AMKASYN
Inverter modules AW
AW 1,3/2,6 , AW 2,5/5 , AW 4,5/9
Hardware description

Version: 2002/22
Part No.: 25321

AMK

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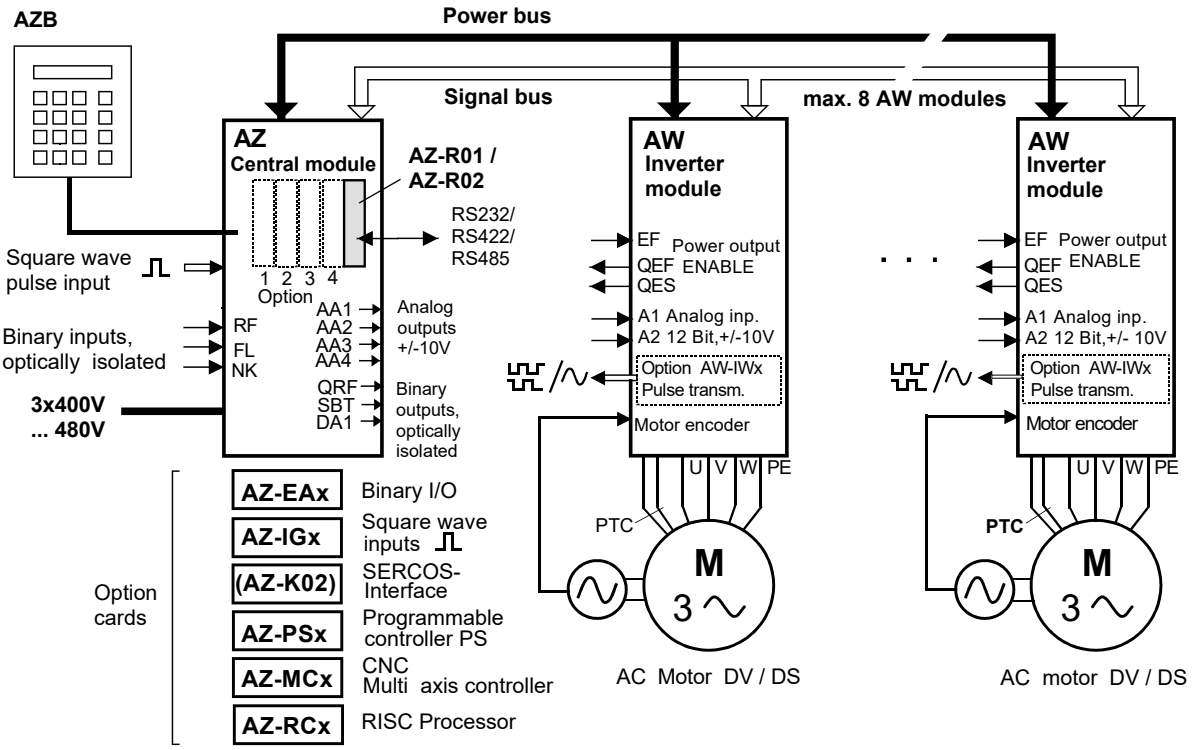
1 System overview



RF All INVERTERS ON
FL ERROR RESET
NK Reference limit switch

QRF INVERTERS ON handshake
SBT SYSTEM READY
DA1 Data output (configurable)

EF Power output ENABLE
QEF Power output ENABLED
QES Power output DISABLED

The AMKASYN series is a drive system of modular construction for feeding AMK AC motors. The digital inverters regulate the drives in 4 quadrant mode precisely and with high dynamic response. The feed is direct from a 400V three-phase power supply. The inverter modules are supplied from a common DC BUS. The latest power semiconductor technology in conjunction with high-grade integration guarantee high reliability. The units are protected against overcurrent.

2 Safety instructions

Please read and observe additionally the „Safety instructions for AMKASYN Inverters“.

Meaning of the used symbols:

Danger

Possible consequences: Dead or severest injuries!

Warning

Possible consequences: Severe injuries or death!

Warning

The operation of the drive system in a manner that does not conform to its purpose and intended use can be dangerous and can cause severe injury, up to loss of life, to the user/operator. Misuse can also cause damage to the machinery/equipment of the enduser.

In order to minimize the risk of accidents and damage it is necessary that installation, start-up, maintenance and repairs are performed diligently by trained and experienced specialists.

Drive system parameters may only be set or modified by the machine manifacturer!
Entry of non-conforming parameter values is effecting the drive behaviour and increasing the risk of accidents and damage!

Danger

Each time before working on the AMKASYN drive system: Interrupt power supply using the MASTER SWITCH!
Working under voltage is dangerous to life!
More than ONE LIVE CIRCUIT! See diagram! (2 line circuits on AZ module X01, X03).
After POWER OFF:
Because of capacitor charge don’t touch electrical connections immediately! DC voltage at terminals UZP and UZN is dangerous to life!
Before working on the modules wait for discharge time longer than 3 minutes after turning power off!

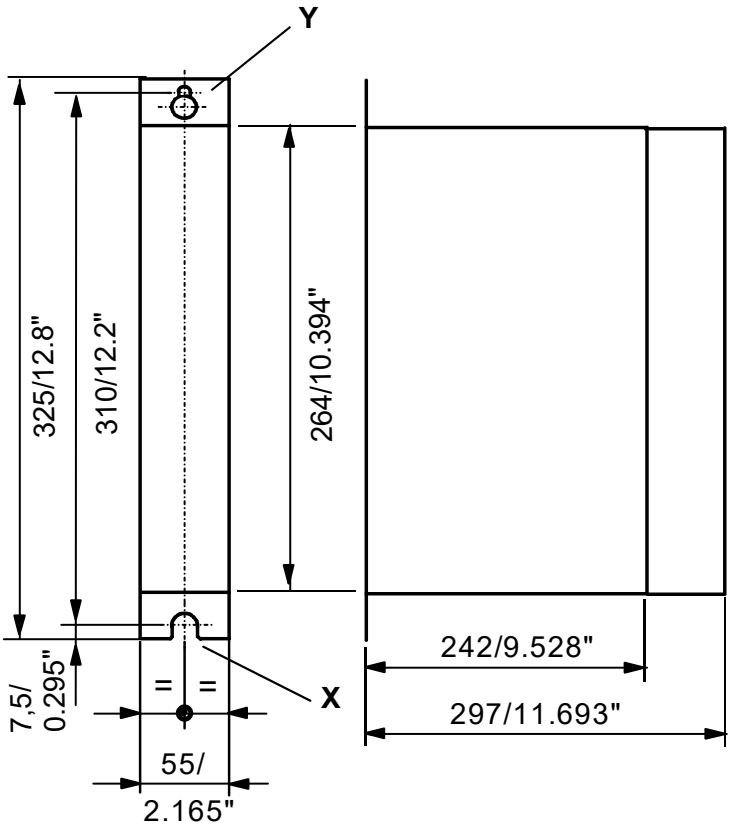
The option cards and all plug connectors must only be inserted or removed when the modules are voltage-free!

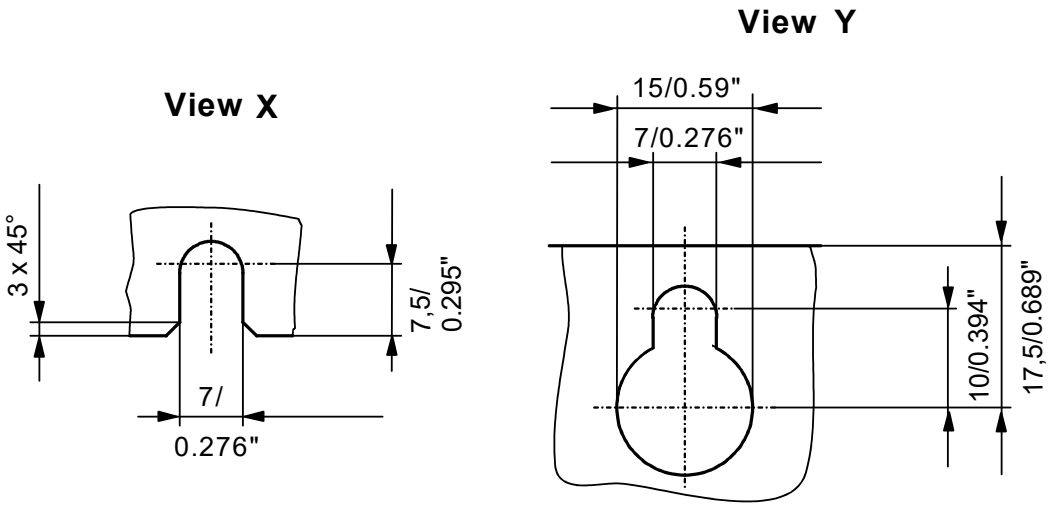
Never losen or tighten terminals under voltage!

3 Inverter modules AW specifications AW 1,3/2,6 , AW 2,5/5 , AW 4,5/9

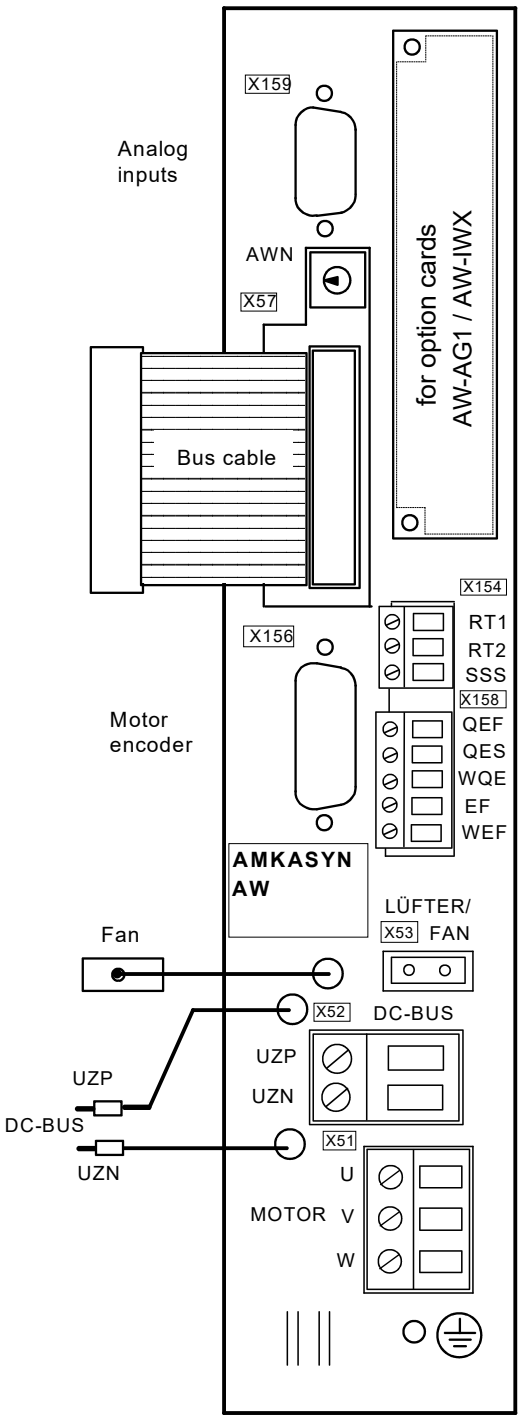
Typ	AW 1,3 / 2,6	AW 2,5 / 5	AW 4,5 / 9
Nominal input voltage range	DC-BUS: 540V ... 650V DC		
Output voltage	up to 3 x 350V for sinusoidal output currents		
Output frequency	0 Hz to 800 Hz		
Output nominal rating	1.3 kVA	2.5 kVA	4.5 kVA
Output peak rating	2.6 kVA	5 kVA	9 kVA
Nominal output current Peak output current / time	2.15 A 4.3 A / 25 s	4.15 A 8.3 A / 25 s	7.5 A 15 A / 25 s
Overload protection level in [%] of full load current	200	200	200
Efficiency	> 0.96		
Cooling	–	forced air cooling	
Fan voltage	–	230 V	
Fan rating	–	2,5 W	5 W
Protective functions	Overcurrent protection		
Control procedure	PWM		
Switching frequency	8 kHz		
recommended cable cross sections [mm^2] (AWG): AW motor X51 (shielded cable)	Cable cross-sections according to „Conductor Table 53, 2 UL 508C“ use copper wires (75°C) only 4 x 1.5 (AWG 14)		
AW PTC resistor X54 (shielded cable)	2 x 0.5 (AWG 20)		
PE connection	10 (AWG 6)		

4 Dimensions inverter modules AW 1,3/2,6 , AW 2,5/5 , AW 4,5/9

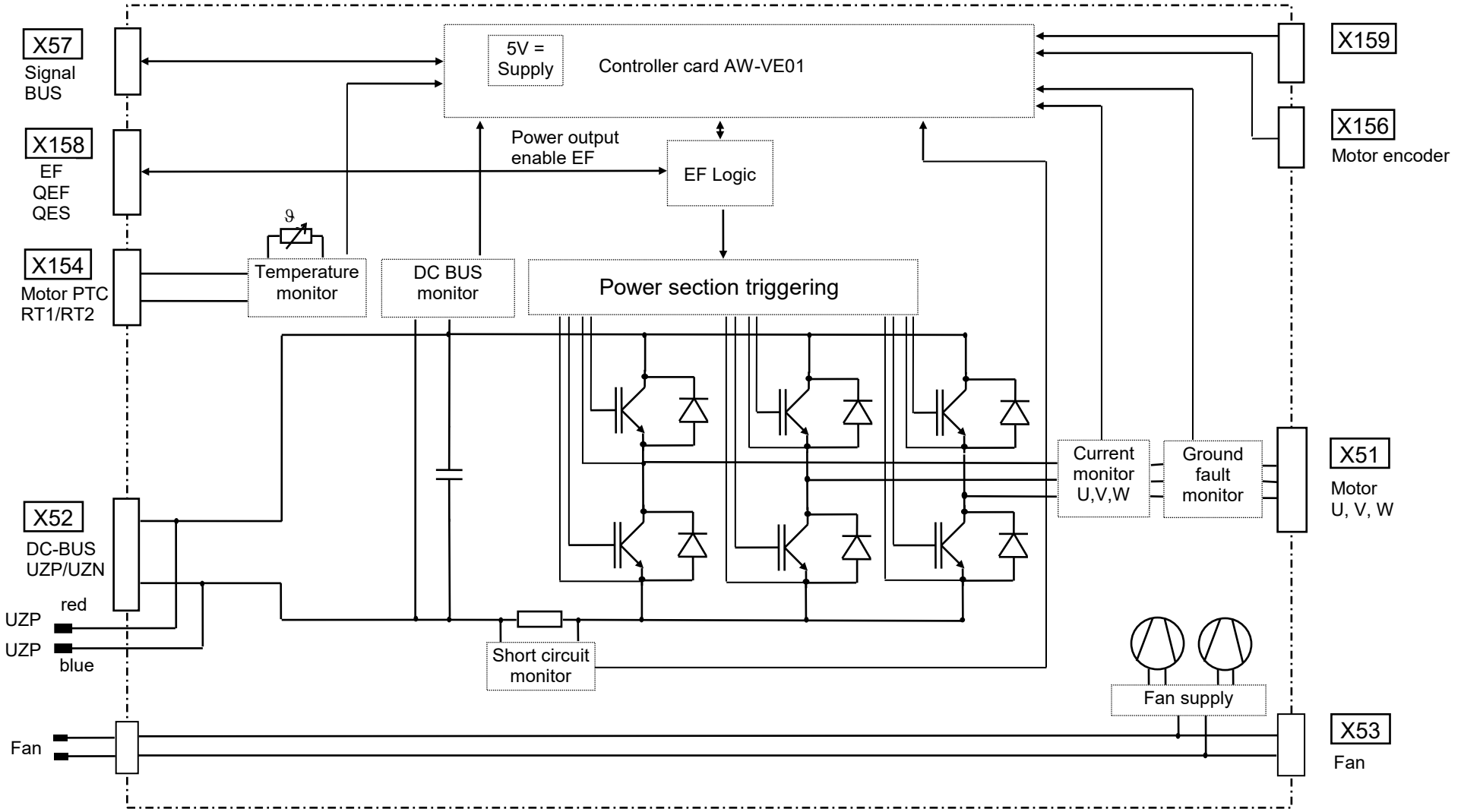




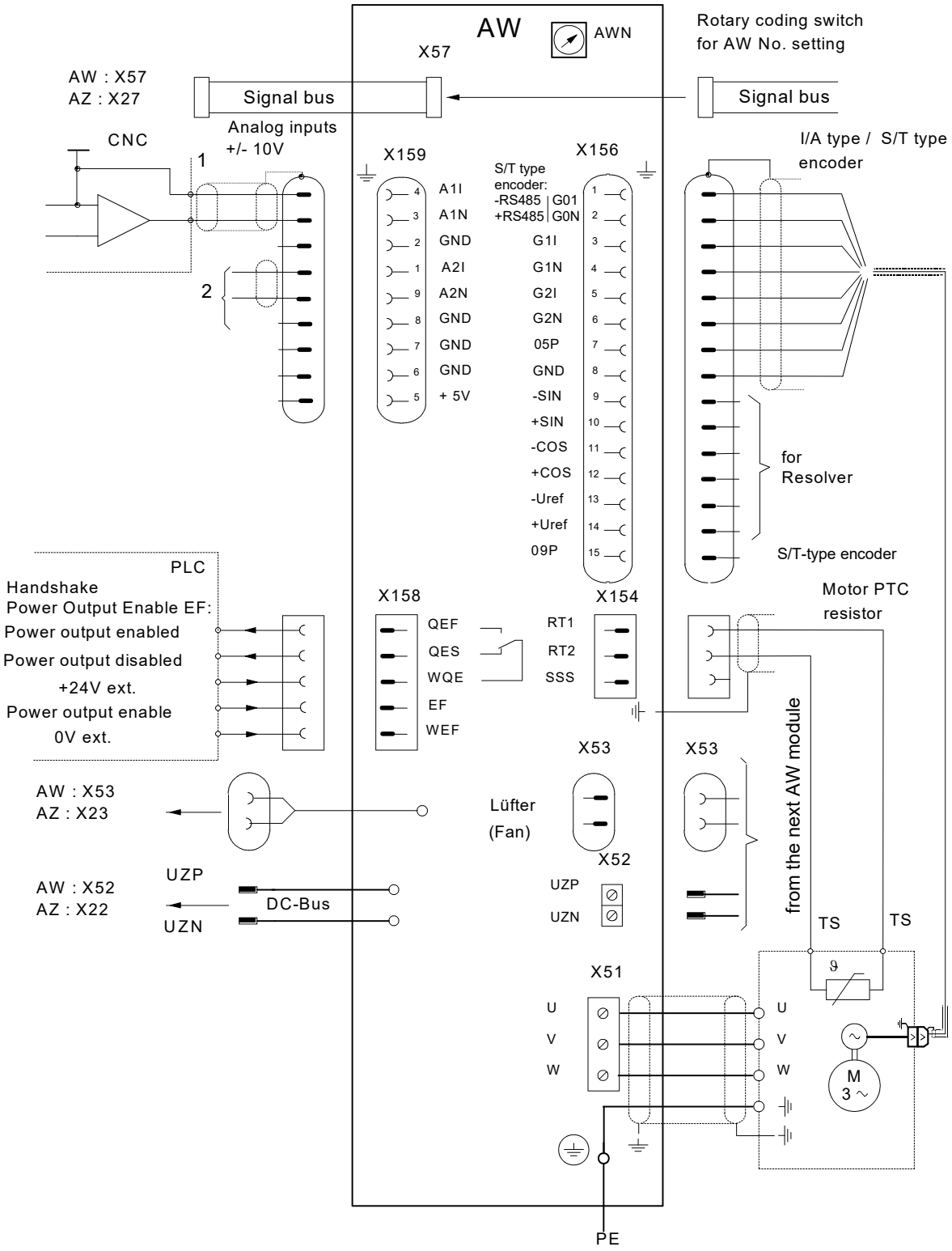
5 Front view of inverter module AW, connections



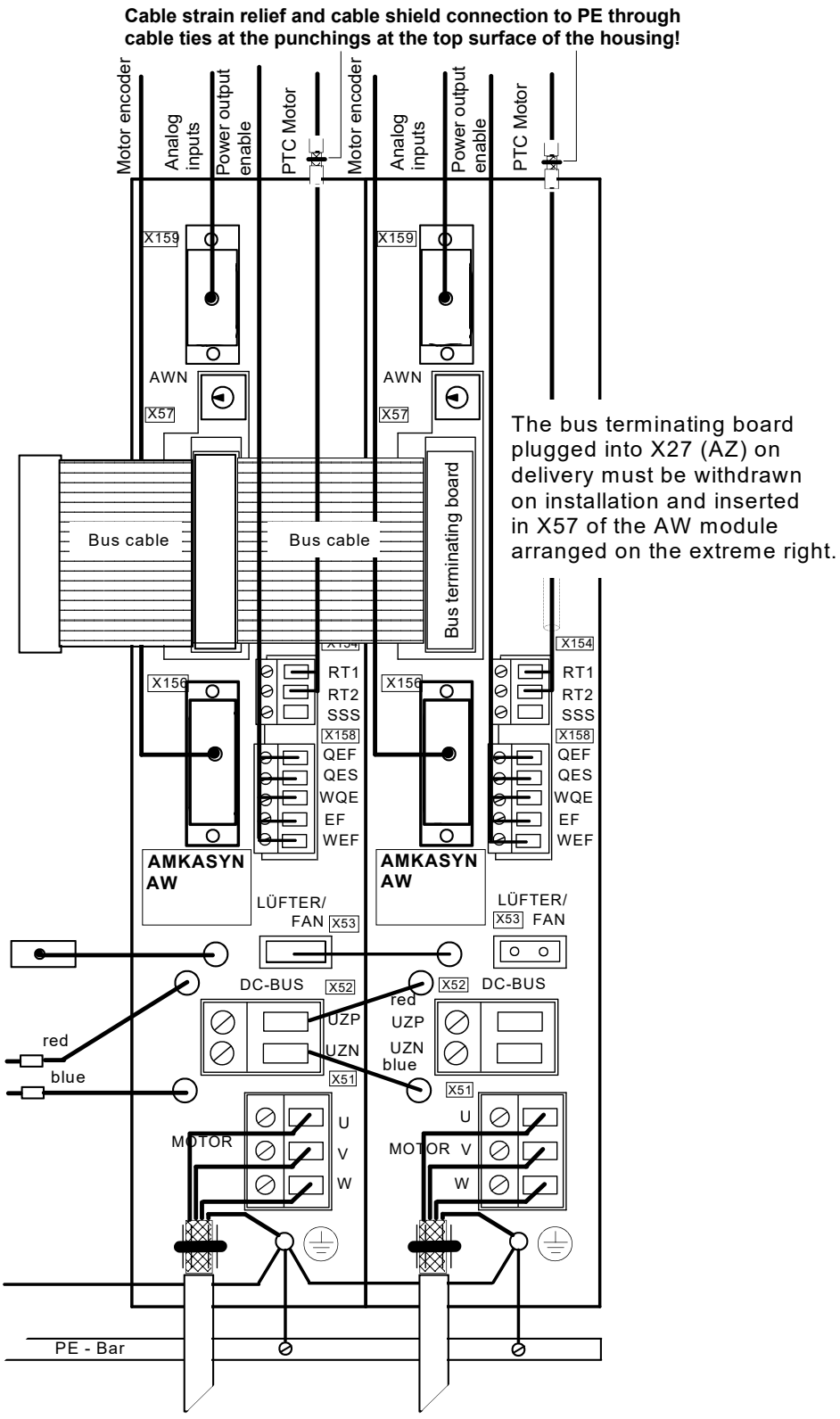
6 Block diagram inverter module AW



7 Connection drawing of inverter modules AW



8 Wiring AW - AW



9 Functional description of inverter module AW

The inverter module AW contains the following functional groups:

- Microcontroller for:
  - Field orientation
  - Motor encoder evaluation and monitoring
  - Speed control
  - Position control
  - Power semiconductor triggering
  - Current control
  - Monitoring
- Converter, equipped with IGBT power semiconductors

The microcomputer calculates cyclicly the instantaneous values of the nominal currents for the phases from the specified setpoint, the actual phase currents as well as the rotor position.

The power semiconductor (IGBT) triggering is synchronized with the basic clock of 8 kHz in the form that the motor windings carry sinusoidal currents when stationary. The entire control system is digital. Logic and power units are galvanically separated by optocouplers. The converter currents are I^2t monitored. The inverter output is protected against overcurrent.

The speed and position control circuits are implemented by the microcontroller. The system derives the actual values for speed and position from the motor encoder signals. Motor encoder types „I“ and „T“ can be connected directly. For encoder type „A“ an electronic interface module is required (AW-AG1).
In operation, the encoder signals are monitored. On failure of the encoder , the „System ready“ SBT is reset, the clock pulses are blocked, the drive coasts.
2 analog setpoint inputs 10V are integrated in the AW module. The effect of the analog setpoint is determined by parameters.

Analog input A1 serves as setpoint input (speed, torque). Change of the torque limit is possible through A2 by altering the analog voltage.

Numerical or pulse setpoints must be input through AZ module. They are distributed from there via the internal BUS system to the individual inverter modules AW.

Each inverter module AW in an AMKASYN drive system receives its own number. This must be set on the rotary coding switch „AWN“ using a small screwdriver before start up (AWN1...8, for a system with 8 drives). Multiple allocation of a AWN number is not permissible.

10 Interfaces, signal description of inverter module AW

10.1 DC-BUS voltage supply (DC-BUS X52):

The single wires UZP (red) and UZN (blue) are in each case connected to the adjoining module (AZ or AW) at the terminals UZP and UZN.
The DC-BUS voltage is provided for the next AW module at the terminals UZP and UZN (X52).

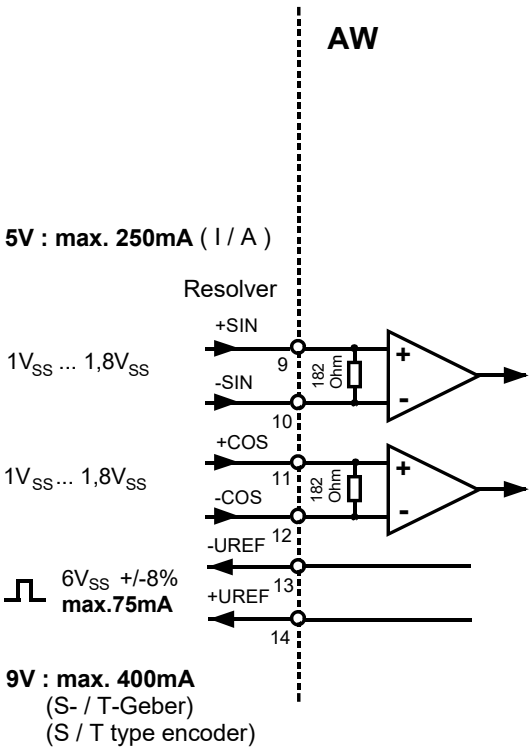
10.2 Motor encoder connection

10.2.1 Motor encoder connection X156

15 pole D-SUB female connector, for I-/S-/T-/A-type encoder or resolver.

Connector pin assignment:

X156	I / A	S / T	Resolver
1	G0I	-RS485	-
2	G0N	+RS485	-
3	G1I	G1I	-
4	G1N	G1N	-
5	G2I	G2I	-
6	G2N	G2N	-
7	05P	-	-
8	GND	GND	-
9	-	-	-SIN
10	-	-	+SIN
11	-	-	-COS
12	-	-	+COS
13	-	-	-UREF
14	-	-	+UREF
15	-	09P	-



The maximum input frequency from the motor encoder (I-/S-/T-/A-type) is 100 kHz.

For motors with A-type encoders AW option card AW-AG1 (A-type encoder adaption) or AW-IWA (pulse transmission with A-type encoder adaption) must be installed into the card slot at the top right beside the AW controller card.

For encoder connection a shielded cable must be used. The cable shield must be grounded at both ends !

10.3 Power output enable X58 (Plug-in terminal block):

Terminal EF: Binary input „Power output enable“

Optically isolated input
Input nominal voltage: +24V_{ext}
Input nominal current: 8 mA

In normal operation, input „EF“ must be set so that the triggering pulses for the power semiconductors are enabled. Interruption of „EF“ with „Inverters on“ (RF) still energized leads to a system fault. The axis coasts.

Terminal WEF: Reference potential 0V_{ext} for EF input voltage.

Terminal QEF: Relay contact output (normally open contact). Handshake „Power output enabled (24V= min. 20 mA; max. 200 mA).
QEF reports that „Power output enable“ is set and the triggering pulses for the power transistors are released.

Terminal QES: Relay contact output (normally open contact). Handshake „Power output disabled (24V= min. 20 mA; max. 200 mA).
QES reports that the enable relay has dropped out and thus the triggering pulses are blocked. The drive is not energized.

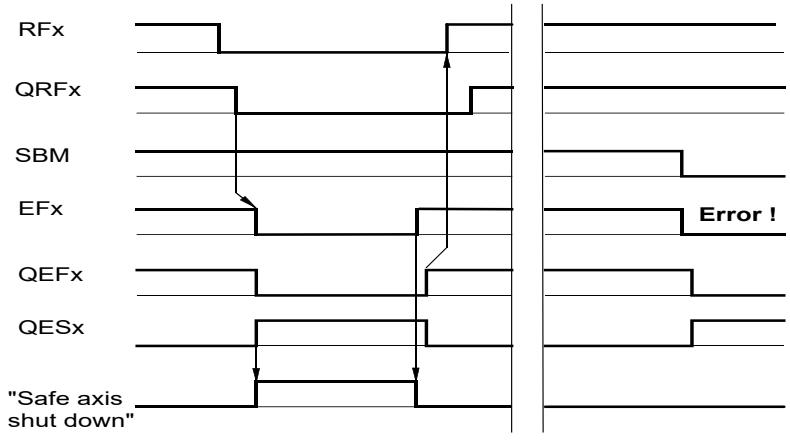
Terminal WQE: +24V_{ext}
24V supply of the relay contact (change-over contact) QEF/QES.

The power side of each inverter can be shut down safely by interrupting input EF and failsafe evaluating of the handshake signals QEF and QES (see table below) in the higher ranking controller.

Logical states for Power Output Enable EF with handshake signals QEF/QES

Control input EF Power output enable		Handshake Power Output QEF enabled	 QES disabled
inactive	0	0	1
active	1	1	0

Pulse diagram for use of „Power output enable EF“:



10.4 Motor PTC resistor X54 (Plug-in terminal block):

Terminal RT1, RT2: Connections for the motor PTC resistor
The resistance of the motor PTC resistor is approx. 170 Ω at approx. 20°/68°F.
Thermal protecion through a positive temperature coefficient thermistor (PTC).

Ratings: R_{PTC} < 1650 Ω at 140°C -5°K
R_{PTC} > 3990 Ω at 140°C +5°K

Terminal 12P, 12N: For AMK service purposes only

Terminal SSS: Not used

10.5 Analog inputs

Analog inputs A1, A2, X159 (D-SUB, 9-pole, female connector)

Two analog inputs are provided for setpoint values and torque limiting via analog voltage ± 10V. They are designed as differential inputs.
The resolution is 12 bits for ± 10V. Interrogation by the microcomputer is performed cyclicly every 250 µs.
Depending on the selected operation mode analog input A1 serves as input for speed or torque setpoint value.
By variation of the input voltage at analog input A2 torque limitation is effected.

Maximum permissible input voltage at A1/A2 is ± 12V!

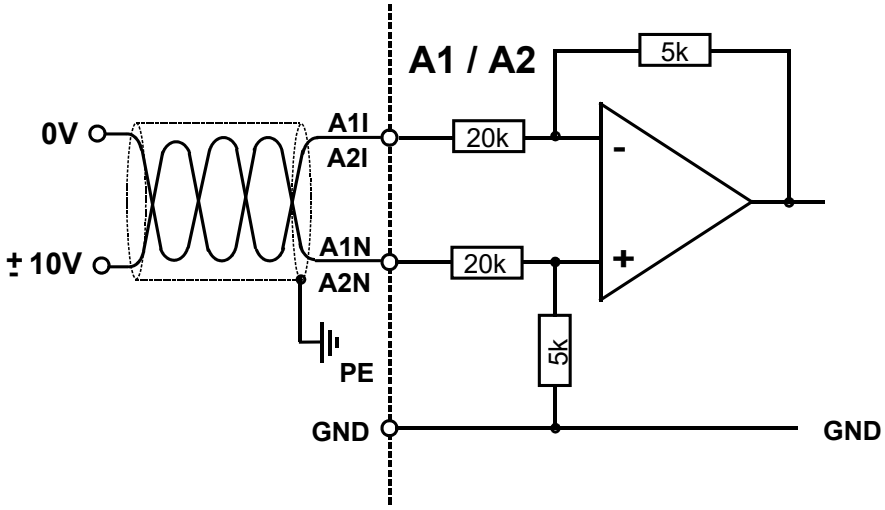
X159

Pin 4: A1I Analog input A1 (inverting)
Pin 3: A1N Analog input A1 (not inverting)
(differential input)

Pin 1: A2I Analog input A2 (inverting)
Pin 9: A2N Analog input A2 (not inverting)
(differential input)

Pin 2: GND Internal GND reference
Pin 5: GND
Pin 8: GND

Connection via twisted-pair shielded cable. The shield must be grounded at the AW end through the metallized D-SUB housing (X159).



11 AW module exchange

Important information:

1. **MASTER SWITCH OFF: Await DC BUS discharging time > 3 minutes!**
2. Remove module front cover.
3. Note position of the rotary coding switch „AWN“ (AW number).
4. Loosen strain relief and cable shield connection for all cables.
5. Remove D-SUB connector X156 (and X159 if used) after loosening of the fixing screws. Disconnect plug-in terminal blocks X54, X58.
6. Loosen the ribbon cable connectors (BUS cable) X27/X57 at the preceding module and X57 at the AW module by pressing the two locking clips to the left and disconnect.
7. If AW-IWx is installed: Loosen fixing screws at D-SUB connector X60 and disconnect it.
8. Only for AW 2,5/5 , AW 4,5/9:
   Disconnect fan connector X53 from the following AW module and X23/X53 at the preceding. For this loosen the latching at the narrow connector edge by pressing with your fingers.
9. Unscrew DC BUS connections UZP (red) and UZN (blue) at X52 from the following AW module and X22/X52 at the preceding module.
10. Unscrew motor connection terminals U, V, W (X51). Be aware of clear wire marking.
11. Unscrew PE connections at AW module and loosen motor cable shield.
12. Loosen module fastening screws at the mounting panel.
13. Slightly lift the module and take it out towards you.
14. Insert the new AW module with the same specification, lower it and securely tighten the fastening screws.
15. Securely tighten PE connections at AW module and connect motor cable shield to the front cover.
16. Securely tighten motor connections U, V, W.

Warning

Pay attention to the correct phase-sequence! Incorrect phase-sequence reverses motor direction! By this false control direction!

Switching on with false phase sequence results in an uncontrolled rotation of the motor shaft with possible damages in the installation!

17. Securely connect DC BUS UZP (red) and UZN (blue) at X52 and X22/X52 at the preceding module.
18. Insert and latch fan connector X53 (from following module) and X23/X53 at the preceding module.
19. If AW-IWx is installed: Insert D-SUB connector X60 in AW-IWx socket and secure it by the two fixing screws.
20. Insert ribbon cable connector (BUS cable) X27/X57 at the preceding module and X57 at the AW module. For this raise both locking clips slightly and then plug-in the connector without force until locking clips close.
21. Insert plug-in terminal blocks X54, X58 into the respective sockets.
    Insert D-SUB connector X156 (and X159 if used) and secure with both fixing screws.

22. For strain relief and cable shield connection fix all cables to the bare metal front panel with cable ties.
23. Set the rotary coding switch „AWN“ to the same value (AW No.) as selected at the just removed AW module (as noted under item 3) using a small screw driver.
24. If the AW module in the extreme right position was exchanged, then withdraw the BUS terminating card AW A from socket X57 (BUS) at the removed AW module and insert it into X57 at the new AW module.
25. Put in the module front cover.
26. MASTER SWITCH ON. After „System ready“ (SBT) activate RF.
27. For motors with A type encoder the encoder adjustment procedure now must be initiated through AZB panel (c.f. chapter 13).

12 Information for motor exchange

For all mechanical works contact the machine manufacturer, follow his instructions for motor disassembling and assembling again!

1. **MASTER SWITCH OFF: Await DC BUS discharging time > 3 minutes!**
2. Remove motor terminal box cover plate by loosening of the 4 screws.
3. Be aware of clear wire marking in the terminal box! Loosen motor connections U, V, W, PE, cable shield and PTC resistor connections.

   If used: Loosen connections for holding brake and motor fan.
4. Loosen all screwed cable glands.
   Pull out all cables including the cable glands of the terminal box.
5. Loosen knurled nut of circular motor encoder connector. Disconnect motor encoder connector.
6. **Disassemble motor, assemble new motor according to the instructions of the machine manufacturer.**
7. Insert cables with cable glands into motor terminal box. Tighten cable glands safely.
8. Carefully connect all wires to the corresponding terminals. Connect PE and cable shield.

Warning

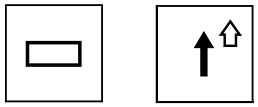
Caution:
Incorrect phase sequence U, V, W reverses motor direction, by this false control direction!

Switching on with false phase sequence results in an uncontrolled rotation of the motor shaft with possible damages in the installation!

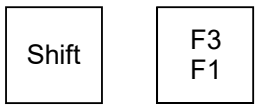
9. Close tight the cover plate of the motor terminal box by tightening the 4 screws.
10. MASTER SWITCH ON.
11. Only for motors with encoder type A
    (motor designation DV [DH] -xx-yy-4**A**..., option card AW-AG1 / AW-IWA must be installed on AW controller card):
    Before start of the process the encoder adjustment procedure must be initiated through AZB panel (c.f. chapter 13).

13 Encoder adjustment

(Only for motors with "A" type encoder)



ENC.ADJUST.	SERVICE
ERR:RESET	SYSTEM



Password:
* * * * * *

(ENC.ADJUST.)

Enter password („1 2 3 4 5").

Enter AW-No.	# 0

Enter AW-No.

Rotate motor shaft	
MANUAL	JOGMODE

(JOGMODE)

Enter speed:
RPM

Enter low speed, e.g. 255 RPM.

ABORT	
cw-rot.	ccw-rot.

As long as one of the softkeys F3 F1 (cw rotation) or F4 F2 (ccw. rotation) is pressed, the motor shaft is rotating. For safe operation the motor should be without load during encoder adjustment procedure.

CAUTION at operation with coupled load! It is the operators responsibility to prevent possible collisions!

Rotate motor shaft (if necessary with change of direction) until the following message is displayed:

Encoder data are stored

After acceptance of the new data into the EEPROM, the following message is output:

Successful enc. adjust	
CONTINUE	

Start of the normal operation.

14 Imprint

Title **Inverter modules AW 1,3/2,6 ;, AW 2,5/5; AW 4,5/9**

Objective Hardware description AW 1,3/2,6; AW 2,5/5; AW 4,5/9

Part-Number 25321

History

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2002/22

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Mon.-Fri. 7:30 - 16:30, on weekends and public holidays the phone number of the standby service personnel is available on the answering machine.

You can assist us in finding a fast and reliable solution for the malfunction by providing our service personnel with the following:

- Information located on the ID plate of the devices
- The software version
- The device setup and the application
- The type of malfunction, suspected cause of the failure
- The diagnostic messages (error codes)

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AMK Arnold Müller Antriebs- und Steuerungstechnik GmbH & Co. KG
Gaußstraße 37 – 39, 73230 Kirchheim/Teck

Tel.: 07021/5005-0, Fax: 07021/5005-176
E-mail: info@amk-antriebe.de

Additional information www.amk-antriebe.de

AMK Arnold Müller GmbH & Co. KG
Antriebs- und Steuerungstechnik
Gaußstrasse 37 – 39
D-73230 Kirchheim/Teck
Telefon: +49 (0) 70 21 / 50 05-0
Telefax: +49 (0) 70 21 / 50 05-199
info@amk-antriebe.de
www.amk-antriebe.de