ratio: the offset ratio of the eventual integrated offset gearing
 - Efficiency: the efficiency grade of the offset gear in reference to the torque
 - Direction change: this option indicates whether the offset gear reverses the turn direction of the screwdriver
- Handheld with External Start: displays if handheld screwdriver will be started by a higher level controller (only visible for handheld screwdrivers)
- Type of program choice: indicates via which interface program selection is controlled
- Delay interrupt: delay interrupt set for the handheld screwdriver
- Device for the serial interface: device into which the serial interface is connected
 - printer
 - barcode scanner
 - fieldbus
- Additional data displayed according to the selected device

8.3.4.4 Process Data → Screwdriving Sequences

This page indicates the available screwdriving programs and their parameters.

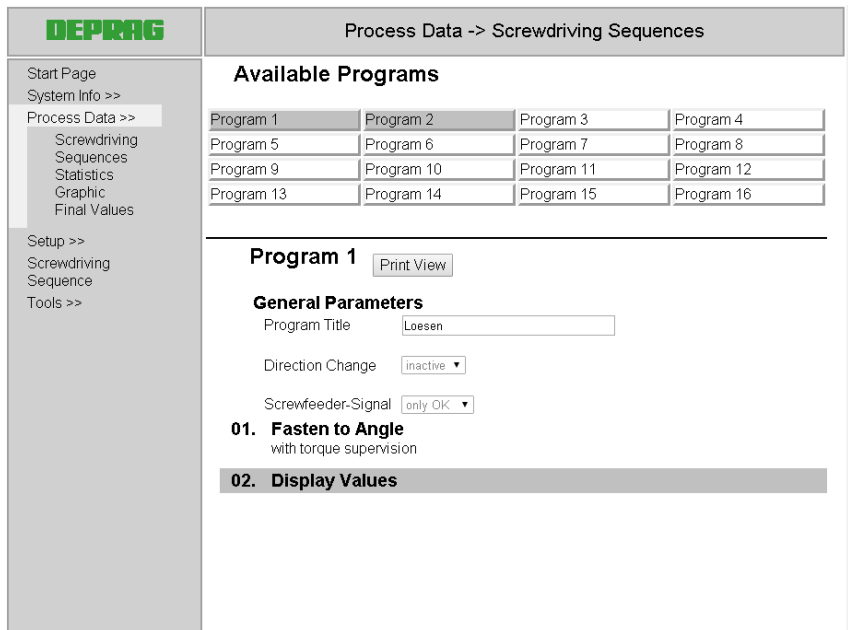


Figure 19: Screwdriving program

This page does not allow generating or changing screwdriving sequences. There are maximum 16 individual screwdriver sequences. Available programs are gray highlighted; the buttons for other programs remain white.

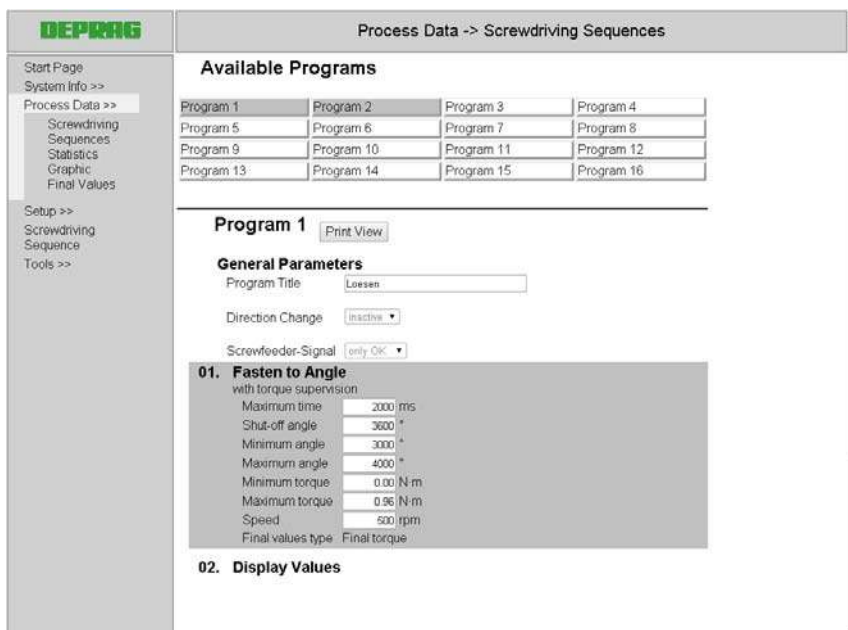


Figure 20: Screwdriving program with displayed parameter values

8.3.4.5 Process Data → Statistics

Here, the statistics for all programs are displayed. You can select the program for which the statistic should be displayed. This is done by clicking the respective button.

(Also refer to [12.3 Statistic](#))

Click on the delete button to delete the statistics for the selected program.

If you want to alter the limit values for the Cp- and Cpk-calculations enter the required values into the fields “Cp-lower limit” and “Cp-upper limit” in the column torque or angle and then click on “Apply”. With one click on “Undo” the altered limit values will return to the standard values of +/- 15 %.

Figure 21: Statistics

Click on “Refresh data”, if further screw assemblies have been carried out whilst the statistics page has been open.

In the lower half of the page the statistics data and the limit values of all programs can be deleted.



IMPORTANT

Statistic values are only saved and analyzed if the "statistic" command in the screwing sequence is open.

8.3.4.6 Process Data → Graphic

This page provides the possibility to load the data of the last screwing application as a data from the sequence controller AST11. In principle, all screwing applications are recorded. The record will be available until the sequence controller AST11 is switched off or a new screw connection is established. It is furthermore possible to download, free of charge, the viewing program GRAPH10(E) for the binary curve data.

If you click the blue note on the "Viewer for the display of binary data" then you will first receive a detailed description of the installation of the GRAPH10 viewer. At the end of the description you will find information to load the program onto your PC.

(Also refer to [12.2 Curve Representation](#))

Figure 22: Downloading curve data

The following data are recorded:

- speed
- torque
- angle
- program step
- current
- screwdriver temperature

8.3.4.7 Process Data → Final Values

This page offers the possibility to save the final values of all assemblies of the last seven days as csv-values (refer to [12.1 Final values](#)).



Figure 23: Screwdriver results

The files have the same limits for CSV-data as described in [12.2 Curve Representation](#).

The final values, which are older than seven days, will be replaced by new final values.

Additionally the final data of the last screwdriving are saved into a file called “actual.csv”. This file can also be downloaded from this page.



IMPORTANT

This data are only available, if the screwdriving program contains the command „Save Values“ or if a sequence error has occurred.

8.3.4.8 Setup → General Settings

Here it is possible to perform most settings for the sequence controller AST11.

Figure 24: General settings

A description of the individual parameters can be found in Chapter [10 Settings](#).

Click "Submit" to transfer the settings to the sequence controller AST11. Click "Default Values" to restore the default values (delivery status).

In the lower part of the page you can save your settings in order to transfer them to other sequence controllers Type AST11, or to reload later.

Figure 25: General settings - lower part of the page

After clicking the "Create Backup" button, a dialog is opened in which you can set the name and location of the back up file.

In order to transfer back up copy to the sequence controller AST11 you must enter the file name and path in the lower input field and click "Load Backup". Alternatively you can select the file by clicking the "Search..." button next to the input field.

8.3.4.9 Setup → Time

Here, you can enter the date and time of the sequence controller AST11.

Figure 26: Date / Time

8.3.4.10 Setup → F-Control

If you use the F-control function, use this area to do the appropriate adjustments.

Figure 27: Setup F-Control

More information on the F-Control function you find in chapter [9 F-Function](#).

8.3.4.11 Setup → Password

On this page you can set the password for the access to the sequence controller AST11.

Figure 28: Change password

The password is only valid for changes to the settings of the sequence controller AST11, not for the complete access.

8.3.4.12 Setup → Serial Device

On this page you can set which device is connected to the multi-functional serial interface. If there is no device connected, select “no device”.

8.3.4.12.1 Printer

The screenshot shows the DEPRAG Setup -> Serial Device interface. On the left is a navigation menu with options: Start Page, System Info >>, Process Data >>, Setup >> (selected), General Settings, Time, New password, Serial Device, Extensions, Screwdriving Sequence, and Tools >>. The main area is titled 'Setup -> Serial Device'. It features a dropdown menu for 'Device on Serial Interface' set to 'Printer'. Below this is a 'Baud rate' dropdown set to '9600'. A 'Print-String' field contains the text '@date_iso @time PG: @prog ST: @step TO: @torque AN: @angle @errortext'. A 'Submit' button is located below the print string. At the bottom, a table lists available commands and their output formats.

Commands	Output	Output Format	
@date_euro	Date Euro-Format	day month year	24
@date_usa	Date US-Format	Month/Day/Year	04
@date_iso	Date ISO-Format	Year-Month-Day	20
@time	Time	Hour:Minute:Second	07
@step	Step Number	Value	3
@torque	Torque	Value Unit	0.:
@angle	Angle	Value Unit	10
@prog	Program Number	Value	1
@errornum	Status / Error Number	Value	0
@errortext	Status / Error Text	Error Text	TC
@runtime	Run Time	Value Unit	0.:
@torqueLL	Torque Lower Limit	Value Unit	0.0
@torqueUL	Torque Upper Limit	Value Unit	0.:
@angleLL	Angle Lower Limit	Value Unit	10

Figure 29: Printer settings

The following settings can be altered:

- Baud rate: the baud rate which the printer receives data
- Printed text: variable text which should be printed after a screw assembly

Under printed text you can determine what should be printed if a screwdriving program uses the command “Print”. The printed text is printed as entered whereby the variables are replaced by the relevant values. Variables always begin with the '@' symbol and must end with a space character. A detailed description of the printouts and variables available can be found in [12.4 Print output](#).

8.3.4.12.2 Fieldbus module

On this page all general settings for the (optional) fieldbus module can be found. The specific settings for the installed fieldbus module can also be carried out on this page, see also [10.1.2 Special parameters for fieldbus systems \(optional\)](#).

The screenshot shows the DEPRAG Setup -> Serial Device interface. The left navigation menu is the same as in Figure 29. The main area is titled 'Setup -> Serial Device'. The 'Device on Serial Interface' dropdown menu is set to 'Fieldbus Module'. Below this is a button labeled 'Search for fieldbus module'.

Figure 30: Selection of fieldbus

First click on the button “Search for fieldbus module”, so that the AST11 establishes a connection with the fieldbus module connected.

DEPRAG		Setup -> Serial Device	
Start Page System Info >> Process Data >> Tools >>	Device on Serial Interface Fieldbus Module ▼		
	EtherCAT This fieldbus type needs no settings. Submit		

Figure 31: Settings for fieldbus, EtherCAT example

DEPRAG		Setup -> Serial Device	
Start Page System Info >> Process Data >> Tools >>	Device on Serial Interface Fieldbus Module ▼		
	EtherNet/IP IP-Address 10 . 10 . 24 . 11 Netmask 255 . 255 . 0 . 0 Gateway 10 . 10 . 20 . 9 DHCP inactive ▼ BootP inactive ▼ Submit		

Figure 32: Settings for fieldbus, EtherNet/IP example

DEPRAG		Setup -> Serial Device	
Start Page System Info >> Process Data >> Tools >>	Device on Serial Interface Fieldbus Module ▼		
	Profibus DP Profibus-Address 2 Submit		

Figure 33: Settings for fieldbus, Profibus example

DEPRAG		Setup -> Serial Device	
Start Page System Info >> Process Data >> Tools >>	Device on Serial Interface Fieldbus Module ▼		
	ProfiNet IO IP-Address 10 . 10 . 24 . 10 Netmask 255 . 255 . 0 . 0 Gateway 10 . 10 . 20 . 9 Station name nic50repns Submit		

Figure 34: Settings for fieldbus, ProfiNet example

Click on “Submit”, to transfer the settings to the AST11.

8.3.4.12.3 Barcode-Scanner

If a barcode scanner is connected to the sequence controller via the serial interface then the relevant settings can be carried out here. Details can be found in the instruction manual of your barcode scanner.

The screenshot shows the 'Setup -> Serial Device' window in the DEPRAG software. On the left is a navigation menu with options: Start Page, System Info >>, Process Data >>, Setup >>, General Settings, Time, New password, Serial Device, Extensions, Screwdriving, Sequence, and Tools >>. The 'Serial Device' option is selected. The main area is titled 'Setup -> Serial Device' and contains the following settings:

- Device on Serial Interface: Barcode Scanner (dropdown)
- Baud rate: 9600 (dropdown)
- Data Bits: 8 (dropdown)
- Stop Bits: 1 (dropdown)
- Parity: even (dropdown)
- End marker for barcode: 0x0A (dropdown)
- Range mask: A row of 30 checkboxes, with checkboxes 9 through 11 highlighted in blue.
- Scancode mapping: A table with 11 rows for Program 1 to Program 11. Each row has two input fields: 'Scancode from' and 'Scancode to'.

Program	Scancode from	Scancode to
Program 1:	000	009
Program 2:	010	011
Program 3:	020	021
Program 4:	030	031
Program 5:	040	041
Program 6:	050	051
Program 7:	060	061
Program 8:	070	071
Program 9:	080	081
Program 10:	090	091
Program 11:	100	101

Figure 35: Settings for Program selection via barcode

The following settings can be altered:

- Baud rate: the baud rate at which the barcode scanner works
- Data Bits: data bits selected can be 5, 6, 7 or 8
- Stop Bits: stop bits selected can be 1 or 2
- Parity: the parity can be selected from none, even or odd
- End marker for barcode: end marker which the barcode scanner sends once a barcode has been read. Any character within the range 0x0A – 0x0F.
- if a barcode is selected for Program Choice in the Basic Settings then the following settings are available:
 - Range mask: this determines which part of the scan code read for program choice is used. Only one mask can be set which is valid for all programs.
 - Scan code mapping: for each program from 1 to 15 a range of codes is selected for each of the programs. The start and end of these ranges is entered. The ranges may not overlap. If only one code is required for the Program Choice then the same start and end code can be entered.



IMPORTANT

The length of the barcode must be a maximum of 30 characters.

8.3.4.13 Setup → Extensions

On this page you are able to activate options of the AST11.

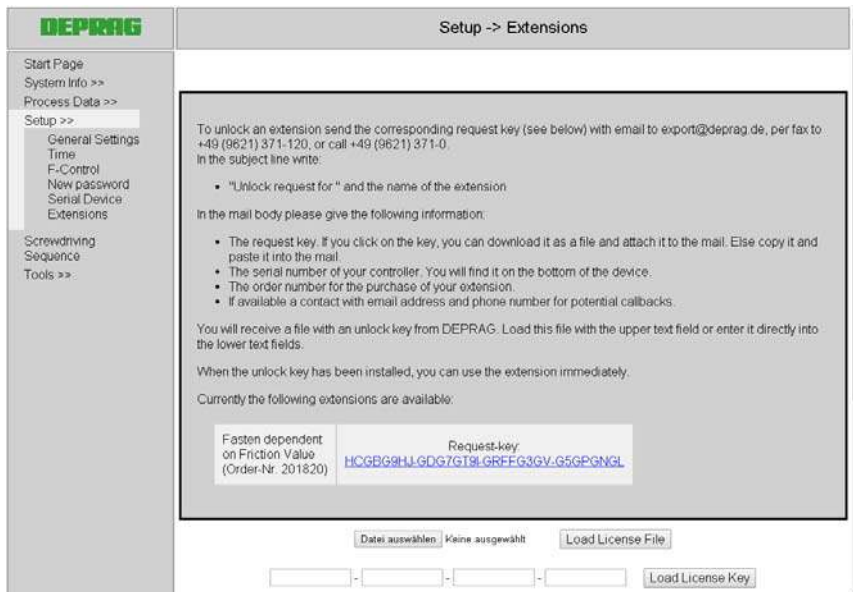


Figure 36: Activating options

Different options are available, at extra cost, for the sequence controller AST11 (also refer to [17.10 Optional software packages](#)).

To activate these options please contact the DEPRAG sales department or your DEPRAG dealer.

In order to be able to perform the activation, some information is required which must be contained in your order:

- Activation key of the respective option
- Serial number of the sequence controller

The activation key can be found to the right, next to the respective option. The key can either be directly copied and inserted in an email or saved by clicking the file.

You will receive a license file for the activation, which contains the respective activation key. The activation key can be entered directly on the bottom of the page or by clicking the button "load key".

- - -

As an alternative, the license data can be also directly loaded. To do this, click on the button "search....." and select the respective file. Click "load license data".

Once the activation key is loaded, the option is displayed as released and can now be used.

8.3.4.14 Screwdriving sequence

You may display, create and edit screwdriver operations on this page.

Making changes is possible only if the correct password has been entered at the time of login, otherwise the information is merely displayed.

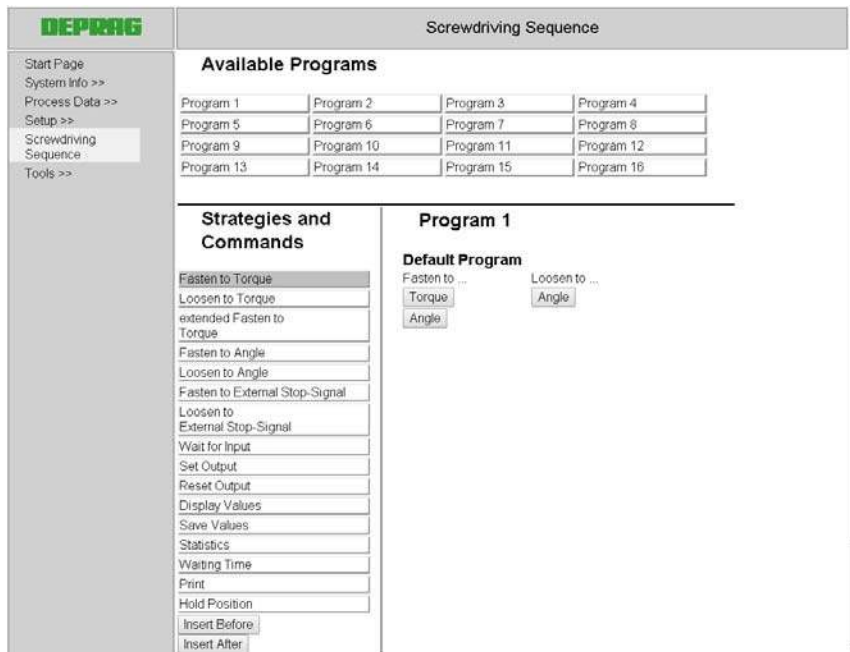


Figure 37: Screwdriving sequence – empty program

If there is no program a standard program can be created. Select the type of program and then it will be created by the sequence controller AST11.

For a detailed description of the screwdriving strategies and commands see [11 Screwdriving Strategies and Commands](#).

You are able to create up to 16 programs. It is easy to detect which programs already exist; they are highlighted in Grey on the respective button.

If you would like to process a program or create a new program, click the button with the corresponding program number.

General parameters:

There are three parameters for each program, which affect the complete program:

- Program title: Any designation with a character length limit of 16 characters. The title is intended for easier labelling of the program and has no effect on the screwdriving sequence. The program name must not contain any special characters.
- Direction change: Determines if another main rotational direction applies for this program as in the general settings. If for example the rotational direction is set to the right, the program will screw to the left if the direction change is active.
- Screw feeder signal: Determines when the reload signal is given to the feed screw-drivers.
 - always: after each screwing application the reload signal is issued.
 - only OK: the reload signal is only issued after an OK screwing application.
 - never: the sequence controller provides no reload signal.

Adding steps to the program:

Option 1:

Select a screwdriver pattern or a command by clicking on it. Keep the mouse button pressed and drag the screwdriver pattern or the command to the desired position in the screwdriver program. Insert the screwdriver pattern or the command by releasing the mouse button.

Option 2:

Select an available program step by clicking this step. Subsequently click the strategy or the command that you like to insert. If you click "insert before", the strategy or command should be inserted in front of the currently selected program step or click "insert after", if the strategy or the command should be inserted behind the currently selected program step.



IMPORTANT

If the screwing program is still empty, then the strategy or command is always inserted as first parameter step.

Available Programs			
Program 1	Program 2	Program 3	Program 4
Program 5	Program 6	Program 7	Program 8
Program 9	Program 10	Program 11	Program 12
Program 13	Program 14	Program 15	Program 16

Strategies and Commands

- Fasten to Torque
- Loosen to Torque
- extended Fasten to Torque
- Fasten to Angle
- Loosen to Angle
- Fasten to External Stop-Signal
- Loosen to External Stop-Signal
- Wait for Input
- Set Output
- Reset Output
- Display Values
- Save Values
- Statistics
- Waiting Time
- Print
- Hold Position
- Insert Before
- Insert After

Program 1 [Print View] [Remove]

General Parameters

Program Title: Loosen

Direction Change: inactive

Screwfeeder-Signal: always

01. Fasten to Angle [Remove]

with torque supervision

- Maximum time: 2000 ms
- Shut-off angle: 3600 °
- Minimum angle: 3000 °
- Maximum angle: 4000 °
- Minimum torque: 0.00 N m
- Maximum torque: 0.96 N m
- Speed: 500 rpm
- Final values type: Final torque

02. Display Values [Remove]

[Submit] [Submit As: 1]

Figure 38: Screwdriving sequence

View/process a program step:

Select an available program step by clicking this step. The parameters of this step are displayed. A new value can be directly entered in the input field next to the parameter.

Save program:

Click the "Submit" button, which can be found below the last program step in order to save the program step and the parameters.

Copy program:

If you want to save an available program under another program number, select the new program number from the list field next to the "submit as" button. The "submit as" button can be found below the last program step. Subsequently click on "submit as" in order to save the program under a new number.

Printing a program:

If you would like to print out a program, click on the "Print Preview" button. To return to the normal view, press the "Normal View" button.

Deleting a program step or a program:

If you would like to delete individual program steps, click on the "Remove" button of the step that needs to be deleted. If you would like to delete the entire screwdriver program, click on the "Remove" button on the right next to the title of the screwdriver program. If you would like to delete all screwdriver programs, first click on the 'General' tab and then on the "Delete all programs" button.



IMPORTANT

A program step, a complete program or all programs are deleted immediately without a confirmation prompt.

Create / Load backup:

At the lower part of the page you may

- back up existing programs
- saved programs can be restored and
- all programs can be deleted.

After clicking the "Create Backup of all Programs" button, a window is opened in which you can set the name and location of the back up file.

In order to restore saved programs, enter the file name and path in the input field and click "Load Backup ". Alternatively you can select the file by clicking the "Search..." button next to the input field.

8.3.4.15 Tools → Manuals

On this page you can transfer and read all available manuals for the sequence controller AST11.

If your browser has a pdf plug in, then you can read the manuals directly in the browser.

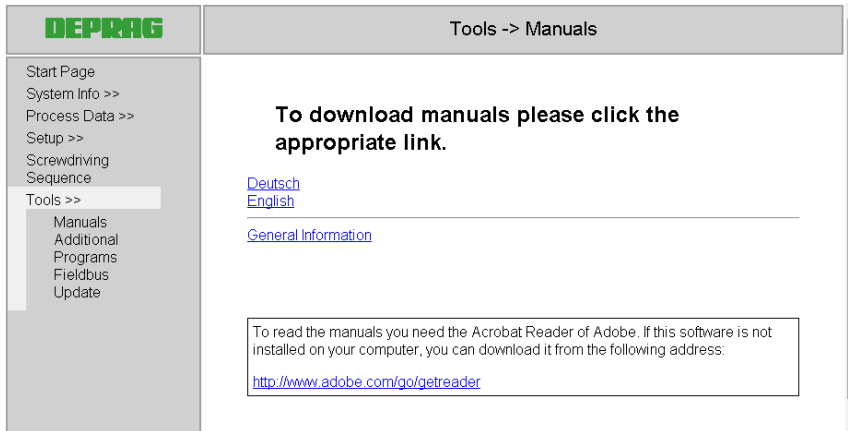


Figure 39: Manuals

8.3.4.16 Tools → Additional Programs

On this page you can download all programs which are available for the controller AST11. Usage of the software is partly liable to pay costs. Please consider the notes regarding the activation in the respective programs.

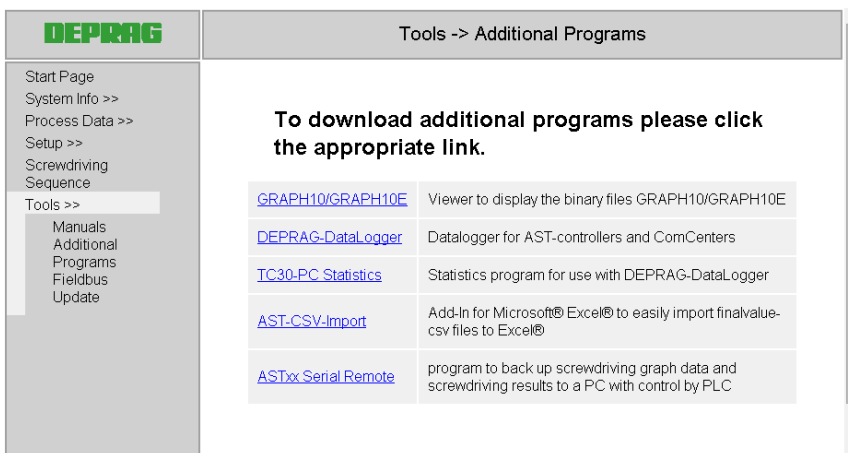


Figure 40: Additional programs

8.3.4.17 Tools → Fieldbus

On this page, you may download all fieldbus drivers available for the AST11 sequence controller.

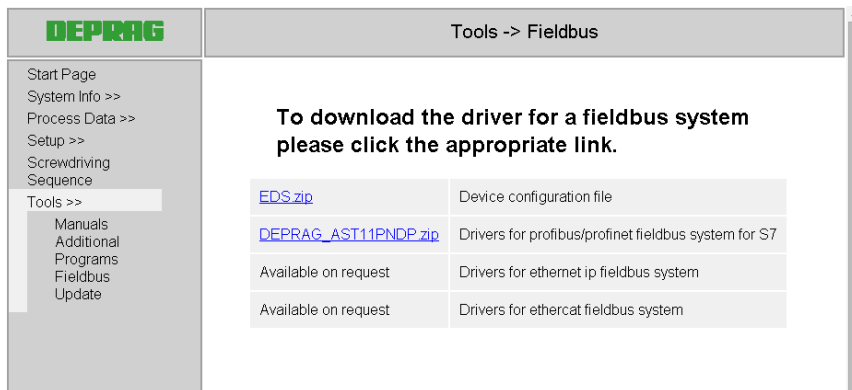


Figure 41: Fieldbus

8.3.4.18 Tools → Update

New software can be loaded onto the sequence controller in the Update menu (also see [13.1 Updating the software](#)).

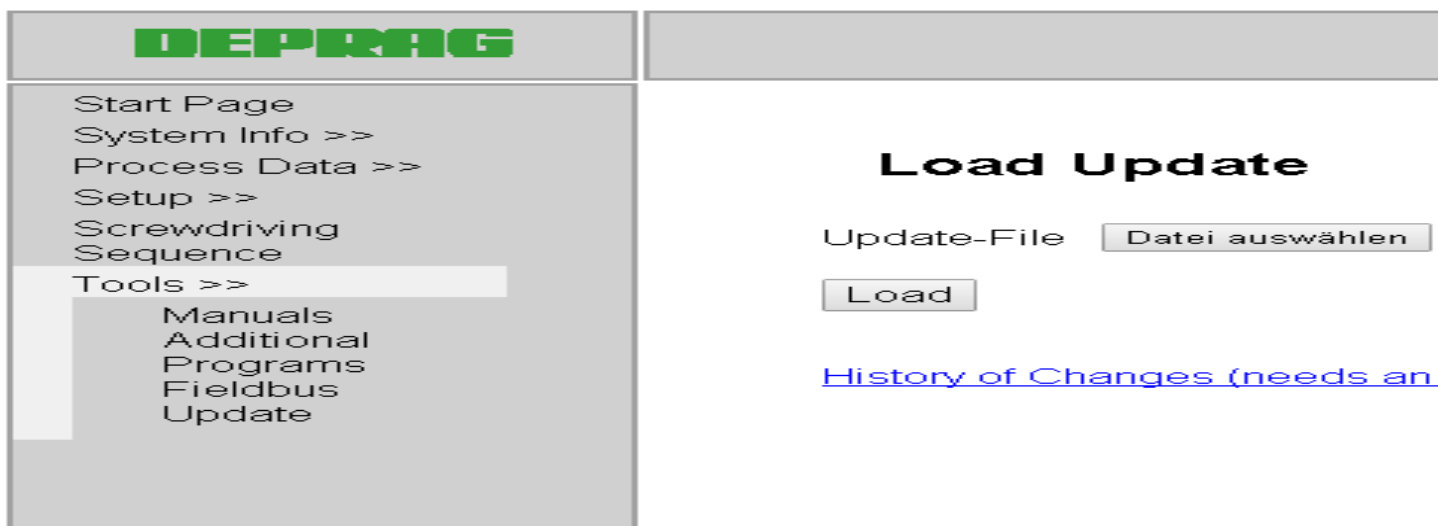


Figure 42: Update

9 F-Function

9.1 General

The F-function of the AST11 offers – besides the supervised values of torque and angle – the following additional possibilities:

- Supervision of total duration of an assembly and with this option it is possible to detect incorrect screw threads, missing washers or an indirect depth control.
- The number of screw joints per product. With this option it is possible to assure that each product is completely assembled.

The adjustment for the F-function on the sequence controller is located in the menu Setup → Optional Parameters → F-Control → Settings and at the web interface in the menu Setup → F-Control.



IMPORTANT

The F-Functionality is only possible with handheld screwdrivers!

9.2 Functionality

9.2.1 General

If the F-function is activated and adjusted to the screw-joint, then the assembly can be started. Position the Screwdriver directly and perpendicular to the screw location. The screwing sequence starts according to the design of the screwdriver either with push-to-start or with button start.

Once the programmed shut-off condition is achieved, the screwdriver shuts off. However, the total cycle time of the screwdriver has to be within a pre-determined time-frame. If this is the case, then the screwdriver is ready for the next assembly.

Otherwise, an error message is shown on the display, the RED LED glows and the sequence controller doesn't release the screwdriver (no Ready-Signal, i.e. no green LED). After resetting the error (either with the reset button on the sequence controller or through the PLC-port), the screwdriver is again ready for operation.

If additionally the number of screw joints per part has to be controlled, then the controller will give an acoustical signal – once the pre-programmed number of O.K. screw joints are reached – and the display indicates that the part has to be changed. The screwdriver is blocked by the AST11 sequence controller, until a new part is presented (loaded). Thereafter, the assembly continues as before.

The screwdriver programs 1 through 15 can be extended to include an individual time-window, as well as the number of screw joints per part.

However, per product only one program can be used, which means that a program change is only possible with a corresponding part change.

The screwdriving program 16 can be used as well, but it is not supervised by the F-function, which means that errors do not have to be reset and O.K. Screw joints will not increase the number of O.K. screw joints per part. The program 16 may be used as a loosening program to correct errors. If this is not allowable, then deactivate program 16, or remove program 16 if it is already activated!

The error evaluation is identical to the error evaluation under normal operation of the AST11; however, the following additional supervisory criteria are evaluated:

- Time-Frame for the total-time of the screw-process

- If a part-presence sensor is used: Presence of the part

The following additional errors or informational notes are shown:

Error Number	Displayed Text	Meaning
0	OK	no error
1	TOO SHORT	the predetermined minimum time of the screw-process was not reached
2	TOO LONG	the predetermined maximum time of the screw-process was exceeded
3	PART MISSING	no part is present
4	CHANGE PART	the predetermined number of individual O.K. screw-joints per part has been reached! Change part!

Table 16: Errors of F-function

9.2.2 Operation with supervision of number of screw-joints per part

This operational mode is activated if the amount of individual screw-joints per part is input into the screwdriving program with a number larger than ZERO.

With this operational mode, the time-frame in the menu item “Settings → Programs → Time Frame” will be activated. The number of individual screw joints in the menu item “Settings → Programs → Number of screw joints” will be controlled as well.

If the screwdriver does not shut-off within the predetermined time-frame, then an error message will be shown on the display and the RED status-light glows. If the part is removed prior to reaching the predetermined number of O.K. screw-joints per part, then an error „Part Missing“ is displayed.

If the correct number of O.K. screw-joints is reached, the controller will give an acoustical signal and the display indicates „Change Part“. If the screwdriver is used on the same, already assembled part, the AST11 controller blocks the screwdriver, until a new part is presented (loaded). Thereafter, the screwdriver is ready for the next screwing sequence.

This operational mode also allows to lock the part, e.g. with a locking-cylinder. For this option use the output „Magnetic Valve“ on the Interface F-controller. The part will only be released, when the correct amount of O.K. screw-joints per part are reached.

If the part has to be removed prior to reaching the predetermined number of O.K. Screw-screw joints (because of an error), then the output can be released through the higher level controller or by using the right function key on the sequence controller (if activated).

9.2.3 Operation without the supervision of number of screw-joints per part

This operational mode is active, if the number of screw-assemblies per part is input into the screwdriving program with a ZERO.

Then the AST11 reacts to incorrect screw-joints as described in [9.2.2 Operation with supervision of number of screw-joints per part](#). However, the monitoring of O.K. screw-assemblies per part is inactive. If a part-sensor for part presence or a PLC is connected, then this operational mode will not be evaluated.

9.3 Menu Functions for the F-Function

9.3.1 Settings

9.3.1.1 Activate

The system offers a choice between „Activate F-Function“ yes or no.

Make your selection with the cursor keys. Confirm your selection with the ENTER-key and exit this menu with the ESC-key.

9.3.1.2 Reset Button

The system offers a choice between „Reset by Button“ yes or no.

Make your selection with the cursor keys. Confirm your selection with the ENTER-key and exit this menu with the ESC-key.

If the reset button is active, then an error reset is possible on the sequence controller, otherwise a reset signal has to be given over the PLC-port.

9.3.1.3 Part Clearance

The system offers a choice between „Part Clearance by Button“ yes or no.

Make your selection with the cursor keys. Confirm your selection with the ENTER-key and exit this menu with the ESC-key.

If the part clearance by button is active, then the right function key on the sequence controller can make the part clearance, otherwise the part clearance signal has to be given over the PLC-port.

9.3.1.4 Programs

Use the menu item „Programs“ to change the parameter for the F-function of each individual program.

First, input the program number, then change the number of screw-joints per part and the time frame.

9.3.1.4.1 Number of Screw-joints

You may input the number of the required O.K. screw-joints per part.

To change the value, proceed as follows:

- Use the left function key „Modify?“
- input value
- confirm your input with the ENTER-key

Use the right function-key „Set?“ to activate your setting.

9.3.1.4.2 Time Frame

The time frame for the screw-joint may be changed.

To change the value, proceed as follows:

- Use the left function key „Modify?“
- input the value for the minimum cycle time and confirm the input with the ENTER-key
- then input the value for the maximal cycle time and confirm your input with the Enter-key

Use the right function-key „Set?“ to activate your setting.

9.3.2 Diagnostic Functions

The diagnostic functions allow the operator to analyze each screw-joint and to automatically establish values for the time-frame. These values are only estimates and have to be fine adjusted, if needed.

The analysis acquires values from 5 screw-joints.

Proceed as follows:

- First, input the program number, which is used for the analysis.
- Thereafter, process the first screw-joint; the actual screwdriving time is displayed.
- Now, process the next screw-joint, and so on.

After the fifth screw-joint, the minimum and maximum screwing time is displayed, with an added upper and lower 20% offset. Use the left function key to activate this setting.

Error screw-joints will be ignored!

You may leave the diagnostic function at any time by pressing the ESC-key, without saving any of the adjustments.'



IMPORTANT

If a feeder is attached to the screwdriver, the screw has to be manually reloaded, so that this diagnostic analysis can be made.

9.4 Interfaces

A detailed description of the ports can be found in the section [6.2.5 I/O Interface](#).

10 Settings

10.1 Description of the adjustable parameters

10.1.1 Parameters of the System Settings

Parameter	Description
IP Address	The IP address via which the AST11 can be reached in the network.
Network mask	It indicates the network segment in which the sequence controller AST11 is located.
Gateway	The IP address of the gateway for the network segment in which the sequence controller AST11 is located.
Display contrast	The display contrast can only be set on the sequence controller.
Language	The language that should be displayed in the web interface as well as also the operating interface of the sequence controller AST11.
Torque unit	The torque unit that is used for display and settings of torque values. Available units are: • N·m • N·cm • ft·lb. • in·lb. • kg·m • kg·cm
Main direction of rotation	The main direction of rotation indicates what direction is defined as screwing application. The main direction right means that all screwing samples will operate rotating to the right, all screw samples to release with rotate to the left.
Speed reduction	If the rotation speed decrease is active then the torque screwing levels, that do not have torque transfer occurring, will automatically lower the rotation speeds when 80% of the target torque is reached. This provides a higher cut-out accuracy.
Start release	If the clearance to start is active then a screwing application can only be started, if 24 V are available at the start release input (also refer to 6.2.5 I/O Interface). Otherwise the controller will not be ready for a screwdriving cycle.
Beeper	Determines under which conditions the signal sound is released at the end of the screwing process.
Print options	Determines what should be printed if a program uses the command "Print" and a printer is connected to the serial interface.
Torque adjustment	Adjustment factor for the torque calculation for special screw joints

Maintenance interval	The maintenance interval determines after how many screwdriving procedures the screwdriver should be checked/undergo maintenance. If a maintenance interval is entered then the sequence controller AST11 signals that the next maintenance of the EC screwdriver is due. This message can be acknowledged by pressing the ESC key and work can continue as normal. The message will appear at regular intervals i.e. if another hundredth of a maintenance interval has passed since the first signal. If the maintenance interval is set to 0 no signal will appear.	
Offset gear	Gear transmission ratio	Transmission ratio for the adapter gear
	Efficiency	Effectiveness of the adapter gear
	Direction change	Specifies whether the adapter gear causes change of direction.
Handheld with external start	Determines that a handheld screwdriver should be started via external start signal (Fieldbus or I/O interface). This setting only appears for handheld screwdrivers.	
Type of program choice	You can set the type of program choice: • fixed setting: the program number set in the menu PG-Setting will always be started • keys: the number keys on the keyboard are used to select program number. This function is not available if F-Function is activated. • Barcode: selection of program depends on barcode read • Inputs ports: selection of program number via I/O interface • Fieldbus: selection of program number via fieldbus connected to serial interface	
Program	The number of screwdriving procedures which should be carried out once screwdriver is started if the program choice is on "fixed setting".	
Delay interrupt	The set abort delay prevents that a screwing process is evaluated as aborted, if the start signal of the screwdriver separates, but is present again within the set time. This is especially important in connection with a screw feeder device to prevent errors during the pushing through of the screw through the mouth piece. This setting only appears for handheld screwdrivers.	
Password	The menus of the sequence controller in which changes can be performed can be password protected. The password can be in a range of 0000 to 9999 and must be four-digit. If 0000 is set as a password then all menus at the sequence controller are freely accessible. In delivery state the password is set to 0000.	
Date / Time	Setting for the internal real-time clock of the sequence controller.	

F-Control	active	Indicates whether F-control is active.
	Reset by Button	If there is an error in screw assembly the reset button can be pressed.
	Release by Button	Once screw assembly on a part is finished this button releases the part.
	Number of Cycles	Number of screw assemblies per component
	Minimum Time	Minimum screw assembly time
	Maximum Time	Maximum screw assembly time

Table 17: Adjustable parameters

10.1.2 Special parameters for fieldbus systems (optional)

10.1.2.1 Profibus

Parameter	Description
Profibus address	Address under which the AST11 is accessible in the Profibus.

Table 18: Configurable Profibus parameters

10.1.2.2 Profinet

Parameter	Description
IP address	The IP address via which the AST11 is accessible in the network via Profinet.
Net mask	It designates the network segment in which the AST11 sequence controller lies.
Gateway	The IP address of the gateway for the network segment in which the AST11 sequence controller lies.
Station name	Station name of the AST11 in the Profinet.

Table 19: Configurable Profinet parameters

10.1.2.3 Ethernet IP

Parameter	Description
IP address	The IP address via which the AST11 is accessible in the network via Ethernet IP.
Net mask	It designates the network segment in which the AST11 sequence controller lies.
Gateway	The IP address of the gateway for the network segment in which the AST11 sequence controller lies.
DHCP	If DHCP is active, the network addresses set / displayed are not valid. They are assigned via a DHCP server.
BOOTP	If BOOTP is active, the network addresses set / displayed are not valid. They are assigned via BOOTP.

Table 20: Configurable Ethernet IP parameters

10.1.2.4 Ethercat

No settings are necessary.

10.2 Default Values

10.2.1 System Settings

The default values can be adjusted as follows:

- in the menu System → Opt. Parameters → Default Values at the control, press the left function key
- click the "Default Values" button in the web interface in the Settings menu → General Settings.

Parameter		Value
Display contrast		195
Language		english
Unit for torque		Nm
Main direction of rotation		right
Speed reduction		active
Start release		inactive
Beeper		never
Print options		always
Offset gear	Gear transmission ratio	1
	Efficiency	100%
	Direction change	no
Type of program choice		fixed setting
Program		1
Password		0000
Delay interrupt		3
F-Control	active	no
	Reset by Button	inactive
	Release by Button	inactive
	Number of Cycles	0
	Minimum Time	0
	Maximum Time	0
Statistic: Limits for CP/CPK value		+/- 15 %

Table 21: Default Values

10.2.2 Special parameters for fieldbus systems (optional)

Profibus:

Parameter	Value
Profibus address	64

Table 22: Default values for Profibus

Profinet:

Parameter	Value
IP address	10.10.24.10
Net mask	255.255.00
Gateway	10.10.20.9
Station name	nic 50 repns

Table 23: Default values for Profinet

Ethernet IP:

Parameter	Value
IP address	10.10.24.11
Net mask	255.255.0.0
Gateway	10.10.20.9
DHCP	inactive
BOOTP	inactive

Table 24: Default values for Ethernet IP

Ethercat:

No settings are necessary.

11 Screwdriving Strategies and Commands

11.1 Screwdriving Strategies

11.1.1 Fasten / Loosen to Torque

The screwdriving strategy fasten / loosen to torque is a tightening / loosening process with stop control via parameter torque. Angle monitoring is possible as an option.

Strategy Description:

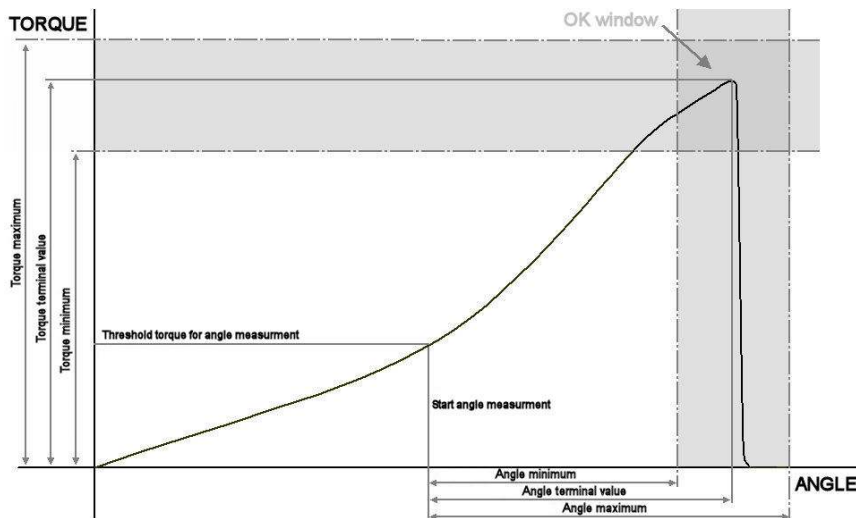


Figure 43: Screwdriving Application to torque

Strategy description:

At the start of the screwdriving sequence cycle time monitoring is started. Cyclic torque measurements are performed. If the angle measurement option is active then angle measurements are performed additionally starting at the pre-selected torque threshold.

Shut-off criteria:

The screwdriving process is ended once the:

- Target torque is achieved
- the maximum screwdriving time (monitoring time) is exceeded
- the maximum angle of rotation is reached (only for angle monitoring)

Analysis:

OK evaluation:

The screwdriving sequence is considered OK (fault free), if the shut off is achieved via torque and the torque value is within the preset limits.

With optional Angle monitoring active the angle value must also be within the preset limits.

Not OK analysis:

The screwdriving sequence is evaluated as Not OK (faulty) if the final torque value is outside the preset limits or the maximum screwdriving time has been exceeded.

If angle monitoring is active the screwdriving sequence is evaluated as Not OK, if the angle value is outside the preset upper and lower limits.

Parameters:

The following parameters are used in the screwdriving Sequence:

- Supervision time: maximum time until the cut-out torque is reached
- Shut-off torque, shut-off torque upper/lower limits
- Speed
- Torque holding time
- Angle supervision: active / inactive

if angle monitoring is active the following parameters are added:

- Threshold torque for angle measurement start
- Angle lower limit / angle upper limit

11.1.2 Extended Fasten to Torque

The screwdriving strategy extended fasten to torque is a tightening process with shut off at a preset torque value. Angle monitoring is possible as an option.

Strategy Description:

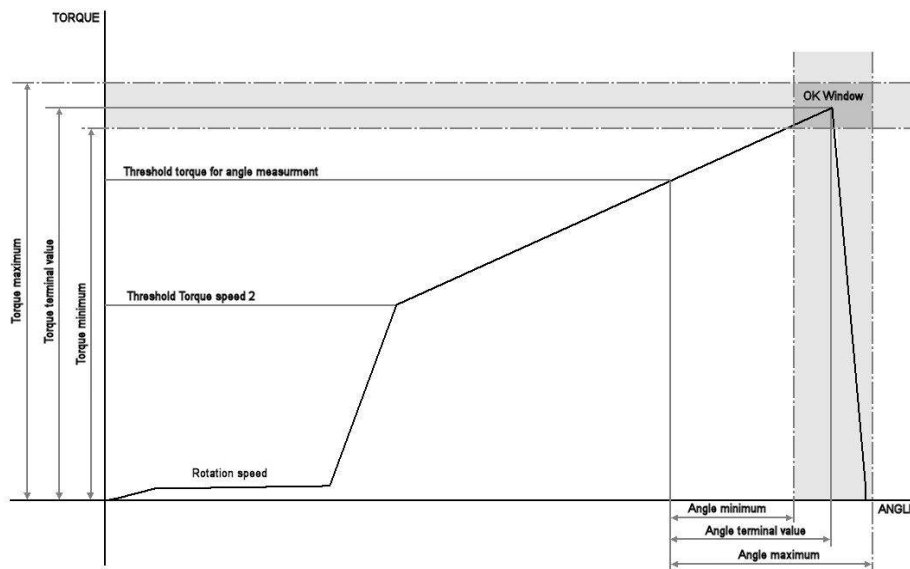


Figure 44: Expanded screwdriving to Torque

Strategy description:

At the start of the first screwdriving sequence/step time monitoring is started and the screwdriving process is started with RPM setting 1. Once the torque threshold for step one has been achieved, Sequence step 2 is started and the speed setting is changed to RPM 2. Cyclic torque measurements are performed. If the angle monitoring option is active then angle measurements are performed in addition starting at the preset torque threshold value (sequence step 2).

Shut-off criteria:

The screwdriving process is ended once the

- target shut-off torque is achieved
- the maximum screwdriving time (time monitoring) is expired
- the maximum angle of rotation is reached (only when angle monitoring is active)

Analysis:

OK evaluation:

The screwdriving sequence is considered OK (fault free), if the shut-off occurs via torque and the torque value is within the preset limits.

If the Angle monitoring option is active the final angle value must be within the preset limits.

Not OK evaluation:

The screwdriving sequence is evaluated as Not OK (faulty) if the final torque value is outside the preset limits or the maximum screwdriving time has been exceeded.

If angle monitoring is active the screwdriving sequence is evaluated as Not OK, if the angle value is outside the preset limits.

Parameters:

The following parameters are used in the screwdriving sequence:

- Supervision time: Maximum time until the shut-off torque is reached
 - shut-off torque, shut-off torque lower / upper limits
 - Speed 1
 - Threshold torque for Speed 2 (step 2)
 - Speed 2
 - Torque holding time
 - Angle of rotation supervision: active / inactive
- if angle monitoring is active the following parameters are added.
- Threshold torque for angle measurement
 - Angle lower limit / angle upper limit

11.1.3 Fasten / Loosen to Angle

The screwdriving strategy fasten / loosen to angle of rotation is a tightening / loosening process with stop control via angular displacement (angle control).

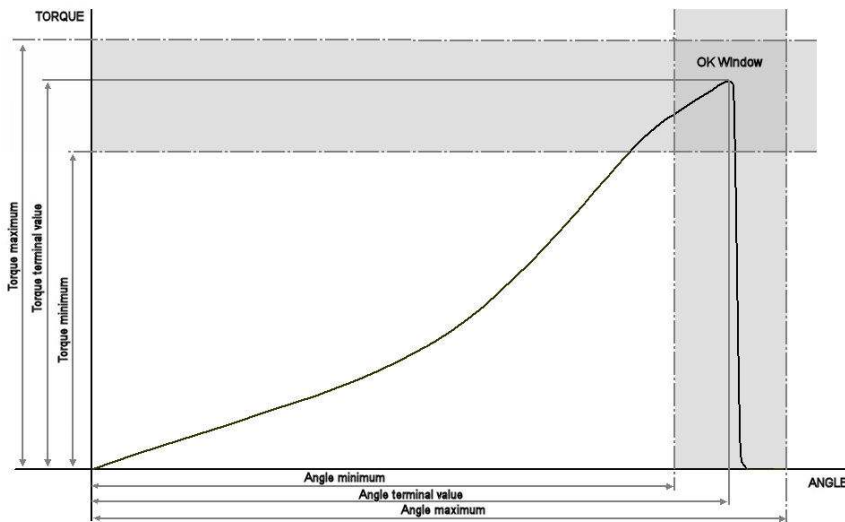


Figure 45: Screwdriving to Angle

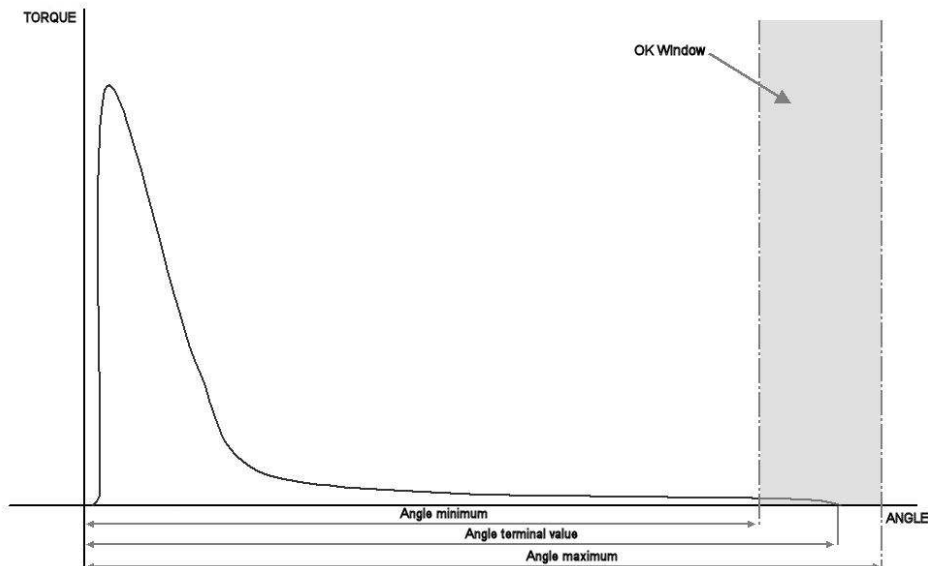


Figure 46: Loosening on Angle

Strategy Description:

At the start of the screwdriving sequence time monitoring and angle measurement is started. Cyclic torque measurements are performed.

Shut-off criteria:

The screwdriving process is ended once the

- shut-off angle is achieved
- the maximum screwdriving time (time monitoring) is exceeded
- the max. torque is reached

Analysis:

OK evaluation:

The screwdriving level is considered OK (fault free), if the screwdriver shut-off occurs via the angle of rotation and the value of the angle measurement is in the preset limits. Furthermore, the torque value must be within the preset limits.

Not OK evaluation:

The screwdriving sequence is evaluated as Not OK (faulty) if the angle of rotation is outside the preset limits or the screwdriving time has been exceeded.

If angle monitoring is active the screwdriving sequence is evaluated as Not OK, if the angle value is outside the preset limits.

Parameters:

The following parameters are used in the screwdriving sequence:

- Supervision time: maximum time until the shut-off angle is achieved
 - Shut-off angle, shut-off angle upper/lower limits
 - Torque upper/lower limits at target angle
 - Speed
 - Result value generation: final torque / maximum torque
- The resulting torque can be displayed as final torque (torque at end of screwdriving) or the maximum torque (maximum torque achieved during the cycle) in the final values.

11.1.4 Fasten / Loosen to external Stop-Signal

The screwdriving strategy Fasten/Loosen to External Stop-Signal is a screwdriving process with switch off to external signal.

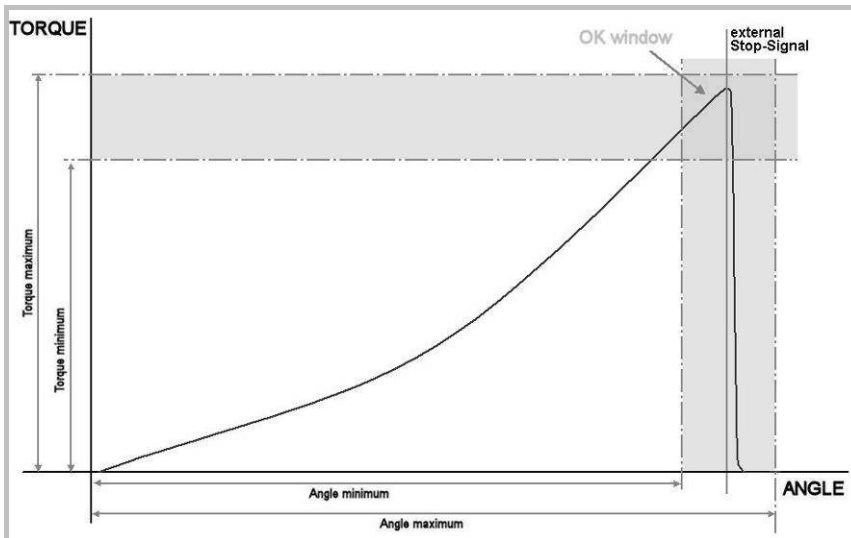


Figure 47: Fasten / Loosen to external Stop-Signal

Sequence of the Screwdriving Strategy:

- at the start of the screwdriving start of the screwdriver with pre-selected speed and time monitoring
- cyclic torque and rotation angle measurement completed
- External stop signal monitored

Switching -Off Criteria:

The screwdriving sequence is completed when

- an external Stop-Signal is received
- the maximum angle is exceeded
- the maximum torque is exceeded

the maximum allowable screwdriving time (time supervision) has run out

Evaluation:

O.K. Evaluation

The screwdriving level is evaluated as OK, if:

- switching off occurs via the external stop signal.
- Torque and angle are within the permissible limits.

NOT O.K. Evaluation

The screwdriving level is evaluated as not OK, if:

- the torque and angle of rotation is outside the set limits.
- the screwdriving time is exceeded.

Parameters:

- Maximum allowable time to reach the shut-off angle (time supervision)
- Shut-Off Angle min / max
- Torque min/max
- Speed

11.1.5 Friction value package (optional)

11.1.5.1 Friction value measurement

The function of the screwing sample is the tightening of a screw, while considering the friction value prior to the head connecting to the surface.

Sequence of the screwing sample

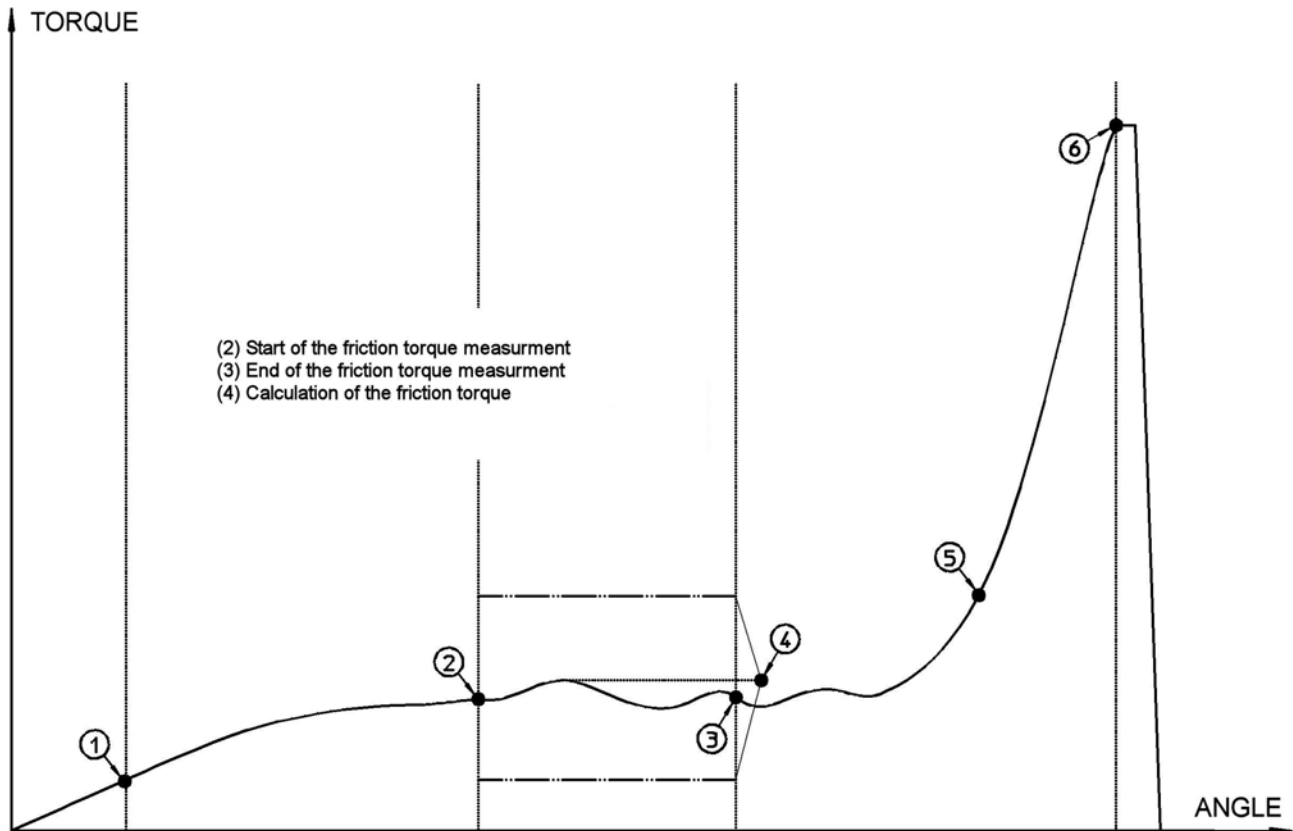


Figure 48: Friction value measurement

Switching off criteria:

The measuring process is ended once the

- end of the measuring range is reached
- a monitoring criteria is reached
- the maximum screwing time (monitoring time) is expired

Analysis:

OK evaluation:

The screwing level is considered OK (fault free), if the friction value has been determined and the value of the torque is in the set limits.

Not OK analysis:

The screwing level is evaluated as Not OK (faulty), if the friction moment in the monitored window is outside the set limits or the determined friction value is outside the indicated limits.

The screwing level is also evaluated as Not OK when the monitoring time is exceeded.

Parameter:

The following parameters are used in the screwing sample:

- Supervision time
Maximum time until the screwing level is aborted
- Angle friction measurement
Input of the angle range in which the friction monitoring should be active.
- Friction value type: Mean value/maximum value
selectively the maximum value or mean value of the friction value can be used to determine the friction torque.
- Friction torque lower limit
Input of a minimum torque that must not be undershot by individual torque values during the friction monitoring.
- Friction torque upper limit
Input of a maximum torque that must not be exceeded by individual torque values during the friction monitoring.
- Friction value lower limit
Input of the minimum torque that must not be undershot by the friction torque.
- Friction value upper limit
Input of the maximum torque that must not be exceeded by the friction torque. The limits of the friction torque can be recorded tighter than the limits of the individual friction values.
- Speed
Input of the rotation speed that should be used for the screwing application.

11.1.5.2 Fasten to differential torque

The function of the screwing sample is the adding of a torque to an occurring torque in the screwing application in a previous stage (e.g. friction measurement).

Sequence of the screwing sample:

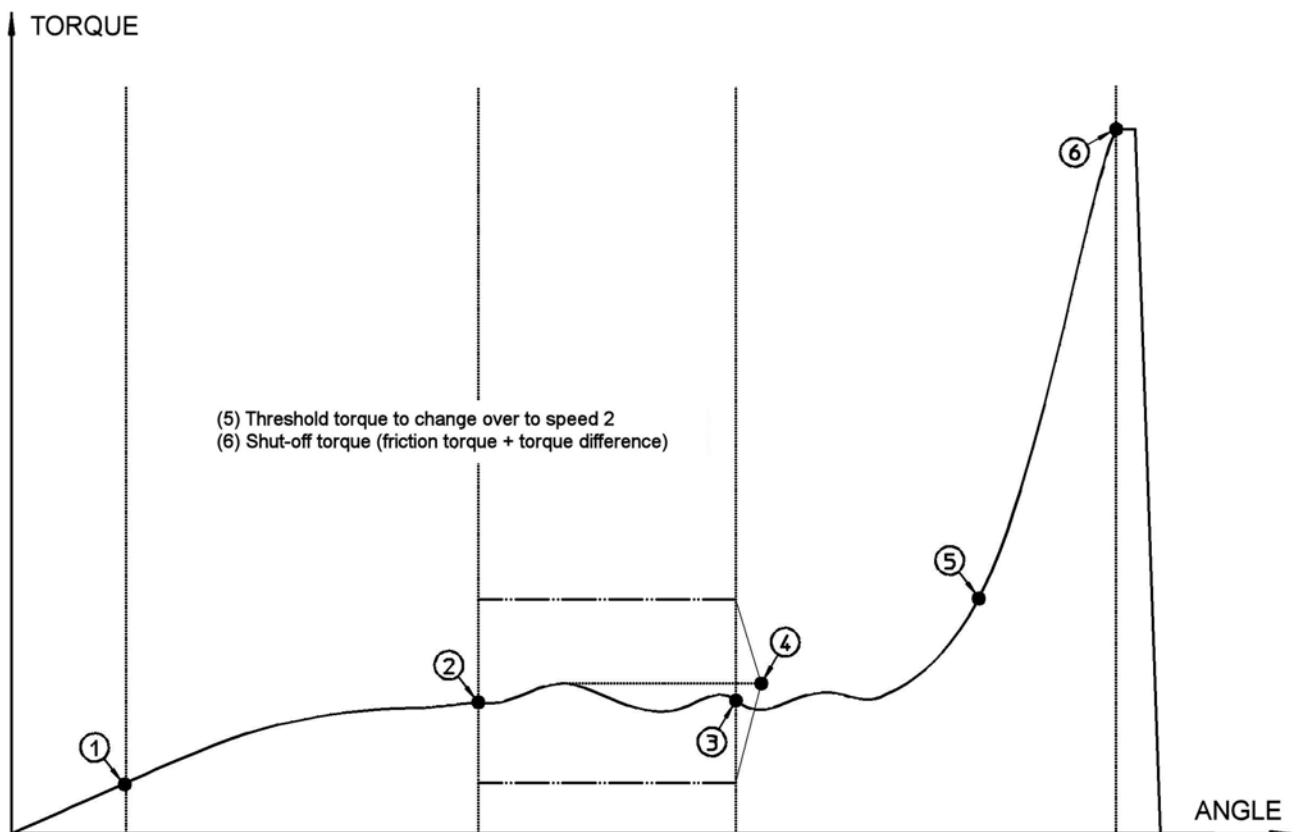


Figure 49: Screwing on differential torque

Switching off criteria:

The screwing process is ended once the

- cut-out torque is reached
- a monitoring criteria is reached
- the maximum screwing time (monitoring time) is expired

Analysis:**OK evaluation:**

The screwing level is considered OK (fault free), if the switching off occurs via the differential moment and the value of the torque is in the set limits.

On the angle of rotation monitoring option the reached angle must be within the set limits.

Not OK analysis:

The screwing level is evaluated as Not OK (faulty) if the torque is outside the set limits.

On an active angle of rotation the screwing level is evaluated as Not OK, if the angle of rotation is outside the indicated limits.

The screwing level is also evaluated as Not OK when the monitoring time is exceeded.

Parameter:

The following parameters are used in the screwing sample:

- Supervision time
Maximum time until the screwing level is aborted
- Differential torque
Input of the differential end moment
The actual target moment/torque results from the sum of the torque of the previous level and the differential moment.
- Differential torque lower limit
Lower limit of the differential end moment. The actual torque lower limit results from the sum of the torque of the previous level and the lower limit of the differential moment.
- Differential torque upper limit
Upper limit of the differential end moment. The actual torque upper limit results from the sum of the torque of the previous level and the upper limit of the differential moment.
- Speed 1
Input of the rotation speed that should be used for the screwing application.
- Threshold torque Speed 2
Input of the differential torque at which the torque decrease on the second rotation speed occurs. The actual swell torque for the rotation speed decrease results from the sum of the torque of the previous level and the differential moment.
- Speed 2
Input of the rotation speed that should be used for the screwing application.
- Torque holding time
A holding time can be defined to keep the torque for this time.
- Final values type: differential torque / total torque
Selectively the end torque can be displayed as difference between the total torque and the torque of the previous level or as total torque in the end values.

- Angle supervision: active / inactive
Monitoring of the angle with a window angle if the angle monitoring is switched on, the following parameters are added:
 - Threshold torque
Input of the torque from when the angle monitoring should be started (compare point 1 in the previous figure).
 - Angle upper limit
Upper limit of the end angle
 - Angle lower limit
Lower limit of the end angle

11.1.5.3 Fasten dependent on friction value

The screwing sample friction dependent screwing connects the screwing sample friction measurement and the screwing to differential moment.

Sequence of the screwing sample:

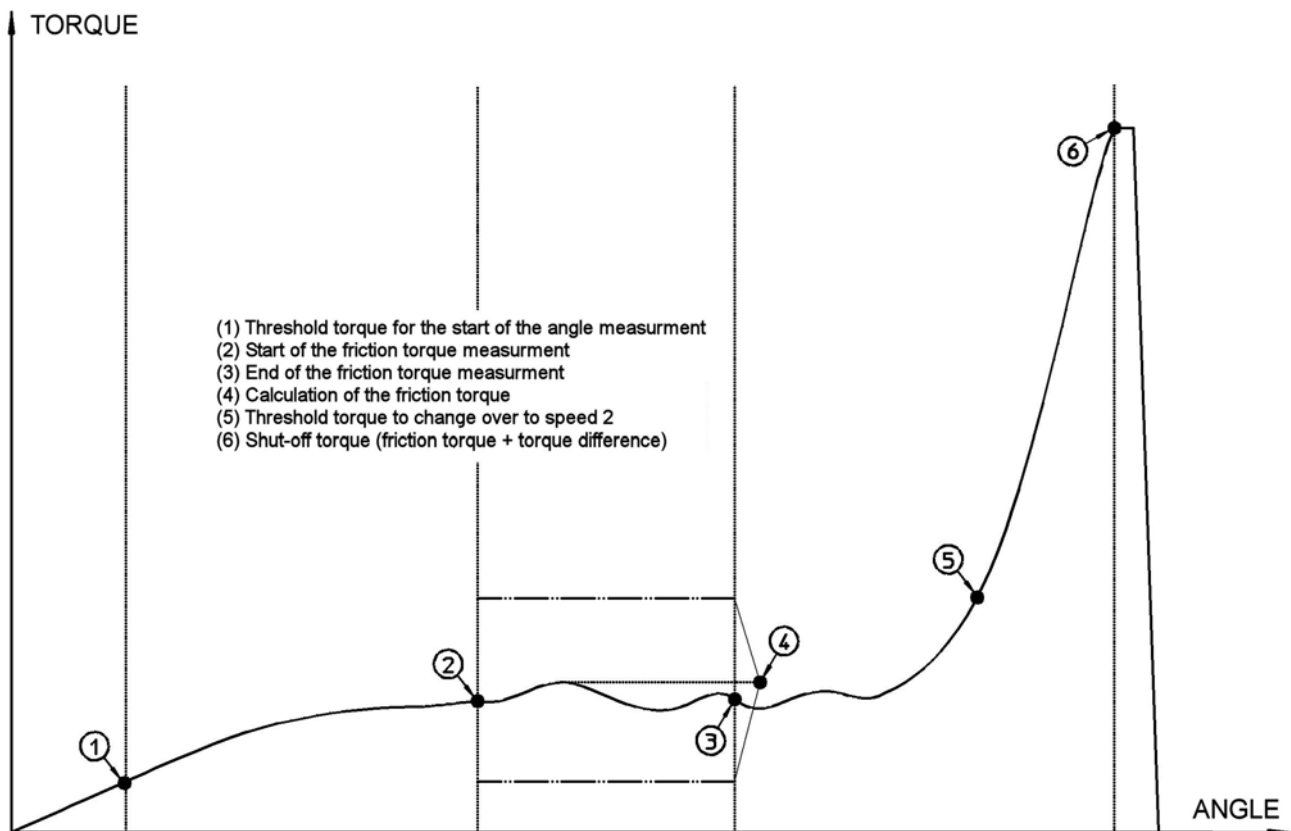


Figure 50: Screwing applications depending on friction

Switching off criteria:

The screwing process is ended once the

- cut-out torque is reached
- a monitoring criteria is reached
- the maximum screwing time (monitoring time) is expired

Analysis:

OK evaluation:

The screwing level is considered OK (fault free), if the switching off occurs via the differential moment and the value of the torque is in the set limits.

On the angle of rotation monitoring option the reached angle must be within the set limits.

Not OK analysis:

The screwing level is evaluated as Not OK (faulty) if the torque is outside the set limits or the determined friction value is outside the indicted limits.

On an active angle of rotation the screwing level is evaluated as Not OK, if the angle of rotation is outside the indicated limits.

The screwing level is also evaluated as Not OK when the monitoring time is exceeded.

Parameter:

The following parameters are used in the screwing sample:

- Supervision time
Maximum time until the screwing level is aborted
- Threshold torque angle measurement
Input of the torque from when the angle counting should be started.
- Start angle friction measurement
Input of an angle that should be turned after reaching the swell moment, prior to activating the friction value monitoring.
- Speed 1
Input of the rotation speed that should be used for the screwing application.
- Angle friction measurement
Input of the angle range in which the friction monitoring should be active. This range starts with the start angle of the friction measurement.
- Friction value type
Selectively the maximum value or mean value of the friction value can be used to determine the friction torque.
- Friction torque lower limit
Input of a minimum torque that must not be undershot by individual torque values during the friction monitoring.
- Friction torque upper limit
Input of a maximum torque that must not be exceeded by individual torque values during the friction monitoring.
- Friction value lower limit
Input of the minimum torque that must not be undershot by the friction torque.
- Friction value upper limit
Input of the maximum torque that must not be exceeded by the friction torque. The limits of the friction torque can be recorded tighter then the limits of the individual friction values.
- Threshold torque Speed 2
Input of the differential torque at which the rotation speed decrease on the second rotation speed occurs. The actual swell moment for the rotation speed decrease is derived from the detected friction torque and the differential torque.
- Speed 2
Input of the rotation speed that should be used for the screwing application.
- Differential torque
Input of the differential end moment.
The actual target moment/torque results from the sum of the determined torque and the differential moment.

- Differential torque lower limit
Lower limit of the differential end moment. The actual torque lower limit results from the sum of the lower limit of the friction moment and the lower limit of the differential moment.
- Differential torque upper limit
Upper limit of the differential end moment. The actual torque upper limit results from the sum of the upper limit of the friction moment and the upper limit of the differential moment.
- Torque hold time
A holding time can be defined to keep the moment for this time.
- Final values type: Differential torque / total torque
Selectively the end torque can be displayed as difference between the total torque and the torque of the previous level or as total torque in the end values.
- Angle supervision: active / inactive
Monitoring of the angle with a window angle if the angle monitoring is switched on, the following parameters are added:
 - Angle upper limit
Upper limit of the end angle. The value counts starting from the end of the friction measurement.
 - Angle lower limit
Lower limit of the end angle. The value counts starting from the end of the friction measurement.

11.2 Commands

11.2.1 Display values

Displays the values of the previous screwing level at the touch display. The command can be used as often as you like.

11.2.2 Save values

Saves the values of the previous screwing level into the end value data set. The command can be used as often as you like (also see [8.3.4.7 Process Data → Final Values](#)).



IMPORTANT

As a maximum the last three results are saved.

11.2.3 Statistic

Affects the calculation of the statistic of the previous screw level (also see [12.3 Statistic](#)).



IMPORTANT

The statistic can only be calculated for a screwing level per program. If the 'statistic' command is entered more than once into the program then only the statistic for the last screwing level is calculated, for which the 'statistic' command has been indicated.

11.2.4 Print

Causes the output of the result of the preceding step on the serial printer interface.



IMPORTANT

One precondition is that a printer is connected to the multifunctional printer interface and the printer is configured as a device on the serial interface (see [8.3.4.12 Setup → Serial Device](#)).

Data is printed after OK or NOT OK screw assembly according to the system settings.

11.2.5 Waiting time

Inserts a waiting time into the program.

Parameter:

- Waiting time

11.2.6 Hold position

Hold the screwdriver tension position.

Parameter:

- Holding time

11.2.7 Wait for input

Waits for an input signal. Only available for input number 2. Change to the next step will occur as soon as the input is set.

Parameters:

- maximum waiting time
- Input number

11.2.8 Set output

Sets an output. Only available for output number 8.

Parameters:

- output number
- time supervision: yes / no
 - time until reset

11.2.9 Reset output

Resets an output. Only available for output number 8.

Parameters:

- output number

12 Documentation

The sequence controller AST11 provides a wide variety of documentation possibilities.

12.1 Final values

If the command 'save value' is used on the screwing program, then the screwing results are stored in a CSV data and can be loaded by the sequence controller via the web interface (see also [8.3.4.7 Process Data → Final Values](#) Process Data →). The command "save values" can be used as often as you like within the screwing process, however, only the three last values are saved. In case of a fault these values are always saved.



IMPORTANT

The data is only available if the screwing program has received the command "save final values" or if a faulty screwing application is present.

One CSV data per day is saved. The last data of the last seven days is always available. The final values of the screwing application that are older than seven days are overwritten by new final values.

The final value data of the last screwing application are also saved in the file "actual.csv".

The files are subject to the same limitations as described in chapter [12.2 Curve Representation](#) for the curve data.

The CSV file is structured as follows:

- First line: Title bar with caption of the values
- Following line: results of a screwing application per line

Value	Description
Date	Date of screwing application
Time	Time of screwing application
Program number	Program used
Status	Status, also see 14.2 Error in the screwing sequence
Total duration	Total duration of the program
Step1	Step number of the first saved step
Moment1	Torque of the first saved step
Angle1	Angle of tilt of the step of the first saved step
Step2	Step number of the second saved step
Moment2	Torque of the second saved step
Angle2	Angle of tilt of the second saved step
Step3	Step number of the third saved step
Moment3	Torque of the step of the third saved step
Angle3	Angle of tilt of the step of the third saved step
Step not OK	Step number of the faulty step
MomentNotOK	Torque of the faulty step
AngleNotOK	Angle of tilt of the faulty step
FC Status	Not available for AST11
FC counter	Not available for AST11
Torque unit	Unit torque
Angle unit	Angle of rotation unit

Table 25: Structure of the data set

12.2 Curve Representation

A screwdriving curve is created for every screwdriving process with the AST sequence controller. This can be viewed or saved in different ways.

- Displayed directly on the control unit in the Process Data menu area → Graphic
- Download via the web-based user interface in the Process Data menu area → Graphic in following formats:
 - As binary file: The file contains the recorded raw data. The GRAPH10 viewer program is required for viewing or processing.

2. Both table processes interpret the decimal number depending on language: German version expects a decimal comma, foreign languages a decimal point, the other format is wrongly represented. The curve data for the sequence controller always uses a decimal point because this is the usual format for computer data. For the analysis with the German version of the table processing the commas should therefore be replaced by semicolons and the decimal point by commas.

- As shortened CSV file: The amount of datasets is shortened under the process limit of the table processing (65536 lines). For this, several datasets are combined by using the highest value respectively. If the file is shortened to half the volume, the maximum rotating speed, the maximum torque, etc. will be assembled into one data set from every two data sets.
- In connection with the GRAPH10 (E) curve viewer as a direct download from the controller

The following data is recorded:

- Rotation speed
- Torque
- Angle
- Program step
- Current strength
- Temperature of the electronics

12.3Statistic

If the command "statistic" is used in the screwing program then in the sequence controller AST11 a statistic is kept about the last 100 values for the respective program.

The following values are calculated for moment and angle:

- Mean value
- Standard deviation absolute
- Standard deviation percentages, based on mean value
- CP value / CPK value

The limits for the Cp/CPK value calculation can be entered. If no limits are set then the calculation is done automatically with $\pm 15\%$ of the mean value. The limits entered are maintained even after switching off the sequence controller AST11.

The statistic can be displayed via the sequence controller AST11 as well as via the web interface (also see [8.2.5.2.2 Statistics](#) and [8.3.4.5 Process Data → Statistics](#)). The statistic can be deleted for individual programs or completely for all programs.

The statistic is deleted when the sequence controller AST11 is switched off.

12.4Print output

Data can be printed out in ASCII format via the serial data port of the AST40. The summary of the required values employs a format string template.

A format string can be summarized using random text and specified commands, whereby texts can be output directly to the printer and commands can be replaced by the respective valid value (see following table).

A command consisting of @ characters and ending with a blank character are shown for this.

Changing the format string is only possible via the web-based user interface (see [8.3.4.12.1 Printer](#)). The print output is activated by the command "Print" during the screw-driving process. Results of NOK screwdriving processes are always printed out.

The following commands are available:

Command	Output value	Output format	Example
date_euro	Date in Euro-format	Day.Month.Year	24.04.20013
date_usa	Date in US format	Month/Day/Year	04/24/20013
date_iso	Date in ISO format	Year-Month-Day	20013-04-24
time	Time	Hour:Minute:Second	7:13:37 AM
step	Step number	Value	3
torque	End torque Measuring system 1	Value unit	0,215 Nm
angle	Angle measuring system 1	Value unit	1080 °
prog	Program number	Value	1
errornum	Status / Error number	Value	0
errortext	Status / Error text	Error message	torque underrun
runtime	Running time	Value unit	0.5 s
torquetarget	Torque target value	Value unit	0.200 Nm
torqueLL	Torque lower limit	Value unit	0,000 Nm
torqueUL	Torque upper limit	Value unit	0,350 Nm
angletarget	Angle target value	Value unit	1080 degrees
angleLL	Angle lower limit	Value unit	1000 degrees
angleUL	Angle upper limit	Value unit	1150 degrees

screwdriver	Screwdriver type	Value	311E27-0020
calibration	Calibration value	Value	1,000
StatAngleAv	Statistics Angle Mean Value	Value unit	1081 °
StatAngleStddev%	Statistics Angle Standard Deviation %	Value unit	1.36 %
StatAngleStddevAbs	Statistics Angle Standard Deviation Absolute	Value unit	14.70
StatAngleCPK	Statistics Angle CPK	Value	2.16
StatAngleCP	Statistics Angle CP	Value	2.03
StatAngleCPKmin	Statistics Angle CPK Lower Limit	Value unit	1000 °
StatAngleCPKmax	Statistics Angle CPK Upper Limit	Value unit	1150 °
StatAngleNum	Statistics Angle Number Values	Value	96
StatTorqueAv	Statistics Torque Mean Value	Value unit	0,213 Nm
StatTorqueStddev%	Statistics Torque Standard Deviation %	Value	1,7 %
StatTorqueStddevAbs	Statistics Torque Standard Deviation abs.	Value unit	0,020 Nm
StatTorqueCPK	Statistics Torque CPK	Value	1,77
StatTorqueCP	Statistics Torque CP	Value	2,12
StatTorqueCPKmin	Statistics Torque CMK Lower Limit	Value unit	0,000 Nm
StatTorqueCPKmax	Statistics Torque CMK Upper Limit	Value unit	0,350 Nm
StatTorqueNum	Statistics Torque Number Values	Value	100
fcerrornum	Status / Error Number F-Function	Value	1
fcerrortext	Status / Error Text F-Function	Error text	TOO SHORT
fcpartnum	Counter F-Function	Value	1/5
screwcounter	Number of cycles since sequence controller has started	Value	1236
title	Program Title	Text	Standard 1

Table 26: Print parameters



IMPORTANT

Statistical values can only be printed if the command "Statistics" is inserted ahead of the print command in the screwdriving process.

At the time of delivery the standard format is:

@date_iso @time PG: @prog ST: @step TQ: @torque AN: @angle @errortext

Issue:

2013-04-24 07:13:37 PG: 12 ST: 3 TQ: 2.15 Nm AN: 1080 °OK

The amended format string

@date_euro @time Program: @prog step: @step fault: @error runtime:@runtime torque:

@torque angle: @angle

delivers following output, e.g.:

24.01.2013 07:13:37 Program: Step 12: 3 faults 0 runtime: 0.5 s torque: 2.15 Nm angle:
1080 °

13 Maintenance and servicing

Incorrect disassembly or assembly can lead to injury of an operator and damage of the machine. Disassembly and assembly work may only be carried out by DEPRAG or qualified personnel.

Recommendations should help to uphold warranty claims.

- Keep the device in a dry place. Precipitation, dampness and all types of fluids or wet conditions may contain minerals which corrode electric circuitry.
- Do not keep or use the device in dusty or dirty surroundings. The moveable parts and electronic components could be damaged.
- Do not keep the device in hot conditions. High temperatures can shorten the life of electric devices and deform or melt certain plastics.
- Do not keep the device in cold conditions. Internal dampness can build up and damage the electric circuitry when the device then is moved to normal temperature conditions.
- Do not try to open the device in any other way than in the instructions.
- Do not let the device fall, be hit or bumped and do not shake it. Rough handling can damage electronic circuitry and mechanical parts.
- Do not use any harsh chemicals, cleaning solvents or strong cleaning agents to clean the device.
- Do not paint the device. Paint could stick together moveable parts and prevent correct operation of the device.



WARNING

To avoid damage to surface finish, avoid using chlorine bleach, chlorine based cleaners, abrasive substances, ammonia, rags or cleaning pads containing metallic particles!

Use adequate cleaning agent!

- Unauthorised alterations or additions can damage the device and violate specifications.

13.1 Updating the software

13.1.1 Main control and touch display

Updating can only be done via the web interface. Registration is done as described in section [8.3.4.1 Start](#).

Click on Tools >> and then Update. In order to update the main control, enter the file name and path in the input field and click "load". Alternatively you can select the file by clicking the "Search..." button next to the input field.

After you clicked the "load" button the inscription "the update is being transfer to the controller" appears. Wait until the update file is transferred and the AST11 is started anew. "Updating Main Unit" appears on the display of the sequence controller AST11.

The update is completed when the main screen with the process display is displayed on the display.

13.1.2 Power element

Updating can only be done via the web interface. Registration is done as described in section [8.3.4.1 Start](#).

Click on Tools >> and then Update. In order to update the power element, enter the file name and path in the input field and click "Load". Alternatively you can select the file by clicking the "Search..." button next to the input field.

After you clicked the "Load" button the inscription "the update is being uploaded to the controller" appears. Wait until the update file is transferred and the sequence controller is started anew. "Updating Power Unit" appears on the display of the AST11.

The update is completed when the main screen with the process display is displayed on the display.

13.2 Replace the filter mat of the sequence controller



Danger

Risk of fatal injury due to electrocution!

The work must only be performed by a licensed electrician!

The sequence of the work process must be adhered to!

Prior to opening the housing, the sequence controller must be switched off and the power plug must be disconnected and secured against unauthorized plugging in!



Important

The filter at the sequence controller must be replaced in regular intervals depending on the degree of contamination. The material used must meet protective class IP54. Suitable filter mats are available under the order number 826057.

All screwdriving connection described in the following work steps are loosened or bolted using a hexagon socket wrench SW 2.5.

This is how you replace the filter mat:

1. Prior to opening the housing, the sequence controller must be switched off and the power plug must be disconnected and secured against unauthorized plugging in.
2. Loosen the six screws (hexagon socket wrench SW 2.5) at the housing rear wall.
3. Open the housing.
4. Loosen the 4 bolts of the power unit.

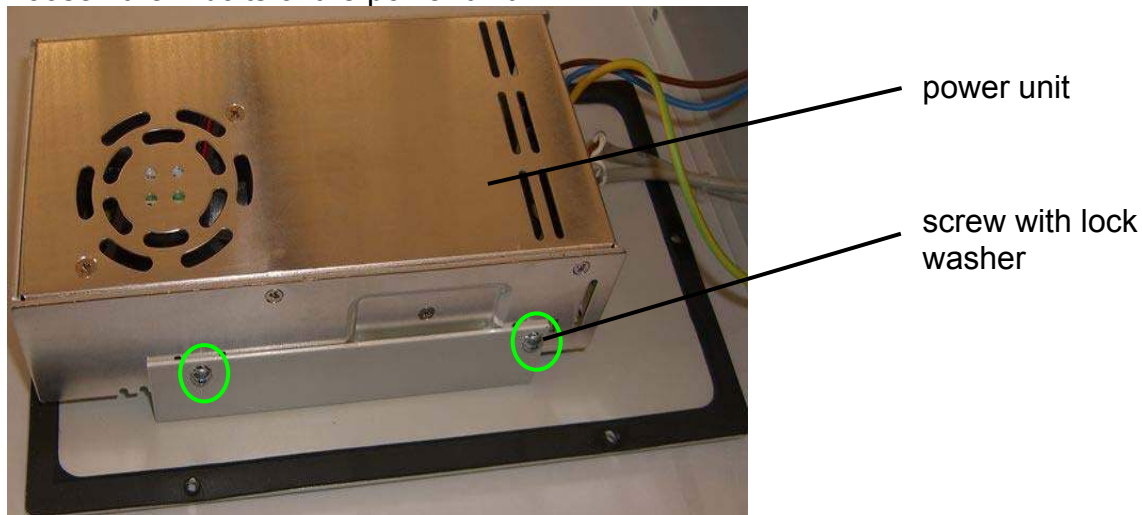


Figure 51: Power unit on the rear housing wall

5. Remove the power unit at the rear housing wall.
6. Pull out the filter mat from the rear wall, in the direction marked in the illustration.

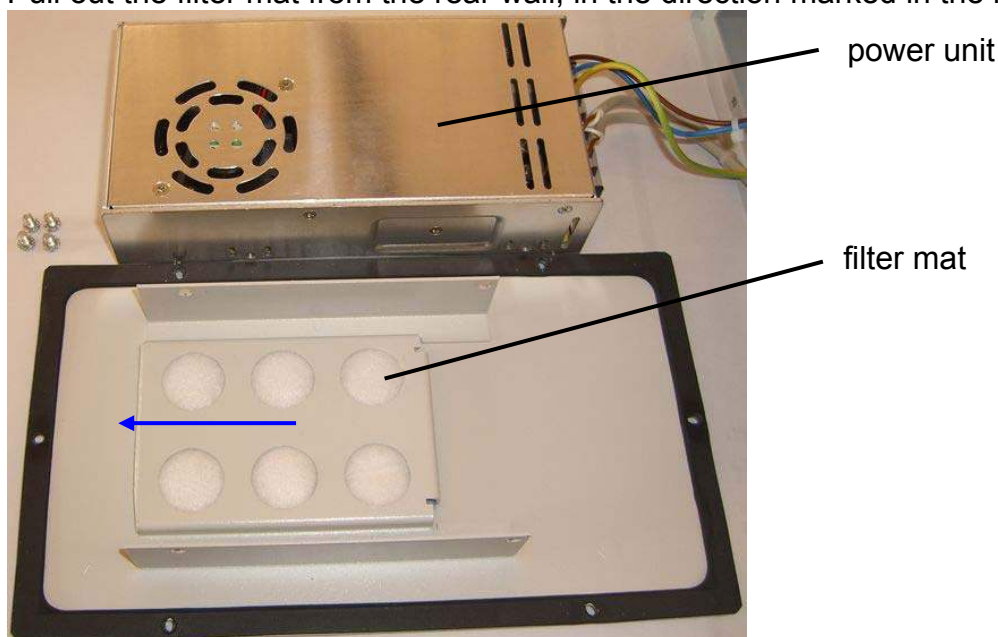


Figure 52: Filter mat on the housing rear wall

7. Place the new filter mat (part no. see [13.3 Spare parts](#)) in a manner that the finely structured, dense side of the filter mat lays against the housings rear wall.
8. Using the four screws and the lock washer mount the power unit to the housings rear wall.
9. Using the six screws attach the rear wall.

**Caution**

Prior to the re-start perform the operating media test acc. to the valid regulations, e.g. BGV A3.

13.3 Spare parts

Designation	Part no.
Filter mat	826057

14 Error display and troubleshooting

14.1 System error

If you discover that the AST11 sequence controller is defective, please send it to DEPRAG. Please do not try to troubleshoot or rectify any electrical fault on your own under any circumstances whatsoever.

14.1.1 MINIMAT–EC-Servo Screwdriver

Number	Meaning	Trouble shooting
--	Screwdriver not found	Insure that the screwdriver and the connection cable are properly attached before you switch on the AST11.
001	Temperature too high	Check the screw assembly process and adjust if required. If necessary please contact DEPRAG Service.
002	Temperature sensor defective	Troubleshooting not possible
003	Test sum error 1 in EEPROM (repairable via the main controller)	
004	EEPROM not writable (not repairable)	
005	Test sum error 2 in EEPROM (not repairable)	
006	Test sum error in RAM	
007	Test sum error in flash	
008	EEPROM error: Maximum amount of screwing cycles reached	Press the ESC key on the AST11. This message will be displayed at regular intervals until the EC screwdriver is sent for maintenance at DEPRAG.
009	next maintenance is due	

Table 27: System error MINIMAT–EC-Servo screwdriver

14.1.2 Power unit

Number	Meaning	Trouble shooting
--	Power unit not found	Switch the AST11 off and then restart again. If the fault remains, please contact the DEPRAG Service Department.
101	Position indicator index signal not found	Ensure that the drive unit of the EC-screwdriver turns freely. Re-start the AST11.
102	QEP position indicator signal missing or wrong	
103	Initialization error, spindle free?	
104	Loading error of condensers, power element defective	Troubleshooting not possible
105	External watchdog or over current fault in power element	

106	Temperature too high	Check the screw assembly and adjust it if necessary. If required, consult the DEPRAG Service Department.
107	Range error	Troubleshooting not possible
108	Under voltage	

Table 28: System error - power unit

14.1.3 Main controller

Number	Meaning	Trouble shooting
201	Fieldbus not available!	Check that the fieldbus module is installed and mounted tightly. If the fieldbus module no longer needs to be used, set the field in web interface Menu Setup → Serial Device to “no device” (see also 8.3.4.12 Setup → Serial Device)
202	Software versions of main controller and power unit do not match!	Please contact the DEPRAG Service Department.
203	Screwdriver and power unit do not match!	Ensure that you have installed the correct screwdriver model to the AST11. The AST11-1/-S can be operated with screwdrivers of the series 320Exx19 and 320Exx22 and 320Exx27. The AST11-2/-S can be operated with screwdrivers of the series 320Exx36.
204	Settings have been lost, default values are being loaded	Check the settings and adjust them if necessary.
205	Error in the data memory	Troubleshooting not possible
206	Error in the communication with the power unit	
207	No connection to the fieldbus!	Check if the external fieldbus module is connected properly to the multifunctional serial interface. Reconnect the external fieldbus module by going to web interface Menu Setup → Serial Device and clicking on “Search for fieldbus module” and then on “Apply” (see also 8.3.4.12.2 Fieldbus module).

Table 29: System error - Master control unit

14.1.4 Communication

Number	Meaning	Trouble shooting
301	No connection	Switch the AST11 off and then restart again.
302	General error	
303	Checksum error	
304	Module not found	
305	Unknown command	
306	Timeout	
307	Access to write-protected area	
308	Value outside of limits!	

Table 30: System error – Communication

14.2 Error in the screwing sequence

Number	Displayed text	Meaning	Troubleshooting
0	OK	No error, the screwing application was ended properly	-
1	TIME LIMIT	The set monitoring time of the screwing level has been exceeded	Check the screw process and adapt the program if required.
2	ANGLE LOW	The indicated minimum angle of the screwing level was not reached	
3	ANGLE HIGH	The set maximum angle of the screwing level has not been reached	
4	TORQUE LOW	The indicated minimum torque of the screwing level was not reached	
5	TORQUE HIGH	The set maximum torque of the screwing level has been exceeded	
6	PU: PROG?	An invalid program was transmitted to the Power unit	Transfer the program over again.
7	DRIVER IO	The program contains too many E/A commands	Check the screwdriver program.
8	START ?	There are too many start signals.	Check the applied start signals. Apply only one start signal.
9	INVALID PROG	Program is not valid (does not exist, or was created for another screwdriver)	Check the program and adapt if required or select a different program.
10	INTERRUPT	The start signal has been reset prior to the normal end of the screwing application.	The start signal must be present until the end of the screwdriver operation.

11	OVERCURRENT	Current exceeds maximum permissible value	Check the screw process and adapt if required. If necessary please contact DEPRAG Service.
12	ERROR TH	While holding the torque the moment dropped at the end below the target torque	Check the screw process and adapt the program if required.
13	ERROR CRC	Error while writing the program	Transfer the program over again.
14	SLINIT	Power element not initialized with screwdriver data.	Switch the cordless EC-screwdriver on again.
15	ERROR POSH	Fault during position hold, position could not be loaded	Check the screw process and adapt the program if required.
16	FRICT. LOW	Friction torque in monitored window too small	
17	FRICT. HIGH	Friction torque in monitored window too large	
18	IIT-ERROR	Overload of the tool via a defined time frame	Check the screw process and adapt if required. If necessary please contact DEPRAG Service.
19	PG NUM > 15	The program number is invalid.	Specify a program number between 1 – 15.
20 – 21	reserved	-	-
22	TOTAL TIME +	The total running time of the screwdriving program has been reached. It is max. 70 s.	Check the program and adapt if required or select a different program.
23	GEN. FAULT	general fault	-

Table 31: Fault in the screwing sequence

15 Trouble Shooting

If you experience any problems, please check first if all instruction included in the safety and operating instructions have been observed. Take appropriate precautions, if required.

Possible problems are listed in the following table:

Problem	Resolution
AST11 indicates a fault	see 14 Error display and troubleshooting
AST 11 does not start, no power supply	Check correct connection of the power cable see 6.1.3 Connection panel
	Switch the AST11 on at the main switch, see 7.2 Assembly Instructions
A connection to the sequence controller is not possible	Check if the IP address set at the AST11 is correct.
Screwdriving program does not start	Check the Program Choice selection in Menu Setup >> Basic Settings.
The pre-selected program does not start	Check the Program Choice selection in Menu Setup >> Basic Settings.

Table 32: Troubleshooting

If you detected that the sequence controller AST11 is defective, then send it to DEPRAG. Under no circumstances should you try to find or remedy the electrical fault.

16 Required accessories

16.1 Power Cable

Designation	Part no.
Power cable KN AST11-EU – 1.8m / 5.9 ft.	385443 A
Power cable KN AST11-US – 1.8m / 5.9 ft.	385443 B
Power cable KN AST11-CN – 2.5 m / 8.2 ft.	385443 C

17 Optional Equipment

17.1 Motor Cable for MICROMAT®-E

Connect MICROMAT-E screwdriver with sequence controller AST11.

Designation	Part no.
Length 2.5 m / 8.2 ft., straight connection	385442 A
Length 5 m / 16.4 ft., straight connection	385442 B
Length 8 m, / 26.2 ft. straight connection	385442 C
Length 12 m / 39.4 ft., straight connection	385442 D
Length 2.5 m / 8.2 ft., angle connection 90°	385442 A
Length 5 m / 16.4 ft., angle connection 90°	385442 B
Length 8 m, / 26.2 ft., angle connection 90°	385442 C
Length 12 m / 39.4 ft., angle connection 90°	385442 D

17.2 Extension for MICROMAT-E Motor Cable

Extension for MICROMAT®-E motor cable, with those the motor cable is firmly connected with the screwdriver.

Designation	Part no.
Length 2.5 m / 8.2 ft.	385478 A
Length 5.5 m / 18.0 ft.	385478 B
Length 9.5 m / 31.2 ft.	385478 C

17.3 Plug

Designation	Part no.
Plug RJ45 – IP54	385453 A

17.4 Fieldbus modules

Only one module can be used per sequence controller.

The fieldbus module cannot be used in conjunction with the printer or with the barcode scanner.



Figure 53: Fieldbus module, power supply and connection cable

17.4.1 Profibus

Designation	Part no.
Interface fieldbus external – Profibus	428010 A
Connection cable FBC4 – AST11 EU	207725 A
Connection cable FBC4 – AST11 US	207725 B

17.4.2 Profinet

Designation	Part no.
Interface fieldbus external – ProfiNet	428010 B
Connection cable FBC4 – AST11 EU	207725 A
Connection cable FBC4 – AST11 US	207725 B

17.4.3 EtherCAT

Designation	Part no.
Interface fieldbus external – EtherCAT	428010 C
Connection cable FBC4 – AST11 EU	207725 A
Connection cable FBC4 – AST11 US	207725 B

17.4.4 EtherNet/IP

Designation	Part no.
Interface fieldbus external – EtherNet/IP	428010 D
Connection cable FBC4 – AST11 EU	207725 A
Connection cable FBC4 – AST11 US	207725 B

17.5 Toolbox

The toolbox increases the application possibilities of the AST11 sequence controller on manual stations, as well as in connection with a PLC-controller. The toolbox allows the use of 7 different bits/sockets with a diameter of up to 24mm (AF 19 mm), which can be inserted into 7 individual cavities. The selection of the screwdriving program on the AST11 is automatically adapted to the corresponding bit/socket.

Designation	Part no.
Toolbox	398097 B
Connector cable AST11 to Toolbox (with power supply 24 V/45 W)	385451 A

17.6 Standfuß

Base to use AST11 as a tabletop unit.

Designation	Part no.
Base	405278 A

17.7 Barcode scanners

The barcode scanner cannot be used in conjunction with the printer or with the fieldbus module.

All barcode scanners, which process up to 24 characters and deliver exactly one end-of-code character, are supported. Scanners with two end-of-code characters are not supported. The end-of-code character can be between 0x0A and 0x0F (corresponding to decimal values of between 10 and 15).

17.8 Printer connector

The printer cannot be used in conjunction with the barcode scanner or with the fieldbus module.



Designation	Part no.
ND100 printer	823476
Connection cable	349938 A

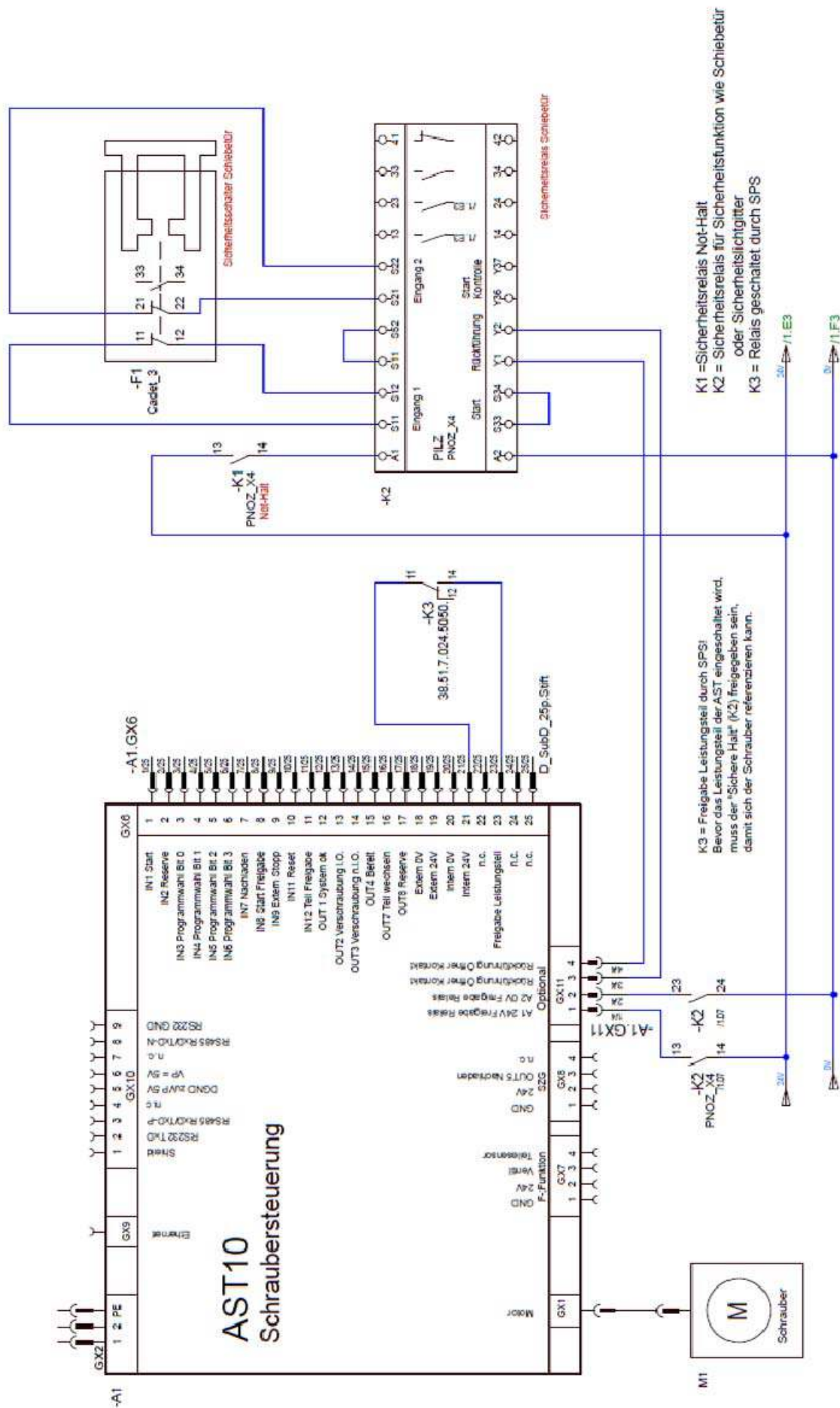
17.9 Hardware-Module

Only for type AST11-1 and AST11-2.

Safe stop without rebooting system

Designation	Part no.
EMERGENCY-STOP-Module	385521 A

Example slide door:



17.10 Optional software packages

17.10.1 Friction value software package

The software package friction values contain the following additional screwing samples:

- Friction value measurement
- Screwing on differential torque
- Screwing applications depending on friction

For detailed description also refer to [11.1.5 Friction value package \(optional\)](#).

The software package must be released as described under [8.3.4.13 Setup → Extensions](#).

Designation	Part no.
Software release key (AST11 friction coefficient)	201820

17.10.2 GRAPH10 – Superimposed graph display

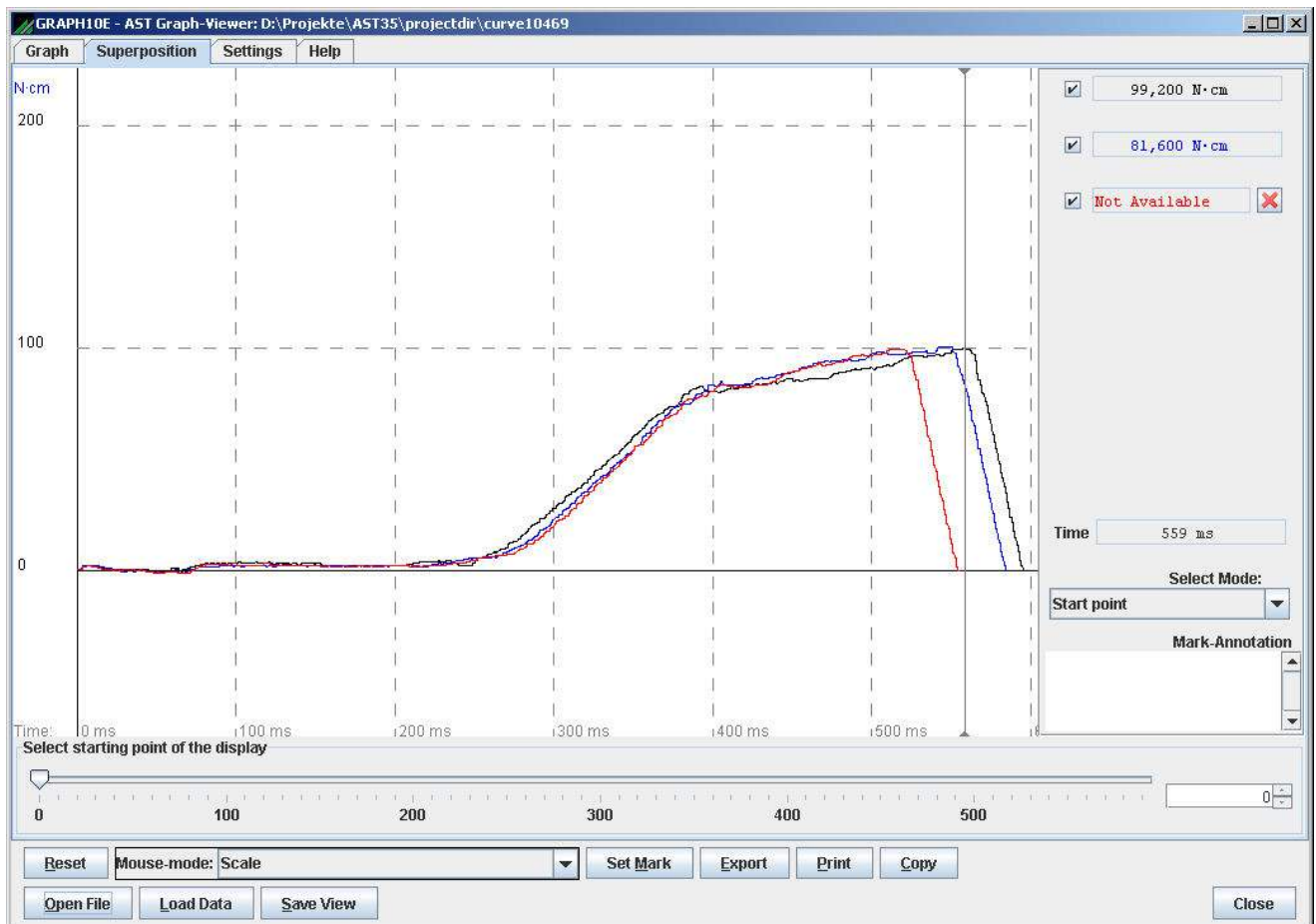


Figure 54: GRAPH10E

The GRAPH10(E) program can be downloaded free of charge via the web interface. However, the use of the superimposed graph display feature is subject to cost.

Designation	Product-Code
Graph 10E Enabling superimposed graph display	202698

17.10.3 DataLogger

Figure 55: DataLogger

The DataLogger provides the possibility to record the end value data sets from up to ten sequence controllers (AST) or ComCenter 10 and to archive them.

The DataLogger program can be downloaded free of charge via the web interface. However, the use of the program is subject to cost.

Designation	Part no.
DEPRAG Datalogger release key	202699

17.10.4 TC30-PC Statistics

Figure 56: TC30-PC Statistics

TC30-PC Statistics is a statistics programme for use in combination with DEPRAG-DataLogger. This software is for evaluation of the screwdriving data and calculation of average value, standard deviation and cmk value. For the graphic display several alternatives may be selected.

The programme TC30-PC Statistics can be downloaded free of charge via the web interface. However, the use of the program is subject to cost.

Designation	Part no.
TC30-PC Statistics release key	206081

17.10.5 DEPRAG ASTxx Serial Remote

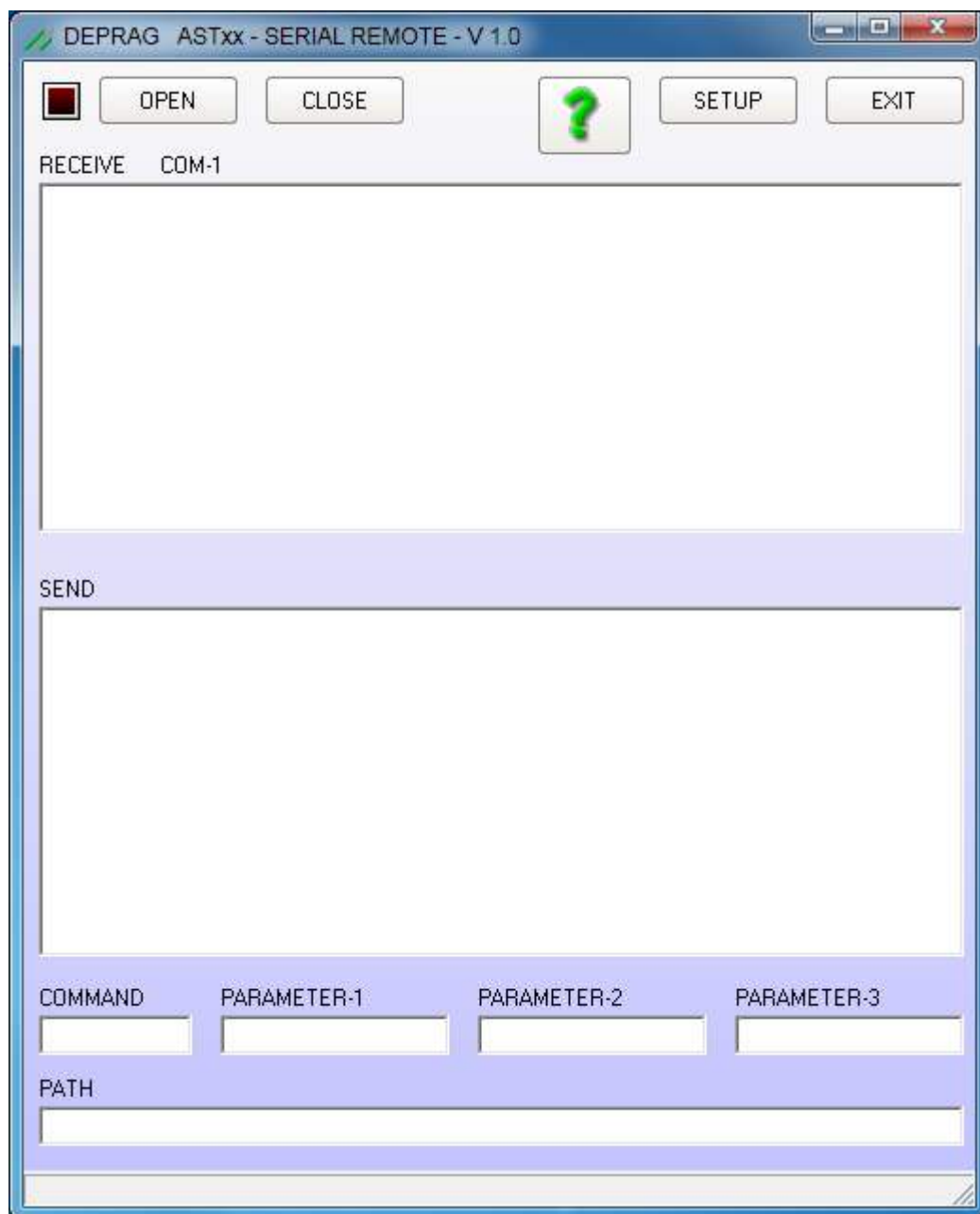


Figure 57: DEPRAG ASTxx Serial Remote

The ASTxx Serial Remote provides the possibility to save screwdriving graphs and end value data sets from a sequence controller to a computer. The supervision, when and which data should be saved, is done by a PLC.

The ASTxx Serial Remote program can be downloaded free of charge via the web interface. However, the use of the program is subject to cost.

Designation	Part no.
DEPRAG ASTxx Serial Remote release key	206565

18 Technical Data

Type Part-no. Type Part-no.	AST11-1 390041 A AST11-1-S 390041 B	AST11-2 390042 A AST11-2-S 390042 B
Voltage Cycle	100-240 VAC / 50 (60) Hz	
Power consumption	250 W (max)	400 W (max)
Maximum load per outlet	100 mA	
Total current max.	100 mA	
Protection class	IP 54	
Dimensions WxHxD	160 mm x 295 mm x 200 mm	
Weight (kg/lbs)	6.0 / 13.23	
Temperature	Ambient conditions MIL-PRF-28800F, class 2	
During operation	0 to 40 °C (32 to 104 °F)	
During storage	-20 to +60 °C (-4 to +140 °F)	
Relative humidity		
During operation	0 to 10 °C no condensation (32 to 50 °F)	
	10 to 30 °C 95 % (50 to 86 °F)	
	30 to 40 °C 75 % (86 to 104 °F)	
	40 to 50 °C 45 % (104 to 122 °F)	
	-20 to +60 °C no condensation (-4 to +140 °F)	
During storage		

Table 33: Technical Data

19 Glossary

Term	Description
Clearance for start	If the clearance for start is activated then the screwdriver will only start if there are 24V at the clearance to start input. Otherwise the controller is not ready to screw.
Command	General program step to create the screwdriving sequence (e.g. setting the output).
DAST	Software packages DAST is used to supervise the operation and visualisation of the screwdriver sequence controller (AST series) through the system control.
EC screwdriver	The screwdriver has a brushless electronic drive (EC motor, abbreviation for electronic commutate).
EC servo screwdriver	The screwdriver has a brushless electronic drive (EC motor, abbreviation for electronic commutate) and has an integrated, sensor controlled torque and angle of rotation measurement.
Encoder	visual sensor to detect the current position of a motor shaft or a drive unit
Ethernet	Data network technology for local data networks to exchange data between all devices connected in a network (computer, printer, etc.).
EtherNet/IP	Ethernet-based fieldbus for the control and data exchange with sequence control resp. the base station, developed by the company Allen-Bradley
EtherCAT	Ethernet-based fieldbus for the control and data exchange with sequence control resp. the base station, initiated by the company Beckhoff
Final value dataset	The dataset in which all result data for the screw assembly is stored.
Handheld screwdriver	Screwdriver to use at hand-work places
High	Signal level +24V
Impact start	The screwdriver starts as soon as the blade is pressed and makes contact.
Lever start	The screwdriver starts as soon as a button or lever on the screwdriver is actuated.
Low	Signal level 0V
Mean value	Mean value on a certain amount of measuring values. $\bar{x} = \frac{1}{n} \sum_{i=1}^n x_n$
Main controller	Component for processing the screwdriving programs
Monitoring criteria	Criteria that will lead to abort the screwdriving program even though the switching off criteria has not yet been reached (e.g. time monitoring, angle monitoring during torque screw assemblies).

MC	see main controller																																
n.c.	not connected – the named pin is not connected																																
NOK	not error free																																
OK	error free																																
Power unit	Component for the motor control of the screwdriver																																
Process ability index (C _p)	C_p = total specific torque tolerance of the Connection: 6 Sigma (s). This index just provides information about the spread angle of the torque values. $C_p = \frac{upper_limit - lower_limit}{6 * s}$																																
Process capability coefficient (C _{pk})	Is defined as the minimum of: 1.) $C_{pk} = \frac{upper_limit - lower_limit}{3 * s}$ or 2.) $C_{pk} = \frac{mean_value - lower_limit}{3 * s}$ This index provides information about the placing as well as the spreading of torque values. The lower acceptable C_{pk} - value for a screwdriver is 1.33 (corresponds to a calculation of the C_{pk} on limits of 4 Sigma (s)). <table><tr><th>C_p / C_{pk}</th><th>Limit values</th><th>within limit values</th><th>Error contribution</th></tr><tr><td>0.30</td><td>±s</td><td>68.3</td><td>> 30%</td></tr><tr><td>0.70</td><td>±2s</td><td>95.4</td><td>~ 5%</td></tr><tr><td>1.00</td><td>±3s</td><td>99.7</td><td>3</td></tr><tr><td>1.33</td><td>±4s</td><td>99.994</td><td>60 ppm</td></tr><tr><td>1.63</td><td>±4.891s</td><td>99.9999</td><td>1 ppm</td></tr><tr><td>1.66</td><td>±5s</td><td>99.99994</td><td>0.6 ppm</td></tr><tr><td>2.00</td><td>±6s</td><td>99.9999998</td><td></td></tr></table> The mean value must not deviate from the target value by more than 3%!!! A correct statement about the process capability index is then no longer possible.	C _p / C _{pk}	Limit values	within limit values	Error contribution	0.30	±s	68.3	> 30%	0.70	±2s	95.4	~ 5%	1.00	±3s	99.7	3	1.33	±4s	99.994	60 ppm	1.63	±4.891s	99.9999	1 ppm	1.66	±5s	99.99994	0.6 ppm	2.00	±6s	99.9999998	
C _p / C _{pk}	Limit values	within limit values	Error contribution																														
0.30	±s	68.3	> 30%																														
0.70	±2s	95.4	~ 5%																														
1.00	±3s	99.7	3																														
1.33	±4s	99.994	60 ppm																														
1.63	±4.891s	99.9999	1 ppm																														
1.66	±5s	99.99994	0.6 ppm																														
2.00	±6s	99.9999998																															
Process capability examination	Prior to using a processing device for the series production it is possible to check if the requirements are met with sufficient safety. It is the objective of the process capability examination to verify that a) the process to be examined is processing with the recognizable are legality. If legality is not recognizable then the process has no defined capability. Especially then it is not permissible to allocate a statistically calculated capability characteristic. b) the process is able to produce the parts in the indicated																																

	tolerances. The required documentation for this can only be provided under point a) found legality. The verification of the process ability must be done over a longer time period. Random sampling is done in set intervals from the running process and quality characteristics are recorded (measured). The influence of the machines, the materials and the operator are assumed by the process ability. The basis of the analysis is the Gauss distribution curve.
Profibus	Industry bus for the control and data exchange with sequence control.
Profinet	Industry bus for the control and data exchange with sequence control resp. the base station
Program selection	Selection of the program to be started. The program selection can occur in different ways, depending on control and selected screw types (e.g. I/O interface at the control, direct program switching at the screwdriver, etc.)
Proxy	Communication interface in a network.
PU	see power unit
Push to start	The screwdriver starts as soon as the bit is pushed.
Ready signal	The ready signal indicates that the control is ready for the start of a screw assembly. If the ready signal is not available then either a screw assembly is active or a state is present that prevents the screw assembly (certain menus, system error).
Reload	Functionality for the control of screw feeders directly via the sequence controller
Resolver	electro-magnetic transducer to change the angle position of a rotor in an electric size
Screwdriver logic	Electronic where all data of the screwdriver is stored. If the screwdriver is connected to the controller then it recognizes all data of the screwdriver. No settings have to be performed manually.
Screwdriving program	Sequence of the screwdriving process Consists of screwdriving strategies and commands
Screwdriving sequence	Sequence of the screwdriving process Consists of screwdriving strategies and commands
Screwdriving strategy	Implementation of common screwdriving processes with pre-defined parameters which contain the precise value of a screw assembly. (e.g. fasten to torque with rotational angle control)
Sequence controller	Controller to use with the EC or EC servo screwdriver
Standard deviations	mean deviation of measuring values from the mean value. $s = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n-1}}$

Stationary screwdriver	Screwdriver for stationary use
Switching off criteria	Criteria to which the screw assembly should be done (e.g. torque, angle etc.).
Toolbox	Accessories for the automatic selection of a certain screwdriving program based on the used tool.
Web interface	Software interface for the programming of the sequence controller that are actuated via a standard Internet browser.

20 EG-Conformity Declaration

Machine Type

please see

Serial Number

type plate

Year of Manufacture

at the machine

Directive	Date	Applied and fulfilled essential requirements
EC-Machinery Directive 2006/42/EC	2006-06	ANNEX I, Article 1.1.2 a) and b), 1.1.3, 1.1.5, 1.3.2, 1.3.4 and 1.5.1 Assembly instructions in accordance with Annex VII B a
Low voltage directive 2006/95/EC	2006-12	ANNEX I basic requirements
Directive for electromagnetic compatibility 2004/108/EC	2004-12	ANNEX I basic requirements
Standards	Date	Remark
EN ISO 12100 Part 1	2003-11	Machine safety fundamental rules, general fabrication directives
Part 2		general technical directives and specifications
EN 60204-1	2007-06	Machine safety; electric equipment of machines, general requirements

Amberg, 1/7/2015

i.V.

Mr. Bernhard März

Head of Development Control Technology

21 Service Locations and Authorized Partners



Contacts in Germany
as well as
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If you need any further information then please either contact your representative or us directly at DEPRAG SCHULZ GMBH u. CO.
During business hours our **Service-Hotline + 49 (0) 700 00 371-371** is available for German and English speakers.

NOTICE:

This hotline is **subject to charges** outside business hours!

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