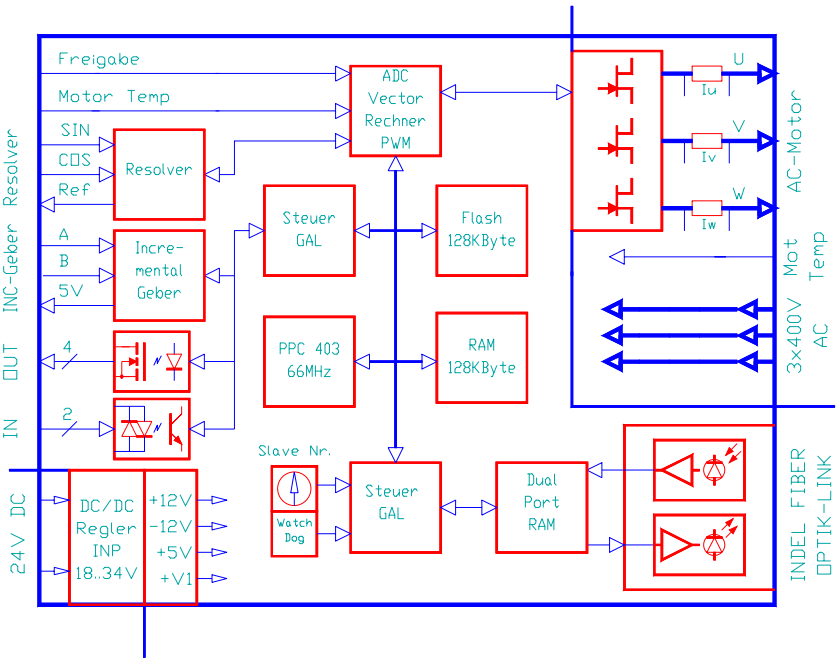
Motion Control

INFO-SAC

Stand Alone Servo-controller 100% digital

High-precision and very fast positioning and control tasks are implemented using the Stand Alone Servo-controllers INFO-SAC.
The 3 phase power supply is integrated on the INFO-SAC controllers. The controller is equipped with a phase monitor.
As on all intelligent periphery boards, a PowerPC processor ensures adequate power. On the SAC Servo- controllers, all off-the-shelf three-phase synchronous and asynchronous motors can be operated, as well as specially developed asynchronous motors for servo-operation.
Three different PID parameter sets and 8 motor configurations are available to users. In addition, up to 6 parameters can be recorded.



Technical Data

Sampling rate
- 12kHz (flow, velocity and position control)

Types
- 2.5A / 3 x 110 ... 400V AC
- 5A / 3 x 110 ... 400V AC
- 8A / 3 x 110 ... 400V AC
- 12A / 3 x 110 ... 400V AC

Path curves
- S-curve
- ISO-code
- User-specific algorithmen

Resolver input
- 12 ... 16-Bit
- Resolver signal as incremental transmitter output

Incremental input
- RS422 signal, electrically isolated

Motors
- Synchronous three-phase motors
- Asynchronous three-phase motors
- Standard motors

5V Supply
- for incremental transmitter

Order No.	INFO-SAC	101321-2.5A
Order No.	INFO-SAC	101321-5A
Order No.	INFO-SAC	101321-8A
Order No.	INFO-SAC	101321-12A

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Rev. 0201

INDEL AG INDUSTRIELLE ELEKTRONIK

Functions

Description

Controller types

Four variants of the INFO-SAC are available. In addition to the specified nominal current, the servo-controllers can be operated during 5s with the current I_{MAX5S}.

INFO-SACr	2.5A	5A	8A	12A
I_{NOM}	$2.5A_{RMS}$	$5A_{RMS}$	$8A_{RMS}$	$12A_{RMS}$
$I_{MAX\ 5s}$	$7.5A_{RMS}$	$15A_{RMS}$	$24A_{RMS}$	$36A_{RMS}$
U_{CC}	3 x 110 ... 400VAC	3 x 110 ... 400VAC	3 x 110 ... 400VAC	3 x 110 ... 400VAC

Integration in the INFO-Link

The AC servo-controllers are systematically integrated in the INFO-Link. Analog interfaces and asynchronicities between the field bus master and the controller are eliminated. All parameters are read and written via the INFO-Link or via a serial connection using tools and are available throughout the network.

PID parameter sets

The different PID parameter sets are freely available to the user. The parameter sets are simultaneously active, allowing load changes to be optimally accommodated. Example: PID parameter set 1 for upward stroke with load; parameter set 2 for downward stroke without load; parameter set 3 for stand-by with reduced current input. In addition to the PID parameters, it is possible to specify pilot controls (boosters) for velocity and acceleration.

Computing power

The PowerPC 403-66MHz performs the following taks at a clock rate of 12kHz:

- PID position controller, velocity control, active current control
- Power factor compensation
- Encoder correction (incremental transmitter)
- Limitation for: I_{MAX}, I_{2t}, controller, motor temperatures
- Logger of 6 freely selectable parameters such as rotary speed, active current, path error, target/actual velocities, etc.

Position registration

Synchronous motors require a resolver for position registration. The resolution of the resolver is 12 ... 16-Bit. 16-Bit precision can only be achieved at standstill. Asynchronous motors require either a resolver or an incremental transmitter for position registration. For uncontrolled rotary speed operation, no actual value registration is necessary.
The incremental transmitter may also be used as an additional encoder. The measurement value can if required also be included directly in the control algorithm, or be used as an independent measured variable.

Operational reliability

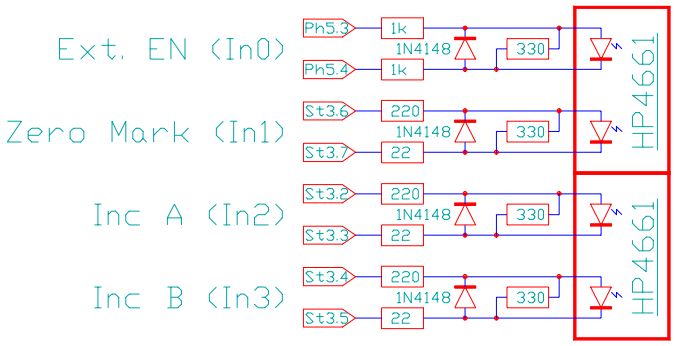
Various quantities of the AC servo-controller are continuously monitored in order to ensure maximum operational reliability. Short-circuit stoppages prevent shorts to motor or ground. In the individual phases, quick-action current cutouts protect the motor and the output stage. These become active when the drive is jammed or is stopped abruptly. The motor and the output stage are monitored for overtemperature. The motor temperature can be measured as required by means of a bimetal switch (digital) or via an NTC in the motor (voltage value).

Interfaces

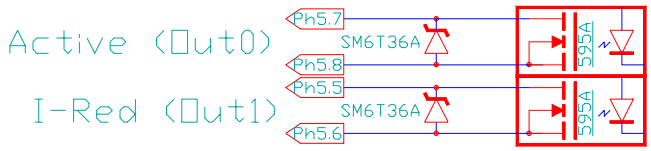
RS232 interface

RS 232 Stecker INFO-HCSr		Kabel	9-Pol-Stecker PC, Laptop
Pin-5 GND		Schirm	Pin-5
Pin-2 Rx	Eingang	←	Pin-3
Pin-3 Tx	Ausgang	→	Pin-2
Pin-6 DSR	Eingang	←	Pin-4
Pin-4 DTR	Ausgang	→	Pin-6

Inputs



Outputs



Wiring

RS232 interface

The RS232 interface serves as direct connection of the controllers to the PC.

Incremental transmitter, external zero pulse

Inputs 1..3 are sized for 5V. Input 0 is sized for 24V. This input is reserved for external controller enable and can be included in the EMERGENCY stop circuit.

If the inputs 1...3 are operated with 24V, a series resistor of 1.2kΩ is necessary. Input 1 is reserved for an external zero pulse. The incremental transmitter is connected to the inputs 2,3. Trak A is connected to input 2; Trak B to input 3. The supply of the transmitter is provided by the INFO-SAC: 5V or 24V. Instead of the incremental transmitter, it is also possible to connect limit switches.

Outputs

The two outputs are reserved for "Motor control active" and "Current reduction active".

Supply of the incremental transmitter

The DC/DC converter on the board also supplies +5V to the incremental transmitter. A special power supply for the transmitter therefore is unnecessary (not electrically isolated from the 24V supply).

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Specifications

Climatic conditions
Ambient temperature:

- Storage: -20...+80°C
- Operation: 0 ... +45°C
- Board temperature: Operation: 0...+70 °C
- Relative air humidity no condensation: 80%
- Enclosure IP-20
- Pollution degree: 2 (EN 50178)

Supply 3x110...400V AC

- Operating voltage: 3 x 110 ... 400V ±10%
- 1-phase operation as option
- Phase error detection
- TT-supply and TN-supply with grounded star point

Motor

- All types of three-phase motors asynchronous und synchronous
- Minimum inductivity: 1mH
- Minimum resistance: 0.2Ω
- Max. motor voltage: 565V
- Max. line length: 20m
- Motor temperature monitoring: bimetal or KTY-84 (NTC) on connector Ph2: T+, T-
- Observe voltage resistance of winding

Resolver inputs

- 12 ... 16 Bit resolution
- 4Vrms sine, bridge connection
- 2Vrms Sin/Cos input

Intermediate circuit, brakes

- 565V DC
- Brake-IGBT (PH-4)

Output stage

- Loss power (I_{MAX}, without brake resistance)
  INFO-SAC-2.5A: 55 W
  INFO-SAC-5A: 100 W
  INFO-SAC-8A: W
  INFO-SAC-12A: W
- Short-circuit protection: Short to ground, short to phase
- Temperature monitor: Precision: ± 2°

Connector Allocations

Casing bottom

PH1
Mains

1	I	PE
2	I	L1
3	I	L2
4	I	L3

PH2
Motor

1	I	T-
2	O	U
3	O	V
4	O	W
5	I	T+
6	O	PE

PH3
Intermediate circuit

1	O	DC+
2	O	DC-

PH4
Ballast resistance

1	O	PE
2	O	RB-
3	O	RB+

Casing top

PH5
Supply/signal

1	I	24V
2	I	0V
3	I	+En
4	I	-En
5	O	+O
6	O	-O
7	O	+Ac
8	O	-Ac

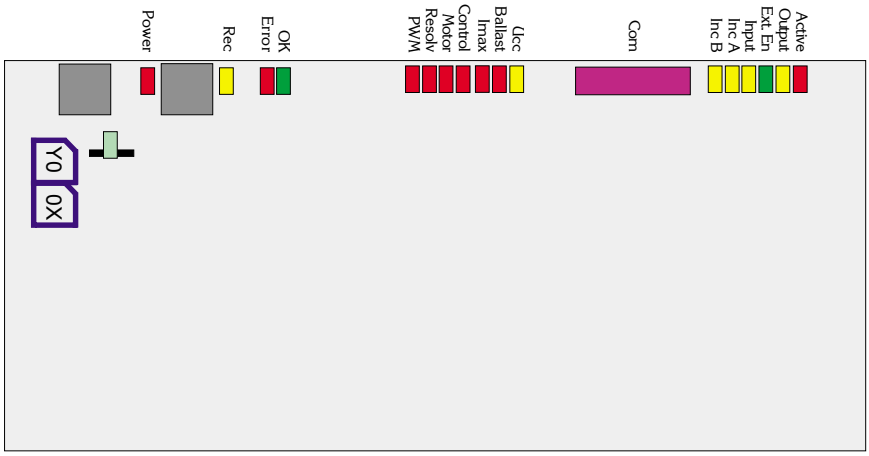
ST2
Resolver
D-Sub 9-pin
(female)

1	O	PE
2	I	MTmp+
3	I	Cos+
4	I	Sin+
5	O	Ref+
6	I	MTmp-
7	I	Cos-
8	I	Sin-
9	O	Ref-

ST3
Incr. transmitter
D-Sub 9-pin
(female)

1	O	PE
2	I	+IncA
3	I	-IncA
4	I	+IncB
5	I	-IncB
6	I	+In1
7	I	-In1
8	O	0V
9	O	5V

Wiring



Adressing (blue)

S1,S2 (Y0,0X) (Adr.)	Axis (channel)	Incr. transmitter (channel)
00 ... 03	0 ... 3	
10 ... 13	4 ... 7	
...		
70 ... 73	28 ... 31	
80, 82	0, 2	1, 3
90, 92	4, 6	5, 7
...		
F0, F2	28, 30	29, 31

The incremental transmitter can be integrated directly into the control algorithm. If 0x80 is added to the current axis number (increase rotary switch Y0 by 8), the incremental transmitter will report on the next followig channel number.
In this connection, only even addresses are allowed for the controller so that the incremental transmitter will always come to lie on an odd address.

LEDs on receiver module

Power = +5V supply
Rec = INFO-Link receiver signal OK

LEDs

The functions of the other LEDs on the front panel are described starting on page 7.

Jumpers (light green)

The jumpers influence the light intensity of the transmitting LED and thereby the segment length of the fiberoptic cable to the next board.

Segment length	Jumper position
0 ... 10m	no jumper
8 ... 30m	>10
20 ... 50m	>30

Specifications

Supply 24V DC

- Electrically isolated
- Operating voltage: +18 ... 34V DC
- Current consumption: ..mA an 24V DC

Sampling rate

- Sampling rate: 8 ...12kHz (current, velocity and position control)

Outputs Out 0,1

- Connector Ph5, Pin 3..8
- Outputs electrically isolated:
  V_{OFF}: 24V
  I_{ON}: 500mA

Inputs INP 0..3

- Electrically isolated:
- Input 0: 24V
- Input 1..3 without connection: 5V
- with 1.2kΩ series resistor: 24V

Increment inputs

- Incremental transmitter input with A,B tracks
- Interface: 5V / RS422
- max. count frequency: 2.5MHz

5V Supply

- Voltage: 5V; +10%
  max. current: 200mA
- Supply for additional incremental transmitter (no electric isolation from 24V board supply)

Mounting

- 2.5A 60 x 167.5 x 280 mm
  5A 75 x 167.5 x 280 mm
  8A 75 x 167.5 x 280 mm
  12A 110 x 167.5 x 280 mm

RS232 interface (violet)

Communication with the controller is done either via the INFO-Link or via the RS232 interface with the aid of the program ACS-Show.

Connections

Board supply

For the board supply, a 3-phase rectifier without electrolytic capacitor is sufficient. To avoid trouble, however, we recommend an electrolytic capacitor of 4'700 ... 10'000µF.
The rack must be provided with a power line filter, immediately after entry of the power supply.

Screening lines

The signals of the resolver are extremely susceptible to interference; therefore the resolver must be installed with a twisted-pair and screened cable.

The incremental transmitter and the serial interface as well as the motor cables must always be connected with screened lines!

Bonding

Always connect all screens at both ends. To avoid undesirable discharge currents through the screening, it may be necessary to provide a binding conductor, especially with large distances or different supplies.

Screen bar

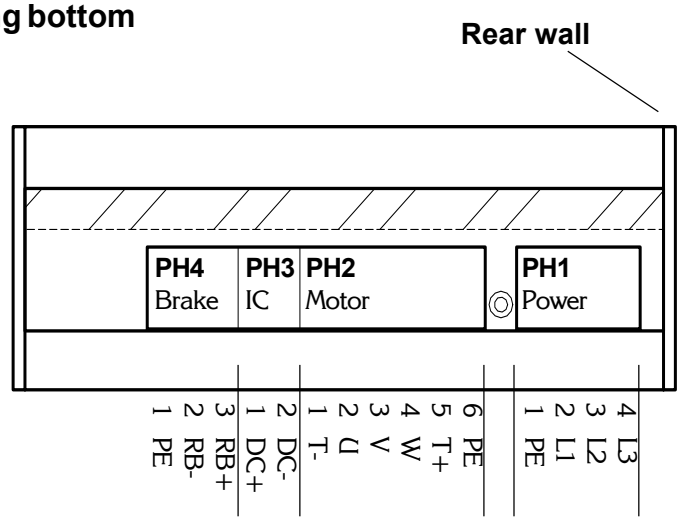
The control cabinet must be provided with a screen bar to which all screened cables are connected.
Metallic connectors with all-round contacting of the screen are also suitable for cable entries.

Connectors

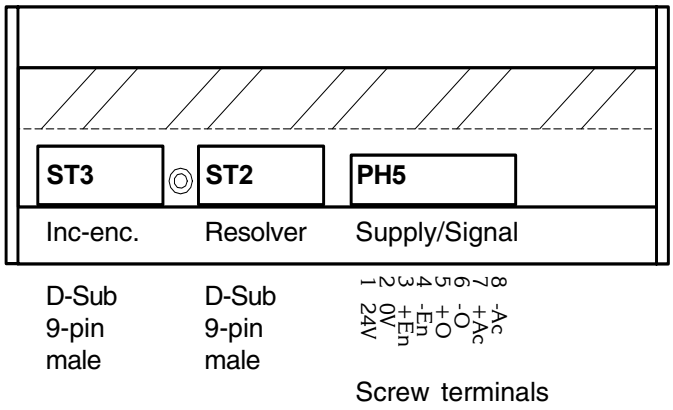
Interruptions in the resolver and motor cables at the cabinet entries etc. should be implemented using metallic connectors and not terminal connections.

Connections

Casing bottom



Casing top



Motor temperature switch

Open = Motor overtemperature connector Ph2, Pin T+, T-
Closed = Ok

Installation

Cooling

All INFO-SAC controllers are provided with a built-in fan. Despite this, an additional fan must be installed inside the cabinet to dissipate the exhaust heat.

Between the individual SAC controllers, observe a clearance of at least 1cm.

The fan is operated at a temperature of 37.5°C with 25% power, at 50°C 100%.

Motor temperature

The motor temperature can be measured as required by a bimetal switch (T-switch) or using an NTC (MTemp).

Sensor leads in the motor cables
If the leads of the bimetal switch are located in the motor cables, these must be wired to connectors Ph 2.

Sensor leads in the resolver cable
If the leads of the bimetal switch or of the NTC are located in the resolver cable, these must be wired to connector Ph 2. (insulation class!)

Filter

The 24V supply must be provided with a filter, as well as the 3 x 400V AC to connector Ph1. The optimal filter may have to be determined by a measurement for line-bound emission, as the radiated interference depend, among other things, on the motor cable length.

Grounding

The casing of the INFO-SAC board is grounded. Take care to ensure that the casing is connected to the mounting plate so that good conduction exists. (EMC and heat dissipation). As the resolver is mounted directly onto the motor, this motor transmitter combination must must always be grounded, as otherwise the transmitter electronics will be exposed to interference.

Further documentation

See also INDEL wiring guidelines and INDEL design guidelines.

LEDs

Function of the LEDs on the Front Panel

Active

Motor control active (Out 0)

Requires external enable (Ext En, INP-0). Output stage ON, motor energized and with current and 4k-Pos control on Active or Simulation.
In the event of an error, the controller will quit the active state.

Output

Current reduction mode active (Out 1)

In this operation mode, the controller limits the maximum current to I_{red}. Out-1 of 4k-Pos-Job = 1

Ext. En

External controller enable (INPUT 0)

Interlocks output stage by hardware function, i.e. the controller cannot be switched to active without external enable.
INP-0 can be included in the emergency off circuit.

Input

Free input (INPUT 1)

Free 5V input, can be read in 4k-Pos Job. (See software manual)

Inc A

Incremental transmitter track A (INPUT 2)

Allocated as standard as incremental transmitter input A (additional encoder). 5V input, or RS 422 interface.

IncB

Incremental transmitter track B (INPUT 3)

Allocated as standard as incremental transmitter input B (for the additional encoder). 5V input, for RS 422 interface.

OK **Error**

Emergency system

In the emergency system, Flash-PROM burning is supported. To enable the controller to start in the emergency system, you must plug a short-circuit connector onto the serial interface (front panel).

Connections:	Signals	Pin
	RxD, TxD	2, 3
	DSR, DTR	6, 4

Once the controller has been started up, the short-circuit connector can be removed and the serial cable to the PC can be connected again.

Function of the LEDs on the Front Panel

LEDs

Controller status

Blink code

The LEDs indicate by lighting, fast or slow blinking the status of different functions of the controller. For the following sketch, the following applies:

E = Error; Delete Error from Software: Deactive, Active
W = Warning

Please use the program "ACS-Show" as additional help in verifying the error.

 same rhythm as OK-LED on controller

 approx. 3 times per second

 approx. 1.5 times per second

Intermediate circuit voltage (565 VDC)

U_{cc}

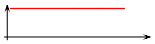
(see also modulation, PWM-LED)

 = E Intermediate circuit voltage lower 20V ($U_{CC\ MIN}$)

 = E Intermediate circuit voltage higher 800V ($U_{CC\ MAX}$)

 = E Phase error, see below

 = W Intermediate circuit voltage lower 500V ($U_{CC\ OK}$)

 = Intermediate circuit voltage 501 ... 799V

Ballast resistance

Ballast

Ballast + U_{cc}

`Dimming` = Ballast resistance is switched on-off (PWM output)

 = E Discharge does not work: U_{CC} does not become smaller although ballast resistance is on.
(U_{CC} blinks with same frequency as ballast LED)

Causes:
- No ballast resistance connected
- Extraneous supply through parallel-connected controllers (U_{CC} bridged)

Phase error

Ballast + U_{cc}

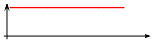
 = E A phase has failed.

LEDs

Function of the LEDs on the Front Panel

I_{MAX}

Motor current

 = E I_{2t} exceeded (I_{2t} ≥ 120%)

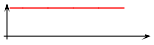
 = E Motor overloaded or blocked (excessive load with excessive starting current).

 = W I_{2t} exceeded, motor current is limited to I_{nom} (I_{2t} = 100 ... 119%)

 = W I_{MAX} reached; if the controller is operated in the current limiting mode, this warning is displayed when I_{red} is reached.

Control

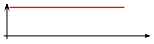
Temperature output stage

 = E Output stage overheated (from 80°C)

 = W Output stage hot (from 75° C)

Motor

Motor: Temperature, short circuit

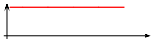
 = E Motor short circuit, or output stage defective

 = E Motor temperature switch tripped for over 10s

 = W Motor temperature switch tripped

Resolver

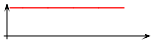
Resolver

 = E Resolver connection defective or incorrect.
This error also occurs when the rotor is turning while the axis is switched to active.

 = E Maximum mechanical rotary speed exceeded

PWM

Modulation

 = E Current offset too high (Test before Active)

 = E Current measurement range exceeded

 = W PWM 100% modulation reached (poss. U_{CC} too low?)

If the motor is operated with high rpm, the PWM-LED will start to blink. U_{CC} is fully modulated, i.e. the full int. circuit voltage is present at the motor. This is an allowable operating condition. With high power (current) and high rpm, the intermediate circuit voltage will drop and the U_{CC} LED and the PWM LED will start to blink. In this state, the controller is allowed to be in continuous operation. Only when the controller exceeds the maximum allowable path error (increment, entrainment error) is the loading limit reached and the controller switches to Error.

Function of the LEDs on the Front Panel

LEDs

Important!
If the maximum rpm cannot be reached because path errors, entrainment errors occur while the U_{CC} LED is blinking, check the following causes:

- Inadequate power of supply mains (400V). Inadequately sized or too high-ohmic isolating transformer. Observe line length and cross-section of the supply line.
- Overloaded motor.

Remedy:
- Increase intermediate circuit voltage with additional transformer windings Observe max. U_{CC}=720V!
- If several controllers exist distribute them among different phases.
- Possibly apply additional power pack (INFO-ACPr).

CPU-OK, controller active

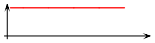
OK


Controller deactive, OFF, CPU ok


Controller active, ON, CPU ok

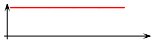
Errors

Error


= E Software error, CPU on Trap

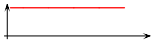
Wrong control parameters

Error + Control


= E After the controller is switched on (not Active), the Control LED together with Error LED indicate unplausible or missing **control** parameters. With the factory-set parameters, this status display appears.

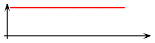
Wrong motor parameters

Error + Motor


= E After the controller is switched on (not Active) the Motor LED together with Error LED indicates unplausible or missing **motor** parameters. With the factory-set parameters, this status display appears.

RAM errorr

Error + U_{cc}


= E If this error message appears, the controller must be subjected to a hardware overhaul. Please contact Indel AG.

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Notes on Safety

Terms

In the following text, the term "Module" refers to the AC Servo-controller and the associated power components as well as control components which have an operating voltage of over 50V AC.

Specialist personnel

Only qualified specialst personnel are allowed to carry out work such as handling, installation, start-up and maintenance.

Documentation

Before installation and start-up, please read the present documentation. Incorrect handling of the Modules may lead to personal injury or property damage. Always observe the technical data and the information provided on the connection conditions.

ESD

The Modules contain electrostatically endangered components which might be damanged by improper treatment. Discharge your body before touching the Modules. Avoid contact with highly insulating materials (synthetic fibers, plastic film, etc.). Place the Modules on a conductive base.

Live components

During operation, keep all covers and cabinet doors closed. If you touch live components, you may risk death or serious injuries or property damage.
Never disconnect the electrical connections of the Modules while they are energized and never withdraw rack boards from the rack while they are energized. In the worst case, this may cause electric arcs, injuring persons and damaging contacts.

Deactivation

Control and power connections may be live even if a motor is not turning. After the operating voltage has been switched off, residual voltages may remain present during several minutes. Measure the intermediate circuit voltage and wait until the voltage has dropped below 50V.

Inquiries

These notes on safety do not claim to be complete. Should you have any inquiries, please call us. (Phone +41 1 956 20 00)