Jetter automation

User Manual

JM-D203-230 - Digital Servoamplifier

60870727

We automate your success.

Article # 608 70 727
Revision 2.16.1
April 2020 / Printed in Germany

Translation of the original German language document.

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This Operator's Manual is an Integral Part of the JetMove D203:

Type: _____

Serial #: _____

Year of construction: _____

Order #: _____

CE

To be entered by the customer:

Inventory #: _____

Place of operation: _____

Significance of this User Manual

This operator's manual is an integral part of the digital servo amplifier JetMove D203.

- Therefore, keep in a way that it is always at hand until the the digital servo amplifier JetMove D203 will be disposed of.
- Pass this manual on if the digital servo amplifier JetMove D203 is sold or loaned/ leased out.

In any case you encounter difficulties to clearly understand this user manual, please contact the manufacturer.
We would appreciate any suggestions and contributions on your part and would ask you to contact us. This will help us to produce manuals that are more user-friendly and to address your wishes and requirements.

From the servo amplifier JetMove D203 may result unavoidable residual risks to persons and property. For this reason, any person who has to deal with the transport, installation, operation, maintenance, and repair of the digital servo amplifier JetMove 206-230 must have been familiarized with it and must be aware of these dangers. Therefore, this person must carefully read, understand and observe this manual, and especially the safety instructions.

Missing or inadequate knowledge of the manual results in the loss of any claim of liability on part of Jetter AG. Therefore, the operating company is recommended to have the instruction of the persons concerned confirmed in writing.

JetMove D203 has been designed for controlling two motors. If, in this manual, one axis is not mentioned explicitely, the description and instructions can be applied both to axis A and axis B.

System Requirements

This user instruction describes the motion system JetMove D203 of the operating system version 2.16.0.0.

History

Revision	Comment
2.07.1	Chapter 12: Option -JC24X has been added
2.09.1	Modifications: max. device temperature, default IP address New: Specifications in lbf-inch and AWG, error 28
2.09.2	Modifications in option -S1 (Safe Torque Off)
2.10.1	Further specifications of the motor cable. See “Recent Revisions” on page 135.
2.10.3	See “Recent Revisions” on page 135.
2.16.1	See “Recent Revisions” on page 135.

Description of Symbols

DANGER

This sign is to indicate a possible impending danger of serious physical damage or death.

CAUTION

This sign is to indicate a possible impending danger of light physical damage.
This sign is also to warn you of material damage.

This sign indicates hazard of life due to electric shock caused by a high operating voltage.

This sign is to indicate hazard of serious physical damage or death due to accidentally touching dangerous parts of the device.

This sign instructs you to wear protective goggles. Failure to comply may lead to injuries.

This sign is to warn you of material damage due to applying hard blows or shocks to the motor flange and shaft.

NOTICE

This sign is to indicate a possible impending situation which might bring damage to the product or to its surroundings.
It also identifies requirements necessary to ensure faultless operation.

INFO

You will be informed of various possible applications and will receive further useful suggestions.
It also gives you words of advice on how to efficiently use hardware and software in order to avoid unnecessary efforts.

· / -

Enumerations are marked by full stops, strokes or scores.

Operating instructions are marked by this arrow.

Automatically running processes or results to be achieved are marked by this arrow.

PC and user interface keys.

This symbol informs you of additional references (data sheets, literature, etc.) associated with the given subject, product, etc. It also helps you to find your way around this manual.

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1 Safety instructions

1.1 General Safety Instructions

The digital servo amplifier JetMove D203 meets the applicable safety regulations and standards. Special emphasis was given to the safety of the users.

Further, the user should adhere to the following regulations:
- relevant accident prevention regulations;
- accepted safety rules;
- EC guidelines and other country-specific regulations.

1.1.1 Intended Use

Usage according to the intended conditions of use includes operation in accordance with these operating instructions.

Operate the digital servo amplifier JetMove D203 only in a closed control cabinet and within the range of the specified values, see Chapter 5 "Technical Data", page 37.
Do not apply a voltage to the digital servo amplifier JetMove D203 that is higher than the specified operating voltage.
The operating voltage voltage of the JM-D203 is 195 ... 265 VAC (one-phase). Thus, the digital servo amplifier is subject to the EU Low Voltage Directive.

The JetMove D203 servo amplifier has been designed to drive 3-phase brushless synchronous servo motors in the following modes: speed control, torque control and/or position control. The winding insulation of the motors must be higher than, or at least equal to, the DC link voltage supplied by the servo amplifier.

The digital servo amplifier JetMove D203 is used to drive machinery, such as conveyors, production machines, and handling machines.

1.1.2 Usage other than intended

This digital servo amplifier must not be used in technical systems which to a high degree have to be fail-safe, e.g. ropeways and airplanes.

Do not use the integrated braking circuit in applications, where, in case of braking circuit failure, safety hazards can occur.

The JetMove D203 is no safety-related part as per Machinery Directive 2006/42/EC. Therefore, using this servo amplifier for safety-relevant applications as regards safety of persons is neither suitable nor permitted.

An exception to this is the STO function of servo amplifiers with option- S1, see Chapter 11 "Option -S1: STO", page 91.

If the digital servo amplifier JetMove D203 is to be run under operating conditions, which differ from the conditions mentioned in Chapter 3 "Operating Conditions", page 29, Jetter AG must be contacted beforehand.

1.1.3 Qualification of Staff

Depending on the life cycle of the product, the persons involved must possess different qualifications. These qualifications are required to ensure proper handling of the JetMove D203 in the corresponding life cycle.

Phase of the product life cycle	Minimum qualification
Transport/storage:	Trained and instructed personnel with knowledge in handling electrostatically sensitive components.
Mechanical/electrical installation	Specialized personnel with training in electrical/automotive engineering, such as industrial electronics engineer.
Commissioning / Programming	Trained and instructed experts with profound knowledge of, and experience with, electrical / drive engineering, such as electronics engineer for automation technology.
Operation:	Trained, instructed and assigned personnel with knowledge of operating electronic devices.
Decommissioning:	Specialized personnel with training in electrical engineering, such as industrial electronics technician.

1.1.4 Modifications and Alterations to the Device

For safety reasons, modifications and alterations to the digital servo amplifier D203 and its functions are NOT permitted.
Any modifications to the servo amplifier JetMove D203 not expressly authorized by us will result in the loss of any warranty and liability claims against Jetter AG.

The original parts are specially designed for the servo amplifier JetMove D203. Parts and equipment from other manufacturers are not tested by Jetter AG, and are, therefore, not released by Jetter AG.
The installation of such parts may impair the safety and the proper functioning of the digital servo amplifier JetMove D203.

Any liability on the part of Jetter AG for any damages resulting from the use of non-original parts and equipment is excluded.

1.1.5 Repairs and Maintenance

Repairs to the digital servo amplifier JetMove D203 must not be carried out by the operator. The servo amplifier JetMove D203 does not contain any parts which can be repaired by the operator.
It must be sent to Jetter AG for repair.

The digital servo amplifier JetMove D203 is maintenance-free. Therefore, absolutely no inspection or maintenance works are required for the operation of this device.

The controller option "-JC24X" is not maintenance-free. It is equipped with a battery which must be replaced at regular intervals. The designed service life of the original battery is more than 10 years. The battery condition can be checked in the following way:

Special register 10183	1:	Battery is okay
	0:	Battery is almost flat

The actual battery voltage can be read out from the following special register:

Special register 10184	Actual Battery voltage in 100 mV
	Value range: 0 ... 255

The battery can provide data backup up to a voltage of 2.0 V.

If the battery needs to be replaced, please send the JetMove D203 controller to Jetter AG.

INFO

The real-time clock and the RAM for application registers are backed up by the same battery.

1.1.6 Disposal

In case of obvious damage or erratic behaviour, the servo amplifier must not be used anymore.

Comply with the local environmental regulations when disposing of the digital servo amplifier.

The main components of the JetMove D203 (aluminum side walls, steel cover, PCBs) are connected by screw connections. To disassemble the servo amplifier just remove the screws.

1.2 Ensure your own Safety

DANGER

- Isolate the JetMove D203 from the mains if maintenance works have to be carried out. By doing so, you will prevent accidents resulting from electric voltage and moving parts.
  Follow the information given in Chapter 1.3 "Residual Dangers", page 17.
- Safety and protective devices, e.g. the guard, cover of the terminal box or the thermal motor circuit-breaker must never be shunted or by-passed.
- Dismantled protective equipment, such as guards and thermal motor circuit-breakers, must be reattached and checked for proper functioning prior to commissioning.
- Before commissioning, the machine manufacturer must carry out a hazard analysis of the respective machine and take adequate measures so that inadvertent motions will not lead to personal injury and to material damage.
  See Chapter 11 "Option -S1: STO", page 91.

1.2.1 Malfunctions

- **In the case of malfunctions or other faults, immediately isolate the JetMove D203 from the mains.**
  Follow the information given in Chapter 1.3 "Residual Dangers", page 17.
- Immediately report any malfunctions or other damages to the responsible person.
- Secure servo amplifier JetMove D203 against misuse or accidental use.

1.2.2 Information Signs and Labels

➢ Follow the instructions given on markings, information signs, and labels. Keep markings, signs and labels readable.

➢ Replace damaged or unreadable information signs and labels.

1.2.3 Earthing Procedure

➢ Screw the enclosure of the JetMove D203 down to a highly conductive, plane and earthed panel.

➢ Use the JetMove D203 only in earthed industrial networks with one mains phase and neutral conductor (TN network, TT network with earthed neutral point, max. 5,000 A symmetrical rated current at 400/480 V + 10 %).
The digital servo amplifier must not be connected to unearthed or to asymmetrically earthed networks.

➢ **The leakage current of the JetMove 206-230 is higher than 3.5 mA. Special precautions are necessary to avoid electric shock.**
- Connect the protective conductor having a minimum cross-sectional area of 10 mm^2 to the PE bolt on the upper side of the housing (1) or
- Connect the PE conductor having a minimum cross-sectional area of 10 mm^2 to the PE bolt on the upper side of the housing (1) and the PE terminal X1 (2) (refer to Fig. 1).
  The cross-sectional area of the two PE conductors must be equal to, or greater than the cross-sectional area of the supply cables (at least 1.5 mm^2/AWG 16).
- Provide a permanent connection with the power supply of the JetMove D203.
- Wire the PE bus according to the connection diagram (refer to Chapter 10 "Connection Diagrams", page 87).

NOTICE

Follow the installation instruction below for the tightening torque of the PE bolt (1) so that it does not become loose or even break off:

➢ Do not overtighten the nut of the PE bolt (1). The maximum tightening torque is **3 Nm**!

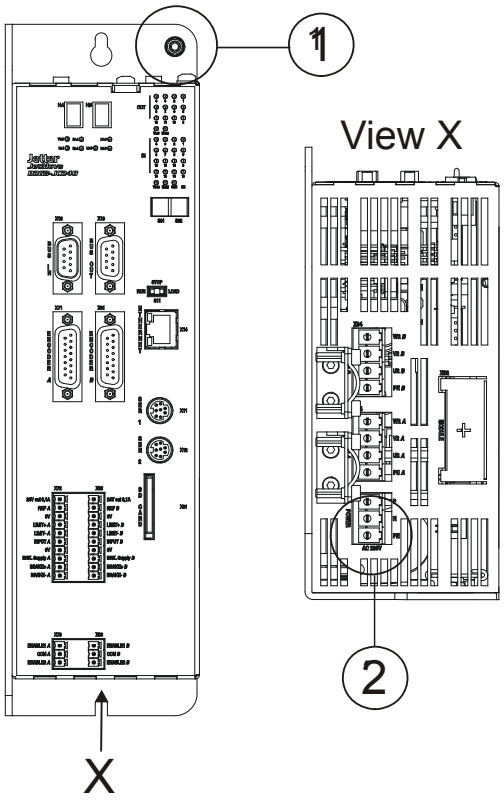


Abb. 1: Double Earthing

NOTICE

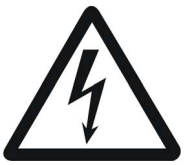
Do not install an earth-leakage current breaker in the supply line.

If this advice is disregarded and an RCD is installed, it will switch off the servo amplifier although there is no error.
When an earth-leakage current breaker needs to be installed, an isolating transformer must be used.

1.3 Residual Dangers

1.3.1 Hazards during Operation

Hazard caused by high operating voltage!



DANGER

Extremely hazardous voltages of up to DC 500 V may occur!

Such voltages may result in muscle cramps, burns, unconsciousness, respiratory standstill, or death.

- During operation, keep all covers and electric cabinet doors closed.
- Do not remove the cover.
- Do not disconnect electrical connections of the JetMove D203 while they are energized.
- **Do not touch the terminals X1, X74 and X84 while the servo amplifier is running**.
  The terminal designations mean:

  X1: AC 230 V voltage supply

  X74, X84: DC motor voltage up to 500 V

DANGER

Caution! Hot surfaces!

CAUTION

During operation, the surfaces, respectively the heat sinks of the JetMove D203 can heat up. The left sidewall can reach temperatures of up to 80 ¬×C.

- **Do not touch the left sidewall during operation and after switching off while the device is still cooling down.**
- Make sure that no temperature-sensitive parts are in contact with or attached to the servo amplifier JetMove D203.

DANGER

Hazard in explosive gas atmosphere!

➢ **Do not use the JetMove D203 in a potentially explosive atmosphere.**

CAUTION

Danger of injuries caused by mechanic force!

The JetMove D203 has been designed for driving a motor. This motor moves mechanic parts or sharp edges. Therefore, failure or malfunctioning of the JetMove D203 can be dangerous for persons or damage the machinery. This should be prevented by installing additional safety devices.

- One safety precaution is to install a second set of limit switches to interrupt the power supply of the motor.
- Another safety precaution would be installing a guard.

➢ Make sure that hazards to persons are precluded even when the drive is moving unintentionally.

➢ Do not remove any guards.

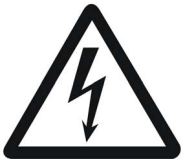
DANGER

➢ **Do not wear gloves.** They could get caught in the rotating drive shaft.

➢ **Never touch a rotating drive shaft.**

1.3.2 Hazards after POWER is turned OFF

Danger resulting from electric shock!



DANGER

Capacitors of the servo amplifier can store dangerous voltages up to 5 minutes after switching off the operating voltage.

- Wait **always** at least 5 minutes after switching off, before touching live parts or disconnecting terminal leads.

- Do not
  - touch the screws of terminals X1, X74 and X84 when the connectors are inserted;
  - unplug connectors and do not touch the contacts.

1.4 Instructions on EMC

The digital servo amplifier JetMove D203 is intended for use in industrial environment. It may cause radio interferences when used in residential areas. It is operated at the operator's own risk.

The noise immunity of a system is determined by the weakest component of the system. For this reason, correct wiring and shielding of cables is of paramount importance.

NOTICE

Measures for increasing immunity to interference:

- Earth the device adequately according to Chapter 1.2.3 "Earthing Procedure", page 15.
- Be sure to connect all protective earth terminals of the JetMove D203. Double earthing is necessary!
  – Connect the PE bolt located on the enclosure.
  – Connect the protective earth (PE) conductor to terminal X1.
  See Abb. 1 on Seite 16
- Connect the motor cable. An optional line filter must be installed close to the servo amplifier. Shield cables on both ends.
- If a motor power cable is used which includes cores for brake control, the brake control cores must be separately shielded. Ground the shielding braid on both ends.
- Keep the distance between optional mains filters and the JetMove D203 as short as possible.
- Follow the instructions given in Application Note 016 "EMC-Compatible Installation of the Electric Cabinet" published by Jetter AG.

The following instructions are excerpts from Application Note 016:

- Screw the enclosure of the JetMove D203 down to a highly conductive, plane and earthed panel.
- On principle, **physical separation** should be maintained between signal and power lines. We recommend spacing greater than 20 cm. Cables and lines should cross each other at an angle of 90¬×.
- Shielded cables **must be used** for the following lines:
  Analog lines, data lines, motor cables coming from inverter drives (servo output stage, frequency converter), lines between components and interference suppressor filter, if the suppressor filter has not been placed at the component directly.

- Connect the shields at both ends of the cables.
- Unshielded wire ends of shielded cables should be as short as possible.
- Draw the **entire shield** behind the isolation, and then clamp it under an earthed strain relief with the **greatest possible surface area**.

When male connectors are used:

- The shield must, in its entire perimeter, must be drawn behind the shielding clamp of the metallized connector housing, respectively of the EMC gland bushing (impedance shielding), its greatest possible surface area being clamped under a strain relief.
- Only use metallized connectors, e.g. Sub-D with metallized housing. Make sure that the strain relief is directly connected with the housing here as well (see Abb. 2).

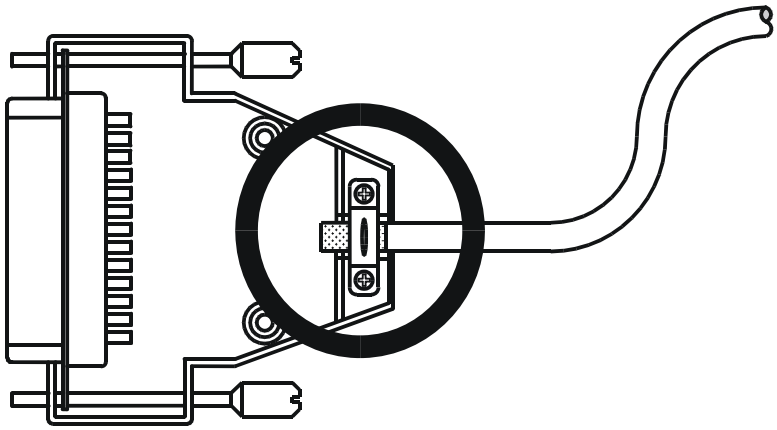


Abb. 2: EMC-compliant shield connection of sub-D connectors

If the shield cannot be attached to the connector, for example, with a screw type terminal:

- It is important that shield and strain relief are highly conductive and directly connected to a grounded surface with the greatest possible surface area. When doing so, grounding must be implemented in a way that the unshielded portion of the cable is as short as possible (refer to Abb. 3).

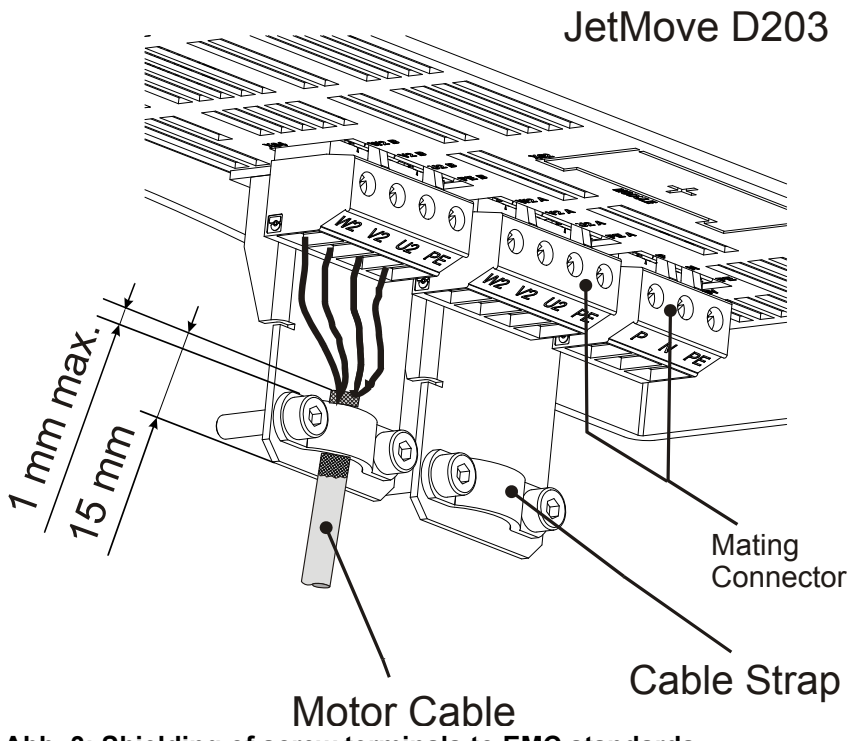


Abb. 3: Shielding of screw terminals to EMC standards

2 Installation of the JetMove D203

2.1 Scope of Delivery

- Digital servo amplifier JetMove D203
- Mating connector plugged-on
- Cable straps serving as strain relief and motor cable shield
- User Manual

Accessories

Accessories are not part of the scope of delivery!

- System bus cable of cable confection # 530 x.x m; length: 0.2 m through 5.0 m. See chapter 7.8 "JX2 System Bus", page 74
- Motor power cable; please refer to chapter 7.2 "Motor Connection", page 50
- Resolver cable, see chapter 7.3 "Resolver Connection", page 56
- HIPERFACE cable, see chapter 7.4 "HIPERFACE Connection", page 59
- Motors, e.g. synchronous servo motors of the motor series JH, JK or JL, made by Jetter AG
- Motor circuit-breaker, see chapter 5 "Technical Data", page 37
- Circuit-breaker, see chapter 5 "Technical Data", page 37
- Isolating, respectively autotransformer
- Mounting screws, 2 pcs.; refer to fig. 4, page 25

INFO

If you are not sure which mounting accessories you will need, please contact Jetter AG.

2.2 Mechanical Installation

- Prior to installing the digital servo amplifier check it for possible transport damages.
- Please check the shipment for completeness.
- To ensure proper functioning of the JetMove D203, check whether the mounting plate in the electric cabinet is unpainted.
- The only possible mounting position is vertical - see fig. 4, page 25.
- Please make sure there is a clearance of at least 100 mm under and above the JetMove D203 - unobstructed ventilation must be granted.
- Please mark on the panel two positions for the fastening screw threads of the JetMove D203 (see fig. 4, page 25).
- Drill the holes and cut the female threads into the mounting plate.
- Screw the corresponding fitting screws into the thread by approximately half of their length.
- By means of the oblong holes in the rear plate, hang up the JetMove D203 by the fitting bolts; then screw them tightly.

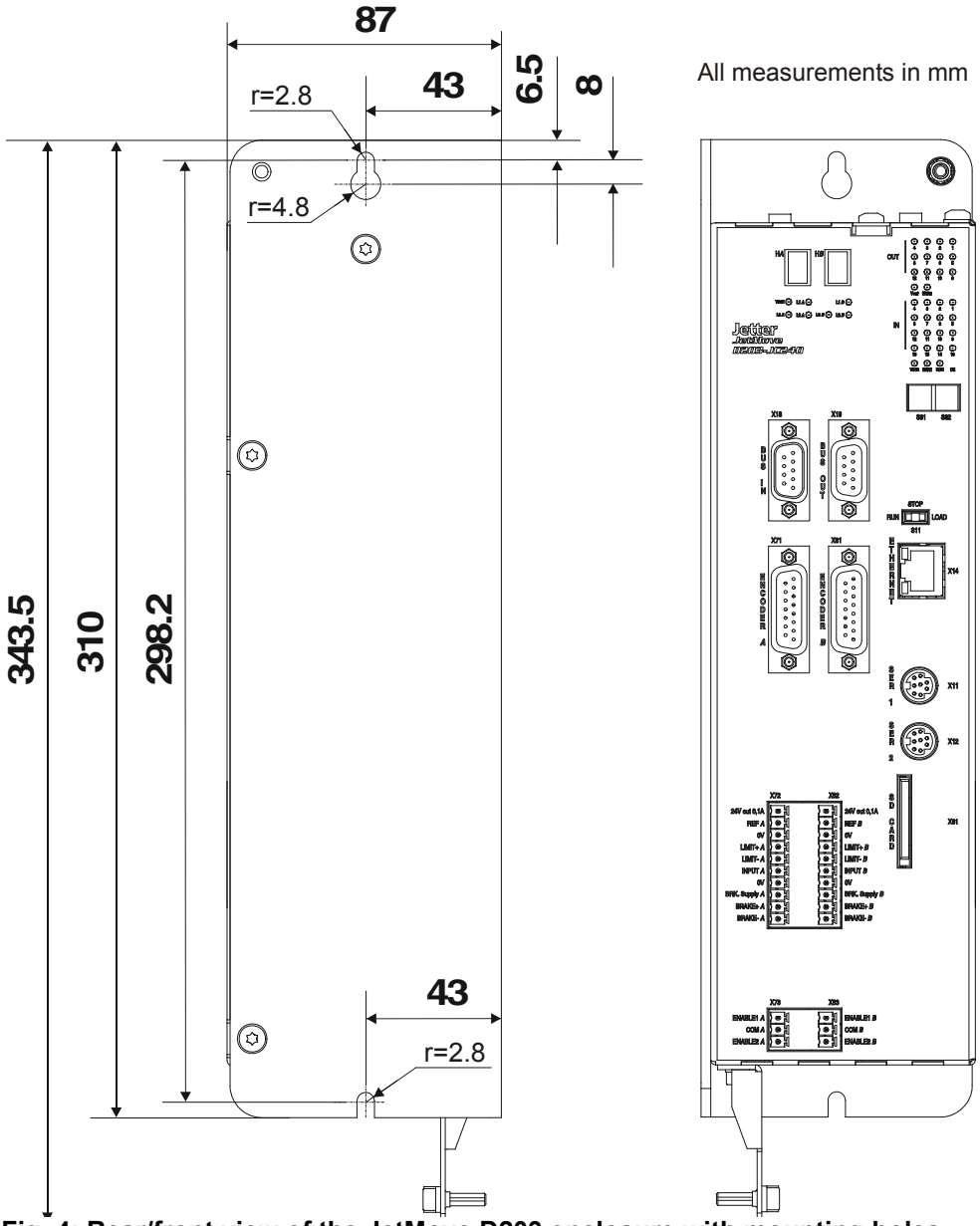


Fig. 4: Rear/front view of the JetMove D203 enclosure with mounting holes

2.3 Electrical Installation

- Check for correct motor and servo amplifier assignment.
- Compare rated voltage and continuous rated current of servo amplifier and motor.
  The motor must be isolated against voltages of DC 500 V min.; please also refer to “Compatible Synchronous Servo Motors" on page 43.
- Connect the JetMoveD203 according to the connection wiring diagram shown in chapter 10 "Connection Diagrams", page 87.
  Especially check the power lines for appropriate protection, see “Overload Protection" on page 38.
  We do not recommend to fuse the motor cables.
- Select the cables according to standards.
- Verify that all earthing cables are connected (double earthing).
- To connect resolvers or power units you can use prefabricated cables available from Jetter or opt for self-made cables. Please refer to chapter 7 "Description of Connections", page 49.
- To ensure that installation is carried out in conformance with EMC regulations, follow the instructions below:
  – If possible, do not connect the controller cable together with the power supply and motor cable;
  – Connect the position transducer;
  – Use shielded terminals or EMC-compliant connectors;
  – Connect the holding brake, if available, and connect shields at both ends of the cables;
  – Connect the motor leads according to fig. 3, page 22.

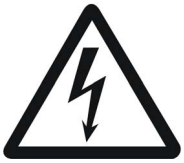
  Please also follow the instructions in chapter 1.4 "Instructions on EMC", page 20.

2.4 Checking the Installation

- Check motor and servo amplifier wiring and connections by means of the connection diagrams used.
- Check the holding brake, if existing, for proper functioning.
- Check to see whether all necessary protection measures against accidental contact with live or moving parts have been taken.
- Carry out any other checks specific to or required for your system.

2.5 Notes on Safety as regards the Installation

Hazard caused by high operating voltage!



WARNING

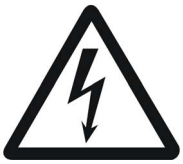
Extremely hazardous voltages of up to DC 500 V may occur!

Please, observe the following precautions in order to avoid injuries such as muscle cramps, burns, unconsciousness, respiratory standstill or possibly death:

- Have installation and maintenance jobs carried out by qualified personnel only, see chapter 1.1.3 "Qualification of Staff", page 12.
- Switch off the operating voltage.
- Please take into account the information on residual dangers given in chapter 1.3.2 "Hazards after POWER is turned OFF", page 19.
- Before carrying out installation and maintenance jobs, separate the servo amplifier JetMove D203 and all connected devices from the mains.

2.6 Safety Instructions for Commissioning

Hazard caused by high operating voltage!



Extremely hazardous voltages of up to DC 500 V may occur!

WARNING

Please, observe the following precautions in order to avoid injuries such as muscle cramps, burns, unconsciousness, respiratory standstill or possibly death:

- Have commissioning jobs carried out by qualified personnel only, see chapter 1.1.3 "Qualification of Staff", page 12.

Before energizing the device make sure that the following requirements are complied with:

- Reattach dismantled protective equipment and check it for proper functioning. This will protect the user from moving parts of the machine.
- Secure the servo amplifier JetMove D203 against accidental contact with conductive parts and components.
- Only connect devices or electrical components to the signal lines of the digital servo amplifier JetMove D203 (Enable1/2, Limit+/-, REF, BRAKE+/-) that have been sufficiently isolated against the connected electric circuit. These signal lines may only be connected with units that have got the ground potential of the DC 24 V power supply.
- Only connect position encoders to the servo amplifier if they are sufficiently isolated from the connected mains and motor circuits.
- The digital servo amplifier JetMove D203 has got a leakage current greater than 3.5 mA. In order to avoid electric shocks, a second protective earth conductor will be required.
  For this, the measures listed in chapter 1.2.3 "Earthing Procedure", page 15, must be taken.
- Every commissioning, even a short functional test, must always be carried out with correctly connected PE bus.

2.7 2.7Notes on decommissioning

Before returning the JetMove, remove the strain relief/shielding bracket of the motor cable.

3 Operating Conditions

DANGER

Danger in the event that the operating parameters for the "Safe Torque Off" option of the JM-D203-...-S1 amplifiers are not complied with.

Dangerous injuries can occur!

For example from
- electric shock because the electrical safety has been violated by not complying with the degree of pollution;
- crushing if the functionality of the safety function STO is no longer guaranteed.

Make sure that the following operating parameters are met.

Operating Parameters Power Rating		
Parameter(s)	**Value(s)**	**Reference standard**
Power rating	Switching device at X1: 1 * AC 230 V, 50 / 60 Hz <= 10 A (AC 195 ... 265 V) Logic unit via X10: DC 24 V, SELV / PELV <= 1.3 A (DC 20 ... 28.8 V) Option: -JC24X: Logic unit via X10: additionally DC 24 V <= 0.35 A LCD via X10: additionally DC 24 V <= 0.75 A Digital outputs via X30: DC 24 V, SELV / PELV <= 6 A (DC 20 ... 28.8 V) Option: -S1 For each channel via X73 / X83: DC 24 V, SELV / PELV <= 50 mA (DC 20 ... 30 V)	
Variations of the mains power supply	Speed of changing the frequency: 2 %/s max. Voltage imbalance: 2 % max. Voltage dips at rated output and rated voltage: 10 ms max.	

Operating Parameters Environment		
Parameter(s)	**Value(s)**	**Reference standard**
Operating conditions	Temperature: 0 °C to +45 °C (+45 °C to +55 °C: Derating 2.5 %/K) Air humidity: 5 % to 85 %, non-condensing	DIN EN 50178
Storage conditions (units within packing)	Temperature: -25 °C bis +55 °C, maximum fluctuation: 20 K/h Air humidity: 5 % to 95 %, non-condensing Maximum storage period: 1 year without restrictions. If this storage time has been exceeded, the device must be connected for at least 2 hours to the mains voltage prior to commissioning. The motor must remain de-energized and the logics circuit must be supplied with power. The servo amplifier can then be used again without restriction.	DIN EN 50178
Transport conditions (units within packing)	Temperature: -25 °C to +70 °C Air humidity: 5 % to 95 %, non-condensing	DIN EN 50178
Pollution degree	2	DIN EN 50178
Corrosion immunity / chemical resistance	No special protection against corrosion. Ambient air must be free from higher concentrations of acids, alkaline solutions, corrosive agents, salts, metal vapors, or other corrosive or electro-conductive contaminants	-
Operating altitude	1,000 m max. above sea level without derating. From 1,000 to 2,000 m above sea level; derating 1.5 % per 100 m increase in alitude	DIN EN 50178

Operating Parameters Mechanical Parameters		
Parameter(s)	**Value(s)**	**Reference standard**
Free falls withstanding test	Within original packing, the device withstands dropping over all of its edges	DIN EN 50178 DIN EN 60068-2-31
Vibration resistance	• 10 Hz ... 57 Hz : 0.075 mm amplitude • 57 Hz ... 150 Hz: 1.0 g constant acceleration • 1 octave per minute, 10 frequency sweeps (sinusoidal), all three spatial axes	DIN EN 50178 DIN EN 60068-2-6
Class of protection	IP 20	DIN EN 60529
Mounting position	Vertical Please make sure there is a clearance of at least 100 mm under and above the module - sufficient ventilation must be granted.	

NOTICE

Measures to avoid damages in transit and storage:

The packaging material and the storage place are to be chosen in a way that the values given in the above table “Operating Parameters Mechanical Parameters" on page 31 are kept to.

Operating Parameters Electrical Safety		
Parameter(s)	**Value(s)**	**Reference standard**
Protection class	I	DIN EN 61800-5-1
Dielectric strength	Protective network conductor and network logics: 1.7 kV, 5 s	DIN EN 61800-5-1
Insulation	Protective network conductor and network logics: > 1 MΩ at 500 V	DIN EN 61800-5-1
Protective earth connection	12 V, 10 A, 0.1 Ω	DIN EN 61800-5-1
Overvoltage category	III	DIN EN 61800-5-1 DIN EN 50178 DIN VDE 0110-1 UL 508C

The following note must be observed for the amplifier models JM-D203-JC24X-EIP...

NOTICE

The quality of the Ethernet cable has a significant influence on the EMC values given in the following tables.

➢ Use a CAT6 cable (S/FTP design) as Ethernet cable.

Operating Parameters EMI - Emitted Interference		
Parameter(s)	**Value(s)**	**Reference standard**
Enclosure	• Frequency band 30 ... 230 MHz, limit 40 dB (µV/m) in 10 m • Frequency band 230 ... 1000 MHz, limit 47 dB (µV/m) in 10 m (Electromagnetic environment in public power systems, installation in category 2)	DIN EN 61800-3
Alternating network current	Frequency bands: • 0.15 ... 0.5 MHz, limit 79 dB (µV)* • 0.5 ... 30 MHz, limit 73 dB (µV)* * Measuring by means of the quasi-peak detector (Electromagnetic environment in public power systems, installation in category 2)	DIN EN 61800-3

NOTICE

This is a product of restricted availability according to IEC/EN 61800-3 and may cause radio interferences in a residential environment.
Follow the instructions below:

➢ If this product is used in a residential environment, take appropriate measures. One of the measures is to use additional line filters. See "Line filter" on page 39.

Operating Parameters EMI - Immunity to Interference Enclosure		
Parameter(s)	**Value(s)**	**Reference standard**
ESD	Discharge through air: Test peak voltage 8 kV Contact discharge: Test peak voltage 4 kV Criterion B (Electromagnetic environment in industrial plants)	DIN EN 61800-3 DIN EN 61000-4-2
RF Field amplitude-modulated	Frequency band 80 ...1000 MHz; test field strength 10 V/m AM 80 % at 1 kHz Criterion A (Electromagnetic environment in industrial plants)	DIN EN 61800-3 DIN EN 61000-4-3

Operating Parameters EMI - Immunity to Interference Power Connections		
Parameter(s)	**Value(s)**	**Reference standard**
Burst (fast transients)	Test voltage 2 kV Repetition frequency 5 kHz Criterion B (Electromagnetic environment in industrial plants)	DIN EN 61800-3 DIN EN 61000-4-4
Impulse voltages	tr/th 1.2/50 µs, 8/20 µs 1 kV (phase to phase) 2 kV (phase to ground) Criterion B (Electromagnetic environment in industrial plants)	DIN EN 61800-3 DIN EN 61000-4-5
Guided radio disturbances	Frequency 0.15 ... 80 MHz Test voltage 10 V AM 80 % at 1 kHz Criterion A (Electromagnetic environment in industrial plants)	DIN EN 61800-3 DIN EN 61000-4-6

Operating Parameters EMI - Immunity to Interference Power Interfaces		
Parameter(s)	**Value(s)**	**Ref. standard**
Burst (fast transients)	Test voltage 2 kV Repetition frequency 5 kHz Capacitive interference Criterion B (Electromagnetic environment in industrial plants)	DIN EN 61800-3 DIN EN 61000-4-4

Operating Parameters EMI - Immunity to Interference Signal interfaces		
Parameter(s)	**Value(s)**	**Ref. standard**
Burst (fast transients)	Test voltage 1 kV Repetition frequency 5 kHz Capacitive interference Criterion B (Electromag. envir. in ind. plants)	DIN EN 61800-3 DIN EN 61000-4-4
Guided radio disturbances	Frequency 0.15 ... 80 MHz Test voltage 10 V AM 80 % at 1 kHz Criterion A (Electromag. envir. in ind. plants)	DIN EN 61800-3 DIN EN 61000-4-6

Operating Parameters EMI - Immunity to Interference Process-Related Measuring and Control Lines		
Parameter(s)	**Value(s)**	**Ref. standard**
Burst (fast transients)	Test voltage 2 kV Repetition frequency 5 kHz Capacitive interference Criterion B (Electromag. envir. in ind. plants)	DIN EN 61800-3 DIN EN 61000-4-4
Impulse voltages	tr/th 1.2/50 µs, 8/20 µs 1 kV (phase to ground) Criterion B (Electromag. envir. in ind. plants)	DIN EN 61800-3 DIN EN 61000-4-5
Guided radio disturbances	Frequency 0.15 ... 80 MHz Test voltage 10 V AM 80 % at 1 kHz Criterion A (Electromag. envir. in ind. plants)	DIN EN 61800-3 DIN EN 61000-4-6

4 Physical Dimensions

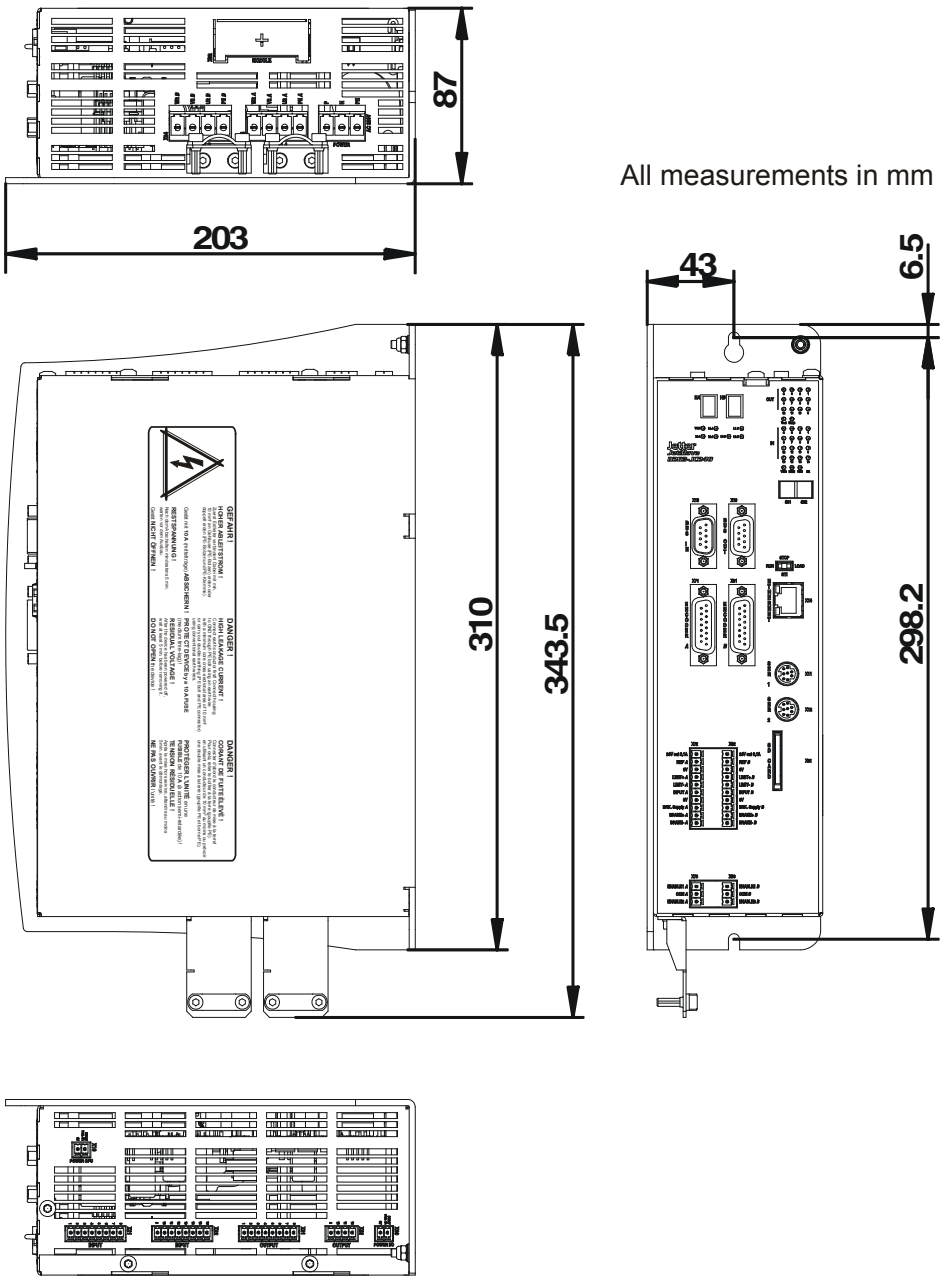
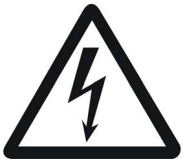


Fig. 5: Physical dimensions of the JetMove D203

For installation, please also refer to fig. 4 on page 25.

5 Technical Data

5.1 Electrical Specification



DANGER

Danger in the event that the Electrical Specification for the "Safe Torque Off (STO)" option of the JM-2xx-xxx...-S1 amplifiers is not complied with.

Serious injuries can occur!

For example from
- electric shock because the electrical safety has been violated by not observing the degree of pollution;
- crushing if the functionality of the safety function STO is not ensured.

Make sure that the following electrical specifications are met.

Electrical Specification	
Rated voltage supply	• Direct suuply U_{eff} = 230 V Common mode of the voltage 2 % max. Voltage dips 10 ms max. at rated power and rated voltage • 48 ... 62 Hz Frequency change 2 % / s max.
Type of power supply connection	one-phase: direct (U_{eff} = 230 V: L to N)
Power supply tolerance	U_{eff} = 195 V ... 265 V(-15 % ... + 15 %)
Inrush current limitation	< 7 A limited to typ. 350 ms during the switch-on-sequence **Refer to “Time between deactivating and activating the mains power supply" on page 41**

Electrical Specification	
Overload Protection	An external overload protection is required. There are three options: – Circuit-breaker 10 A C – Fuse 10 A M (medium time lag) – Motor circuit breaker 10 A For systems with NRTL approval use overload protection devices that are NRTL listed (acc. To UL 508)(NKJH)) self protected combination motor controller (specification: 10 A). The JetMove D203 is suitable for use on a circuit capable of delivering not more than 5000 (rms) symmetrical Amperes, 230 Volts maximum.
Supply cable Cable size Material Temperature class	 3 * 1.5 mm^2 min. (AWG 16) Copper > 60 °C
Maximum output voltage of the motor	450 V
Motor output current at an ambient temperature of 45 °C	Nominal current: I_{eff} = 3 A per axis Peak current for 30 seconds: I_{eff} = 6 A per axis (the time depends on the heat sink temperature) **See “INFO 1” on page 41.**
Continuous output	0.5 kW per axis
Short-circuit protection, motor side	Designed for • phase to phase • phase to earth
Motor overload protection	See “Motor Protection” on page 43.
Motor cable Cable size Material Capacitance Temperature class Maximum length	 4 * min. 0,75 mm^2 min. (AWG 18) Copper < 150 pF/m > 60 °C 50 m max. (for greater length please contact Jetter AG)

Electrical Specification	
Line filter	A line filter ensuring unlimited EMC in residential environment to DIN EN 61800-3 is needed. The following filters can be applied with input circuits: – NEFB 10332 with I_r = 16 A – NEFB 10333 with I_r = 25 A – NEFB 10334 with I_r = 36 A **See “INFO 2” on page 41.**
Internal ballast resistor	• Resistor: typically 120 Ω • Rated power: 60 W • Energy dissipation: 800 Ws (Joule) The energy dissipation is dependent on the actual enclosure temperature and the footprint. **See “INFO 3” on page 41.** **See “Typical power dissipation of the ballast resistor” on page 42.**
Residual voltage	To avoid hazard of electrical shock wait at least 5 minute after switching-off the digital servo amplifier before attempting to pull out the plug or remove this unit (refer to Page 19).
Leakage current	> 3.5 mA **See “Danger resulting from electric shock!” on page 42.**
Voltage supply of processor logics (demands on power supply module)	• DC 24 V (20 ... 28.8 V) ≤ 1.3 A • For the option -JC24x, additionally 0.35 A max. are needed. For using a display at X12, additionally 0.75 A max. are needed. • The voltage output of the power supply unit must comply with the SELV or PELV type.
Inrush current limitation of the processor logics	The JM-D203 is equipped with an internal 4700 µF capacitors for buffering. The inrush current is not limited.
Digital inputs – Enable1/2, – Reference switch (REF), – Positive limit switch (Limit+), – Negative limit switch (Limit-) – Input (Inp)	• DC 20 V ... 28.8 V related to the ground potential of the processor logics • Input current of 7.5 mA max. each • For the option -S1 (Safe Torque Off), the input current is 50 mA max. per input • Refer to chapter 7.7 "Digital Inputs, Logic Power Supply", page 70

Electrical Specification	
Braking circuit (contacts: Brake+ and Brake-)	Can be switched by the control program of the PLC or automatically at enable of the motor current. DC 24 V (20 ... 28.8 V) $I_{max.}$ = 2 A per axis Contact: Semiconductor switch (NOC) with integrated free-wheeling diode The terminals may only be connected to devices that are related to the same potential as the power supply of the controller logic. (Give heed to polarity; Brake- is internally switched to 0 V)
Encoder supply voltage (X71 / X81)	• Encoder supply voltage: DC 5 V +/-5 % at using the sense-inputs of up to 8.5 V • Encoder current: 350 mA max. per encoder • By connecting a resistor to the encoder lines, an encoder voltage of between 5 V and 8.5 V can be set. See fig. 16, page 65. • Monitoring for short circuit of the encoder supply and the sensor lines
Resolver inputs	• Resolver excitation: 1.8 Vpp • Frequency: 8 kHz • Input impedance: 22 kΩ
HIPERFACE encoder inputs	• Digital interface: RS-485 • 1 Vpp differential signals • Max. frequency: analog 100 kHz, digital 250 kHz • Input impedance: 22 kΩ
SinCos encoder inputs	• 1 Vpp differential signals • Max. frequency: analog 100 kHz, digital 250 kHz • Input impedance: 22 kΩ
Incremental encoder inputs	• 5 V differential signals (RS-422) • Max. frequency: 250 kHz, • Input impedance: 22 kΩ
Sensor supply voltage (X72 / X82: 24 V out)	• Sensor supply: DC 24 V (20 ... 28.8 V) • Sensor current: 100 mA max. per axis • Short-circuit proof
Analog input	• 1 differential channel per axis • Resolution 12 bits • Voltage range 0 ... 10 V • Value range 0 ... 32767 (in steps of 8) • Sampling interval 2 ms • Input impedance 200 kΩ

Electrical Specification	
Power loss P_v	• Output stage: 50 W max. • Logic circuit: 14 W max. • Option -JC24X: 18 W max.
Weight, mating connectors included	• JM-D203: 2,500 g • Option -S1 (Safe Torque Off): 150 g • Option -JC24X (controller): 300 g

NOTICE

Time between deactivating and activating the mains power supply

The time between switching off and on the power supply must be longer than 1.5 seconds. If this is not given heed to, the inrush current cannot be limited and thus take on high values. As a consequence, the device can be destroyed, or the external fuse is activated.

INFO 1

Cooling:
- The overtemperature protection is activated at 85 °C.
- The overtemperature alarm is activated at 80 °C.
- The duration for the peak current is measured at a starting temperature of 45 °C at the heat sink.

INFO 2

A line filter can supply several digital servo amplifiers JetMove D203, if I_f (the rated current of the line filter) is greater than the total current of the connected servo amplifiers.

INFO 3

At overloading, the ballast resistor will become high-resistance. In this case, the braking energy cannot be dissipated any more.

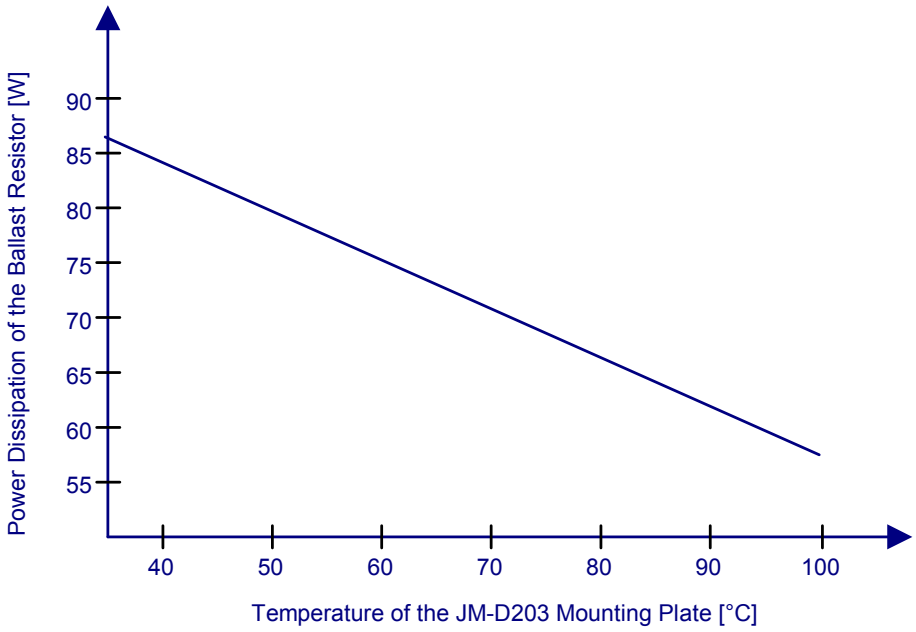
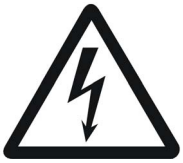


Fig. 6: Typical power dissipation of the ballast resistor

Danger resulting from electric shock!



WARNING

In order to avoid electric shocks, earth the digital servo amplifier JetMove D203 in either of the ways described below:

– At the bolt on the top side of the enclosure by a minimum cross-sectional area of 10 mm²

or

– in two positions, namely at the bolt on the top side of the enclosure, and at the PE terminal X1; for this, see chapter 1.2.3 "Earthing Procedure", page 15.

Compatible Synchronous Servo Motors	
Motor types	Jetter motors of the JHN, JHQ, and JI series with 2-cable technology. Please also refer to the User Manual of the motors or contact the sales department of Jetter AG.

INFO

In case you intend to use motors other than the above mentioned types, please contact Jetter AG.

5.2 Motor Protection

There are three ways of motor protection:

5.2.1 Thermal sensor integrated in the motor

The servo amplifier JetMove D203 can read out and process four different motor temperature sensors:

Sensor type	Type of sensor signal evaluation
Temperature switch	Go-no-go decision Error detection at maximum motor temperature
KTY84-130	Temperature is measured in °C The warning threshold can be set Error detection at maximum motor temperature
KTY83-110	Temperature is measured in °C The warning threshold can be set Error detection at maximum motor temperature
PTC	Go-no-go decision Error detection at maximum motor temperature • Nominal addressing resistance at ϑ_{NAT} between 550 Ω and 4000 Ω within +/- 5 K. • The resistance must be lower than 500 at temperatures smaller than ϑ_{NAT} - 20 K Ω

The thermal sensors must be designed for being connected with 10 V at 10 mA.

5.2.2 I²t calculation

The digital servo amplifier JetMove D203 calculates the model of motor power loss by an I²t calculation. The calculated value is a measure of the average power loss of the motor. It is calculated in percent of the maximum motor power loss.
For this calculation it is important, that the parameters are entered correctly:
– Nominal current (which is the minimum of nominal motor current and nominal servo amplifier current),
– Overload factor
– and time constant of the motor

The I²t calculation must be activated by JetSym or by the PLC program.
It is possible to parameterize the warning level.
The error level (error 30) is set to 100 %.

The I²t value is readable in a variable of JetMove D203 through JetSym or the PLC.

The digital servo amplifier JetMove D203 calculates the percentage of motor power loss according to the following formula:

$$x(t) = 100\% \times \left(\frac{\text{average motor current}}{\text{rated current}}\right)^2 \times \left(1 - e^{-\frac{t}{T}}\right)$$

x(t) =	Displayed value of the motor power loss in %
t =	Time since start of motor running it with the average current (in seconds)
T =	Motor time constant (in seconds)

The formula shows that the 100 % value will never be reached as long as the average motor current is lower than the nominal current of the motor.
Further, calculating always starts by 0 (at t = 0, the result of the equation is 0). After some time that is by far longer than the motor time constant, the result does virtually not change any more.
The time till error stop (x = 100 %) is a result of the following formula:

$$t = -T \times \ln\left[1 - \left(\frac{\text{rated current}}{\text{average motor current}}\right)^2\right]$$

After reset, the values of the important parameters are:

Nominal current:	3 A
Overload factor:	2
Motor time constant:	1,800 s (30 min.)

With these parameters the 100 % error level will be reached if, for example the motor is run by a current of 6 A for about 8 minutes and 30 seconds.

NOTICE

Because of the fact that after reset the I²t calculation always starts at zero, the motor overload calculation is wrong if the motor is already hot when the JetMove D203 is energized (that is, when parameterization of I²t calculation is completed and 24 V logic power supply is applied).

Therefore wait until the motor is cold before enabling the axis again.

5.2.3 Motor overload calculation to UL

The UL standard prescribes a motor overload detection for a servo amplifier that meets the following requirements:

The "trip current" is defined to 1.15 times the user-set nominal current.

- If the average motor current corresponds to the trip current the overload protection must switch of the motor after a limited time
- If the average motor current is 2 times higher than the trip current the overload protection must switch of the motor after at least 8 minutes.
- If the average motor current is six times higher than the trip current, the overload protection must switch off the motor after at least 20 seconds.

This protection (error message 31 will occur) can be parameterized only through the nominal current value.
The motor overload protection is always active and cannot be deactivated.

NOTICE

Because of the fact that after reset the motor overload calculation always starts at zero, the result is wrong if the motor is already hot when the JetMove D203 is energized (that is, when the 24 V logic power supply is applied).

Therefore wait until the motor is cold before enabling the axis again.

6 Drive Controller Structure

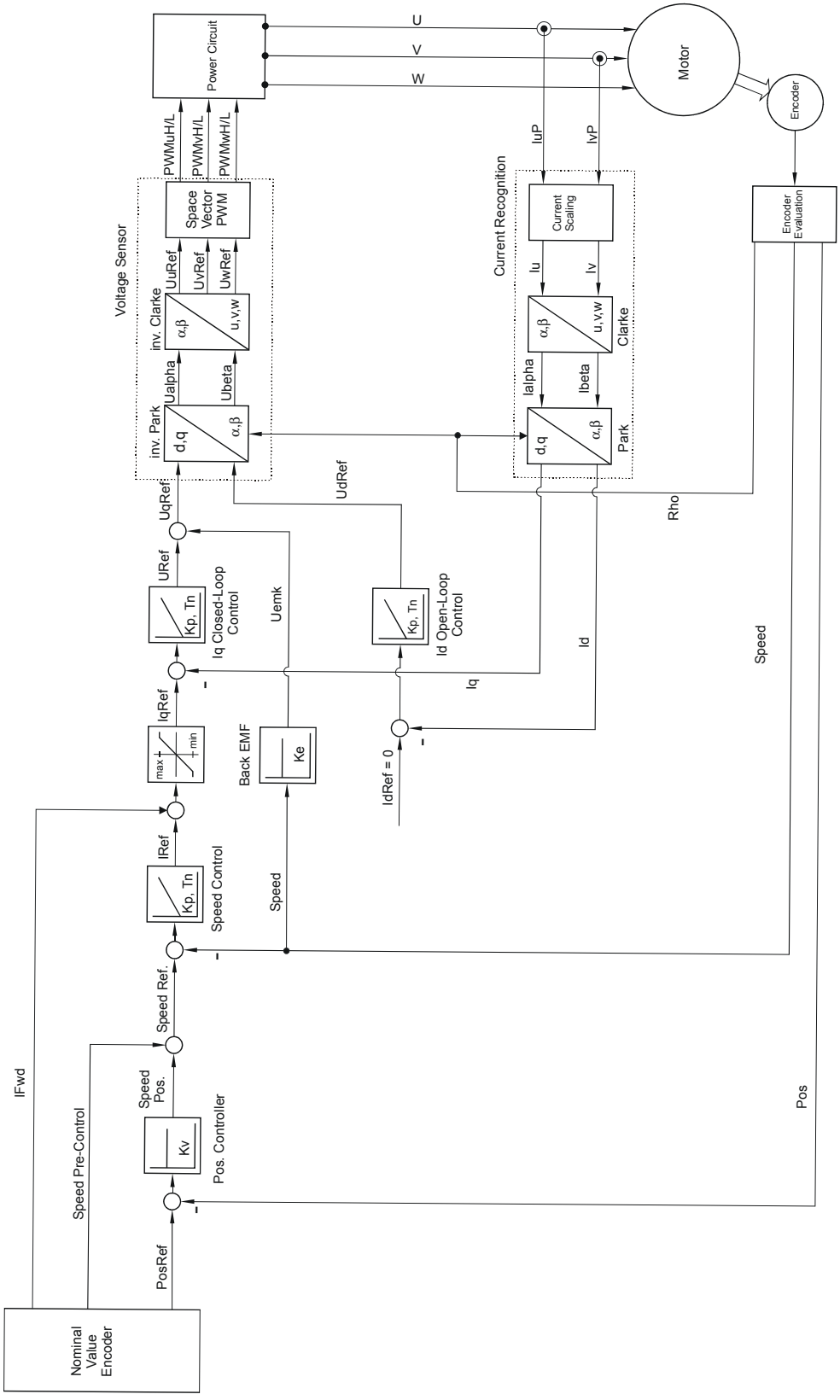


Fig. 7: Block diagram of drive controller structure
All drive controllers can be parameterized through the control program.

Controller type	Specification
Motor control (commutation)	Space vector modulation
PWM frequency	16 kHz
Current controller:	
– Cycle time	62.5 µs
Speed controller:	
– Cycle time	125 µs
– Power supply	adjustable
Position feedback controller:	
– Cycle time	250 µs
– Speed pre-control	adjustable
Position setpoint generator:	
– Sine-square and linear acceleration/ deceleration ramp	can be parameterized individually
– Setpoint output cycle (position feedback controller interpolation)	2 ms
Position sensing:	
Resolver:	
– Resolution	12 bits per revolution
– Sampling interval	62.5 µs
HIPERFACE encoder (multi- and single-turn)**:**	
– Interface	HIPERFACE
– Resolution of absolute position	15 bits per revolution
– Resolution of velocity pickup	20 bits per revolution
– Sampling interval	62.5 µs
Sine-cosine sensor:	
– Resolution of absolute position	15 bits per encoder period
– Resolution of velocity pickup	20 bits per encoder period
– Sampling interval	62.5 µs

7 Description of Connections

- For axis A, the connection designations X71 through X74 are available.
- For axis B, the connection designations X81 through X84 are available.

7.1 Mains Power Supply

Specification of terminal X1

- 3-pin screw clamping terminal (type PC 4/ 3-ST-7.62)
- Cross-sectional area of the connecting cable: 0.25 - 4.0 mm^2 (AWG 24 - AWG 12)
- Bladed screw-driver: 0.6 x 3.5 x 100 mm
- Stud torque for the screw clamping terminal:
  0.5 Nm - 0.6 Nm (4.4 - 5.3 lbf-inch)

Connecting cable specifications

- Cable size: 3 * 1.5 mm² (AWG 16(3))
- Material: Copper
- Temperature class: 60 °C
- Stripping length of cores: 6 mm
- Bootlace ferrules are recommended

Cable shielding

- Not needed

Power Supply 1-Phase Connection		
Terminals X1	**Signal**	**Specifications**
L	L	• AC 230 V between mains phase and neutral
N	N	
PE	PE conductor	

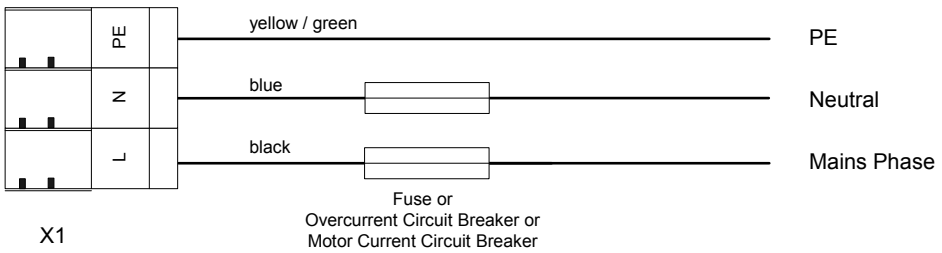


Fig. 8: Connection of the mains power supply

7.2 Motor Connection

7.2.1 Assignment and Specification

Specification of the connector for terminal X74/84

- 4-pin screw clamping terminal (type PC 4/ 4-ST-7.62)
- Cross-sectional area of connecting cable: 0.25 ... 4.0 mm^2 (AWG 24 ... AWG 12)
- Bladed screw-driver: 0.6 x 3.5 x 100 mm
- Stud torque for the screw clamping terminal:
  0.5 Nm ... 0.6 Nm (4.4 ... 5.3 lbf-inch)

Specification of the motor cable

- Cable size: 4 * 0.75 mm² (AWG 18(4))
- Material: Copper
- Temperature class: 60 °C
- Stripping length of cores: 6 mm
- Bootlace ferrules are recommended

Cable shielding

- Braided copper shield of 80 % coverage min.

Connection of the motor to the digital servo amplifier JetMove D203 has to be done following the wiring diagram below. Connection of the brake is optional.

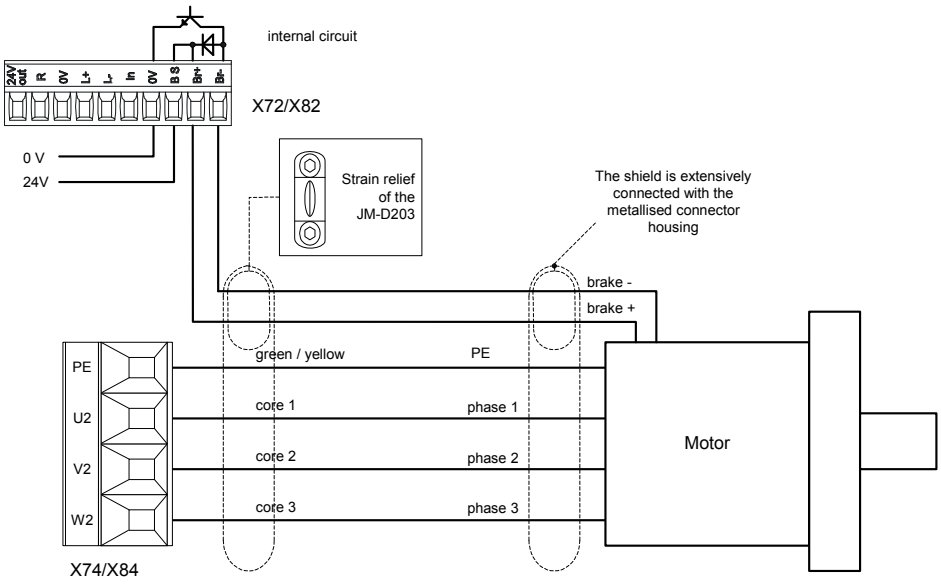


Fig. 9: Connection of motor lines

7.2.2 General Information

NOTICE

Alternative measures to avoid malfunctions of the control system and the motor:

- Operate the brake through a separately shielded brake line.
- Always connect brake lines to a separate power supply unit DC 24 V if brake and motor lines are run together in one bunch of cables, and are not separately shielded.

NOTICE

Measures to avoid oscillation and blocking of the motor:

- Avoid mixing-up of the motor phases, resp. be sure to connect the motor phase cables according to the pin assignment.

7.2.3 Motor cables with SC mating connector

INFO

The suitable mating connector SC (female connector) can be ordered from Jetter AG under part number 15100070.

INFO

The ready-made motor power cable with SC mating connector can be ordered from Jetter AG. It is equipped with the corresponding motor mating connector and can be ordered from Jetter AG by specifying the following cable confection number (KABEL-KONF):

Without brake:

Cable confection # 26.1

With brake:

Cable confection # 24.1

Mating connector of the motor (solder side)

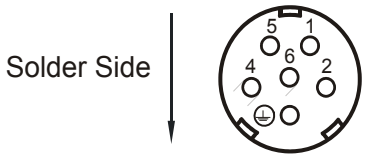
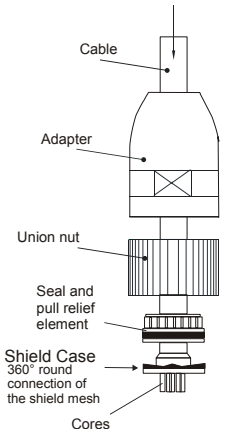
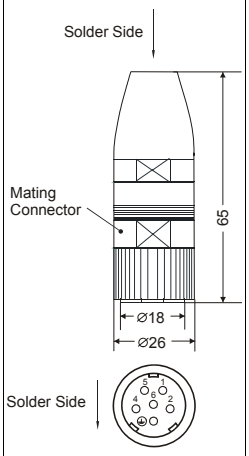
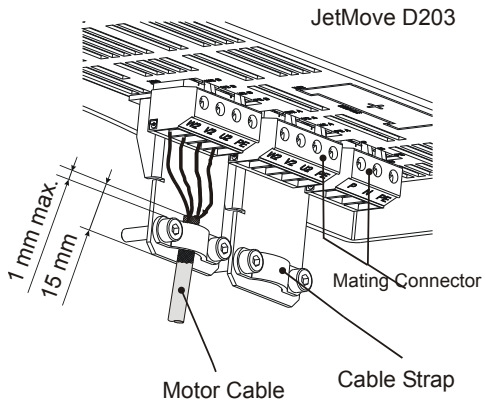


Fig. 10: View on the SC mating connector of the motor (internal thread M23)

Cable Specification of the Motor Power Cable with Mating Connector SC for JetMove D203

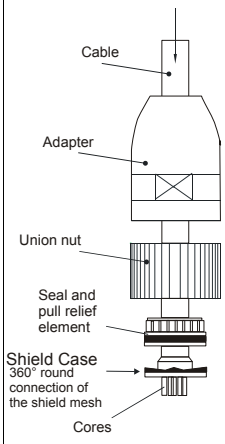
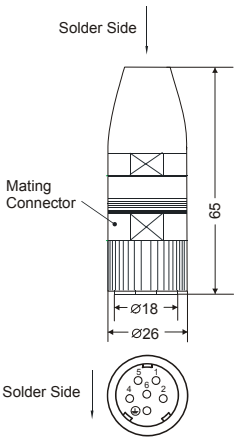
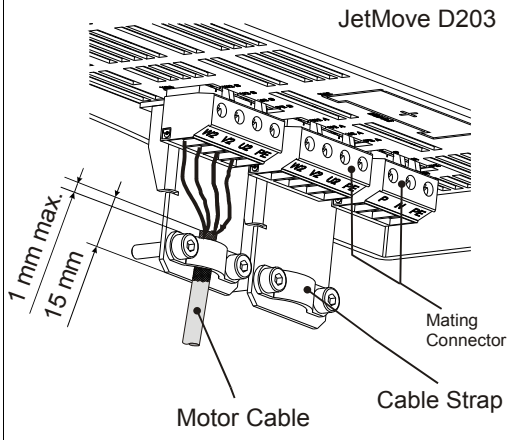
For connection without motor holding brake

Motor Power Cable - Cable Confection # 26.1			
Wiring Terminals JetMove D203	**Shield**		**Mating Connector of the Motor (female, solder side)**
4 x 1.5 mm^2 (AWG 16(4)) The wires are equipped with wire end ferrules.	Shielded, highly flexible 4-wire cable with PE (GND).		
			
	Connect both sides of the shield with the greatest possible surface area! Use metallized housing only!		
Pin	**Wire Number**	**Signal**	**Pin**
X74 / X84.U2	1	Phase 1	1
X74 / X84.V2	2	Phase 2	5
X74 / X84.W2	3	Phase 3	2
X74 / X84.PE	Yellow-green	PE conductor	⏚

Dimensions of the motor mating connector are specified in millimeters.

For connection with motor holding brake

Motor Power Cable - Cable Confection # 24.1

Wiring Terminals JetMove D203	Shield		Mating Connector of the Motor (female, solder side)
4 x 1.5 mm^2 (2 x 1.5 mm$^{2)}$ (AWG 16(6)) The wires are equipped with wire end ferrules.	Highly flexible 6-wire cable with PE (GND) (cable with separate shield for brake wires and overall shield)		
			
	Connect both sides of the shield with the greatest possible surface area! Use metallized housing only!		

Pin	Wire Number	Signal	Pin
X74 / X84.U2	1	Phase 1	1
X74 / X84.V2	2	Phase 2	5
X74 / X84.W2	3	Phase 3	2
X74 / X84.PE	Yellow-green	PE conductor	⏚
X72 / X82.BRAKE+	5	Brake +	6
X72 / X82.BRAKE-	4	Brake -	4

Dimensions of the motor mating connector are specified in millimeters.

7.2.4 Connection assignment of terminal box

Connection Assignment of Terminal Box*)		
Connection Terminals of the Amplifier	**Motor Terminal Box - Terminal Assignment**	
X74 / X84.U2	Pin 1	Phase 1
X74 / X84.V2	Pin 2	Phase 2
X74 / X84.W2	Pin 3	Phase 3
X74 / X84.PE	Pin 4	 Protective earth
X72 / X82.BRAKE+	Pin 7	Brake +
X72 / X82.BRAKE-	Pin 8	Brake -

*) alternatively to motor connectors

7.3 Resolver Connection

7.3.1 Specifications

Specification of the connector for terminal X71 / X81 (ENCODER)

- 15-pin male SUB-D connector
- Metallized enclosure

Specification of the resolver cable

- Cable size: 4 * 2 * 0.14 mm² (AWG 26(8)) min.
- Cores have to be shielded and twisted in pairs and must be included in an overall shielding
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area.
- Material: Copper
- Temperature class: 60 °C
- Maximum cable length: 50 m

7.3.2 Resolver cable with mating connector

INFO

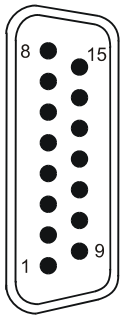
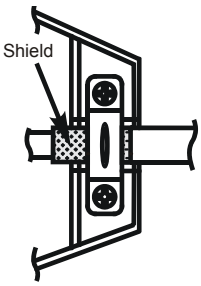
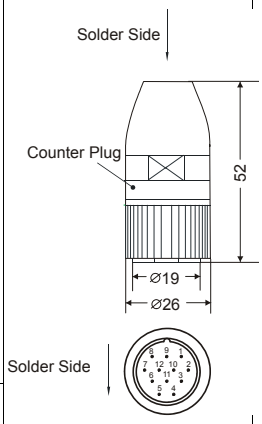
The compatible resolver or HIPERFACE mating connector can be ordered from Jetter AG by specifying the part number below:

Article # 15100069 Resolver / HIPERFACE

The complete resolver cable connecting the servo amplifier series JetMove D203 and synchronous servo motors can be ordered from Jetter AG by specifying the following item number (KAY) and the respective cable length in cm:

KAY_0823-xxxx For the JetMove D203 servo amplifier series

Resolver Cable - KAY_0823-xxxx

JetMove D203 (SUB-D connector X71 / X81)	Shield		Motor (Resolver) (female, solder side)
 Attaching screws must have a metric thread!	 Connect shield with the greatest possible surface area! Use metallized housing only!		
Pin	**Signal**	**Core Color**	**Pin**
2	Cosine +	red	1
10	Cosine -	blue	2
9	Sine -	yellow	3
1	Sine +	green	4
4	R1 (exciter winding +)	pink	5
12	R2 (exciter winding -)	gray	6
7	Th1 (thermal sensor)	white	7
15	Th2 (thermal sensor)	brown	8
	Unassigned	-	9 - 12
8	Selecting signal	-	-
13	0 V	-	-

Dimensions of the resolver mating connector are specified in millimeters.

INFO 1

Selecting signal:
By means of the selecting signal, a coding can be carried out, in order to diagnose mixing up the two encoder connectors. This is only useful, if one of the two encoder connectors has got this coding. For coding, this pin must be connected to 0 V. A coded encoder connector can be checked via the application program of the controller.

Mating connector of the resolver (solder side)

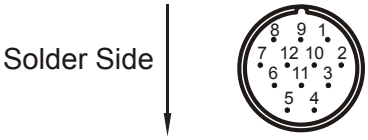


Fig. 11: RC series mating connector of the resolver (internal thread M23)

7.4 HIPERFACE Connection

7.4.1 Specifications

Specification of the connector for terminal X71 / X81 (ENCODER)

- 15-pin male SUB-D connector
- Metallized enclosure

Specification of HIPERFACE cable

- Cable size:
  Minimum 4 * 2 * 0.14 mm² + 2 * 0.5 mm² (AWG 26(8) + AWG 20(2)).
  2 * 0.5 mm² (AWG 20(2)) must be used for power supply and for GND.
- Twisted-pair cables shielded with the all-over shield must be used;
  The signal lines must also be twisted in pairs:
  Sine + and reference sine
  Cosine + and reference cosine
  DATA - and DATA +
  0 V and voltage supply
- The shield must be connected to the connector housings at both ends of the cable with the greatest possible surface area.
- Material: Copper
- Temperature class: 60 °C
- Maximum cable length: 50 m

7.4.2 HIPERFACE cable with mating connector

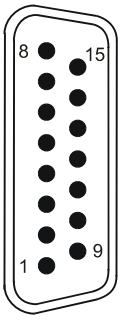
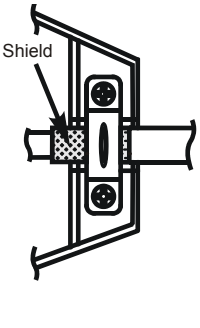
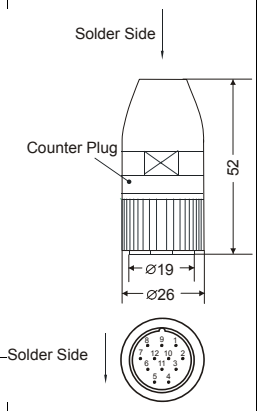
INFO

The resolver respectively HIPERFACE mating connector can be ordered from Jetter AG by specifying item number 15100069.

The complete resolver cable connecting the servo amplifier series JetMove D203 and synchronous servo motors can be ordered from Jetter AG by specifying the following item number (KAY) and the respective cable length in cm:

KAY_0923-xxxx	For the servo amplifier series JetMove D203

HIPERFACE Cable - KAY_0923-xxxx

JetMove D203 (SUB-D connector X71 / X81)	Shield		Motor (HIPERFACE) (female, solder side)
			
Attaching screws must have a metric thread!	Connect shield with the greatest possible surface area! Use metallized housing only!		
Pin	**Signal**	**Core Color**	**Pin**
-	Unassigned	-	1 - 2
1	Sine +	white	3
9	Reference sine	brown	4
2	Cosine +	green	5
10	Reference cosine	yellow	6
11	DATA - (RS-485)	gray	7
3	DATA + (RS-485)	pink	8
13	0 V	blue	9
5	Power supply (5 through 8.5 volts)	red	10
6	Sense +	-	-
14	Sense -	-	-
7	Thermal sensor	black	11
15	Thermal sensor	violet	12
8	Selecting signal	-	-
12	0 V	-	-

Dimensions of the HIPERFACE mating connector are specified in millimeters.

INFO 1

Supply voltage:
With the help of the sense resistor, the supply voltage can be set for the encoder. The resistance can be calculated by the following formula:

$$R(U) = \frac{4700\Omega}{U - 5V}$$

In order to set the HIPERFACE supply voltage of 8.5 V, a resistor of 1.33 K is needed.Ω .

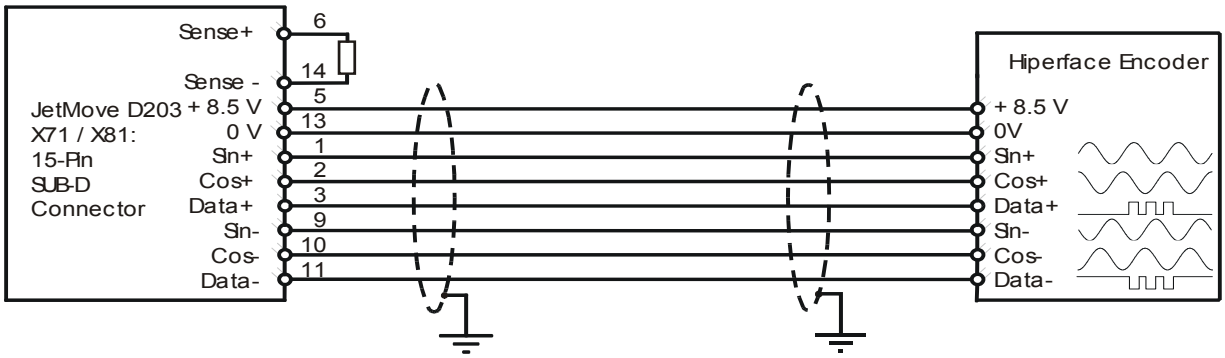


Fig. 12: HIPERFACE connection with set supply voltage

INFO 2

Selecting signal:
By means of the selecting signal, a coding can be carried out, in order to diagnose mixing up the two encoder connectors. This is only useful, if one of the two encoder connectors has got this coding. For coding, this pin must be connected to 0 V. A coded encoder connector can be checked via the application program of the controller.

HIPERFACE mating connector (solder side)

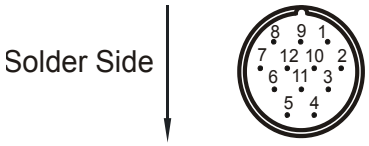


Fig. 13: RC series HIPERFACE mating connector (internal thread M23)

7.5 Sin-Cos Encoder Connection

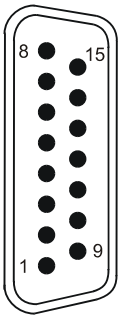
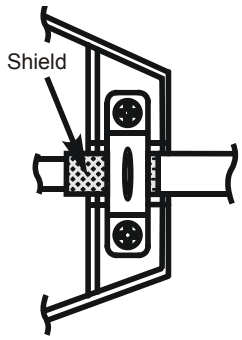
7.5.1 Specifications

Specification of the connector for terminal X71 / X81 (ENCODER)

- 15-pin male SUB-D connector
- Metallized enclosure

Sin-cos encoder cable specifications

- Cable size: 3 * 2 * 0.14 mm² + 2 * 0.5 mm² min. (AWG 26(6) + AWG 20(2)), if the wires of the thermal sensor have not been integrated in the encoder cable.
- Cable size: 4 * 2 * 0.14 mm² + 2 * 0.5 mm² min. (AWG 26(8) + AWG 20(2)), if the wires of the thermal sensor have been integrated in the encoder cable.
- 2 * 0.5 mm² (AWG 20(2)) must be used for the power supply unit and for GND.
- Twisted-pair cables shielded with the all-over shield must be used.
  The signal lines must also be twisted in pairs:
  Sine + and reference sine
  Cosine + and reference cosine
  Index + and reference index
  0 V and voltage supply
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area.
- Material: Copper
- Temperature class: 60 °C
- Maximum cable length: 100 m

Sin-Cos Encoder Cable		
JetMove D203 (SUB-D Connector X71 / X81)	**Shield**	**Cable Specification**
		Maximum cable length: 100 m
Attaching screws must have a metric thread!	Connect shield with the greatest possible surface area! Use metallized housing only!	
Pin	**Signal**	
1	Sine +	
9	Reference sine	
2	Cosine +	
10	Reference cosine	
3	Index +	
11	Reference index	
5	Power supply (5 through 8.5 volts)	
13	0 V	
6	Sense +	
14	Sense -	
7	Thermal sensor	
15	Thermal sensor	
8	Selecting signal	
12	0 V	

INFO 1.1

Supply voltage +5 V at the JetMove D203:
If the sense wires are not connected, the supply voltage of +5 V is issued at the JetMove D203. Due to performance degradation, a lower voltage might be supplied to the encoder.

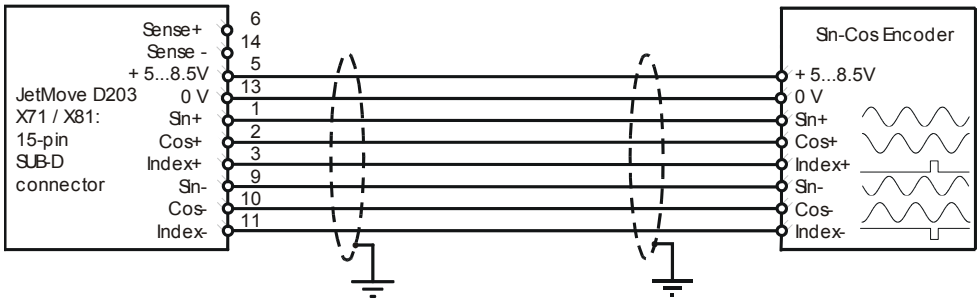


Fig. 14: Sin-cos encoder connection of +5 V supply voltage

INFO 1.2

Supply voltage +5 V at the encoder:
With the help of the sense connections, the supply voltage can be controlled in a way that +5 V are supplied to the encoder. Wiring should be carried out as follows:

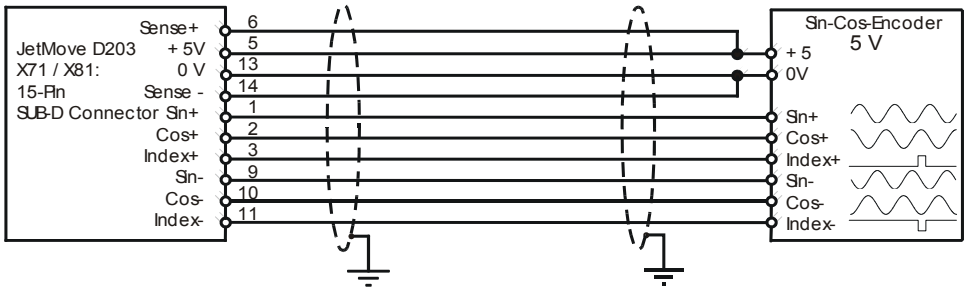


Fig. 15: Sin-cos encoder connection with a feedback control of the supply voltage

INFO 1.3

Supply voltage +5 ... 8.5 V at the JetMove D203:
With the help of the sense resistor, the supply voltage can be set for the encoder. The resistance can be calculated by the following formula:

$$R(U) = \frac{4700\Omega}{U - 5V}$$

In order to set a supply voltage of +8.5 V, for example, a resistor of 1.33 kΩ is needed.

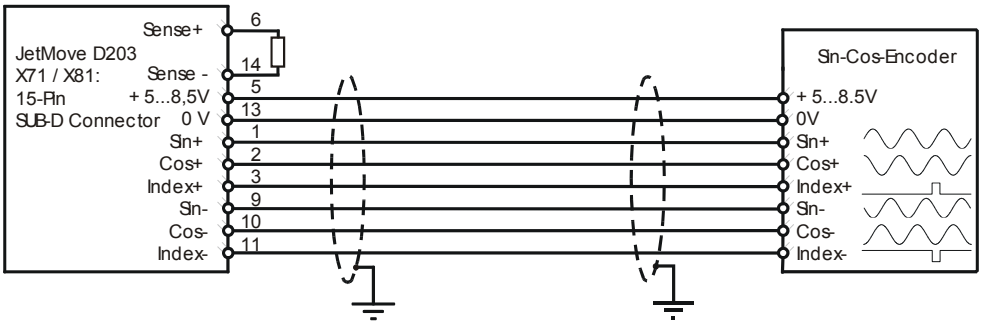


Fig. 16: Sin-cos encoder connection, also setting the supply voltage

INFO 2

Selecting signal:
By means of the selecting signal, a coding can be carried out, in order to diagnose mixing up the two encoder connectors. This is only useful, if one of the two encoder connectors has got this coding. For coding, this pin must be connected to 0 V. A coded encoder connector can be checked via the application program of the controller.

7.6 Incremental Encoder Connection

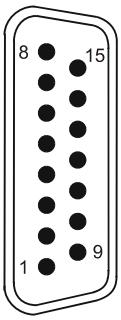
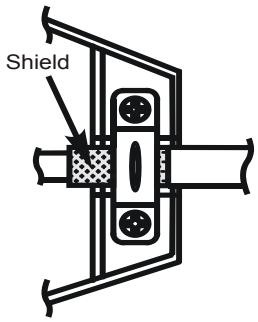
7.6.1 Specifications

Specification of the connector for terminal X71 / X81 (ENCODER)

- 15-pin male SUB-D connector
- Metallized enclosure

Specification of the incremental encoder cable

- Cable size: 3 * 2 * 0.14 mm² + 2 * 0.5 mm² min. (AWG 26(6) + AWG 20(2)), if the wires of the thermal sensor have not been integrated in the encoder cable.
- Cable size: Additionally 1 * 2 * 0.14 mm² min. (AWG 26(2)), if the wires of the thermal sensor have been integrated in the encoder cable.
- Cable size: Additionally 1 * 2 * 0.14 mm² min. (AWG 26(2)), if the sense wires have been integrated in the encoder cable.
- 2 * 0.5 mm² (AWG 20(2)) has to be used for the power supply unit and for GND
- Twisted-pair cables shielded with the all-over shield must be used; the signal lines must also be twisted in pairs:
  K0 + and referencing K0
  K1 + and referencing K1
  K2 + and referencing K2
  0 V and voltage supply
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area.
- Material: Copper
- Temperature class: 60 °C
- Maximum cable length: 100 m

Incremental Encoder Cable		
JetMove D203 (SUB-D Connector X71 / X81)	**Shield**	**Specifications of the Cable**
		Encoder signal: 5 V difference signal Maximum cable length: 100 m
Attaching screws must have a metric thread!	Connect shield with the greatest possible surface area! Use metallized housing only!	
Pin	**Signal**	
1	K1+	
9	K1-	
2	K2+	
10	K2-	
3	K0+	
11	K0-	
5	Power supply (5 through 8.5 volts)	
13	0 V	
6	Sense +	
14	Sense -	
7	Thermal sensor	
15	Thermal sensor	
8	Selecting signal	
12	0 V	

INFO 1.1

Supply voltage +5 V at the JetMove D203:
If the sense wires are not connected, the supply voltage of +5 V is issued at the JetMove D203. Due to performance degradation, a lower voltage might be supplied to the encoder.

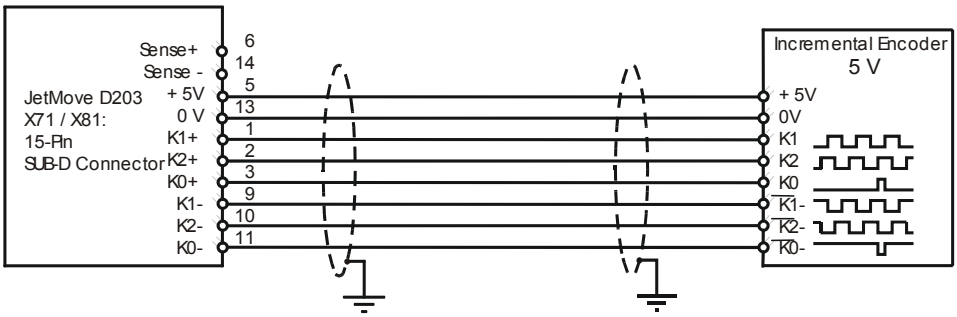


Fig. 17: Incremental encoder connection of a +5 V supply voltage

INFO 1.2

Supply voltage +5 V at the encoder:
With the help of the sense connections, the supply voltage can be controlled in a way that +5 V are supplied to the encoder. Wiring should be carried out as follows:

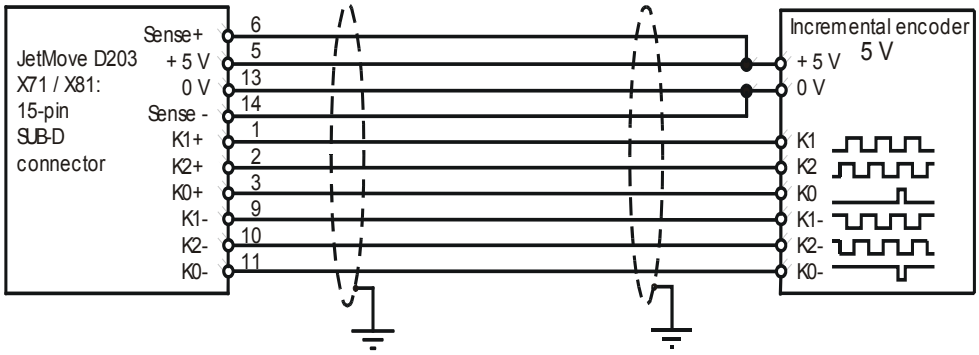


Fig. 18: Incremental encoder connection with feedback controlling of the supply voltage

INFO 2

Selecting signal:
By means of the selecting signal, a coding can be carried out, in order to diagnose mixing up the two encoder connectors. This is only useful, if one of the two encoder connectors has got this coding. For coding, this pin must be connected to 0 V. A coded encoder connector can be checked via the application program of the controller.

7.7 Digital Inputs, Logic Power Supply

Specification of terminal X10

- 2-pin screw clamping terminal (type MC 1.5/ 2-ST-3.5)
- Cross-sectional area of connecting cable: 0.14 ... 1.5 mm^2 (AWG 26 ... AWG 16) with bootlace ferrules in a plastic sleeve: 0.25 ... 0.5 mm^2 (AWG 24 ... AWG 20)
- Bladed screw-driver: 0.4 x 2.5 mm
- Stud torque for the screw clamping terminal: 0.22 Nm (1.95 lbf-inch)

Power Supply - Logic Circuit			
Terminal X10	**Signal**	**Description**	**Specification**
DC 24 V	Power supply	Power supply of the logic unit	DC 20 ... 28.8 V (I < 1.3 A)
0 V	Common ground	Ground for logic power supply	

Specification of terminal X72 / X82

- 10-pin screw clamping terminal (type MC 1.5/ 10-ST-3.81)
- Cross-sectional area of connecting cable: 0.14 ... 1.5 mm^2 (AWG 26 ... AWG 16) with bootlace ferrules in a plastic sleeve: 0.25 ... 0.5 mm^2 (AWG 24 ... AWG 20)
- Bladed screw-driver: 0.4 x 2.5 mm
- Stud torque for the screw clamping terminal: 0.22 Nm (1.95 lbf-inch)

Digital Inputs, Brake Terminals			
Terminals X72/X82	**Signal**	**Description**	**Specification**
DC 24 V OUT	Sensor supply voltage	• This voltage output can be used for supplying the reference and limit switches.	DC 20 .. 28.8 V (I < 100 mA)
REF	Reference switch (Input)	• Depending on the parameter setting, this input is used for reference run	• DC 24 V • 7.5 mA max. • Operating point: < 6 V low, > 15 V high NC or NO contact
0 V	Common ground		Ground*) for all inputs

Digital Inputs, Brake Terminals			
Terminals X72/X82	**Signal**	**Description**	**Specification**
LIMIT +	Positive limit switch (input)	• Depending on the parameter setting, this input is used as a positive limit switch.	• DC 24 V • 7.5 mA max. • Operating point: < 6 V low, > 15 V high NC or NO contact
LIMIT -	Negative limit switch (input)	• Depending on the parameter setting, this input is used as a negative limit switch.	• DC 24 V • 7.5 mA max. • Operating point: < 6 V low, > 15 V high NC or NO contact
INPUT	Digital input	• Depending on the parameter setting, this input can be used for quick stop, position capture or referencing without stop.	• DC 24 V • 7.5 mA max. • Operating point: < 6 V low, > 15 V high
0 V	Common ground		Ground*) for all inputs or for braking circuit
BRK. Supply	Voltage supply for the motor brake	• The voltage supply for the motor brake must be connected to this terminal.	DC 24 V (I < 2.0 A)

Digital Inputs, Brake Terminals			
Terminals X72/X82	**Signal**	**Description**	**Specification**
BRAKE +	Braking circuit contact BRAKE +	Contacts for the motor brake The internal semiconductor switching device can be operated either by the control program or by the firmware of the JetMove D203 at release of the motor current. JetMove D203 is equipped with an internal freewheeling diode. Contact: Type NO These connections are only for devices having got the same reference to ground as the power supply of the logic.	This contact has been connected internally with the brake supply.
BRAKE -	Braking circuit contact BRAKE -		The internal semiconductor switching device closes the contact BRAKE- by internal ground.

*) is connected to the ground of the controller.

7.7.1 Enable Input without Option -S1 (Safe Torque Off)

Specification of terminal X73 / X83

- 2-pin screw clamping terminal (type MC 1.5/ 2-ST-3.81)
- Cross-sectional area of connecting cable: 0.14 ... 1.5 mm^2 (AWG 26 - AWG 16) with bootlace ferrules in a plastic sleeve: 0.25 ... 0.5 mm^2 (AWG 24 ... AWG 20)
- Bladed screw-driver: 0.4 x 2.5 mm
- Stud torque for the screw clamping terminal: 0.22 Nm (1.95 lbf-inch)

Enable Inputs			
Terminals X73/X83	**Signal**	**Description**	**Specification**
ENABLE	Hardware enable for the power supply of the motor (Input)	• At this input, a high signal is necessary for power supply of the motor. This signal must have been applied before carrying out the software enable. • A low signal de-energizes the motor immediately.	• DC 24 V • 5 mA max. • Operating point: < 6 V low, > 15 V high
0 V	Common ground		Ground*) for the enable inputs

*) is connected to the ground of the controller.

For connections see “Connection Diagrams”, page 87.

7.7.2 Enable input with Option -S1 (Safe Torque Off)

Specification of terminal X73 / X83

- 3-pin screw clamping terminal (type MC 1.5/ 3-ST-3.81)
- Cross-sectional area of connecting cable: 0.14 ... 1.5 mm^2 (AWG 26 - AWG 16) with bootlace ferrules in a plastic sleeve: 0.25 ... 0.5 mm^2 (AWG 24 - AWG 20)
- Bladed screw-driver: 0.4 x 2.5 mm
- Stud torque for the screw clamping terminal: 0.22 Nm (1.95 lbf-inch)

Inputs for Enable: X73 / X83			
Terminals X73 / X 83	**Signal**	**Description**	**Specification**
ENABLE1	Hardware enable for the power supply of the motor (Input)	• At this input, a high signal is necessary for power supply of the motor. This signal must have been applied before carrying out the software enable. • A low signal de-energizes the motor after 1 ms (OSSD filtering).	• DC 24 V • max. 50 mA • Operating point: < 6 V low, > 15 V high
COM	Common ground	The ground reference of the inputs for enable is potentially isolated from the ground of the controller.	Ground for the enable-inputs
ENABLE2	Hardware enable for the power supply of the motor (input)	• At this input, a high signal is necessary for power supply of the motor. This signal must have been applied before carrying out the software enable. • A low signal de-energizes the motor after 1 ms (OSSD filtering).	• DC 20 ... 30 V • 50 mA max. • Operating point: < 6 V low, > 15 V high

Please refer to chapter 11 "Option -S1: STO", page 91

Connections see “Connection Diagrams”, page 87.

7.8 JX2 System Bus

The JetMove D203 is interlinked with the controller, other JetMove amplifiers, or JX2 peripheral modules by means of the JX2 system bus. The JX2 system bus input BUS-IN is a 9-pin male Sub-D connector, and the JX2 bus output BUS-OUT is a 9-pin female Sub-D connector.

When the JC24x option is used, the JX2 system bus must not be used at the BUS-IN connection (X18).

7.8.1 Specification of the JX2 system bus cable

Specification of connectors

On the BUS-OUT (X19) side
- 9-pin male SUB-D connector
- Metallized enclosure

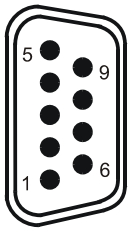
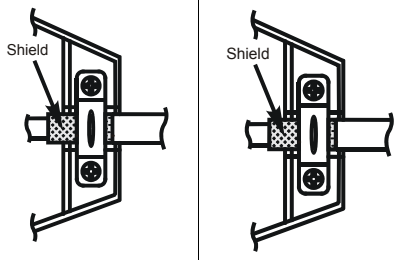
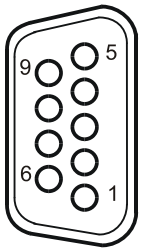
On the BUS-IN (X18) side
- 9-pin female SUB-D connector
- Metallized enclosure

JX2 System Bus Cable Specification

The minimum requirements listed below apply to the JX2 system bus cable:

JX2 System Bus Cable - Technical Data		
Parameter	**Specification**	
Core cross-sectional area	1 MBaud:	0.25 - 0.34 mm^2
	500 kBaud:	0.34 - 0.50 mm^2
	250 kBaud:	0.34 - 0.60 mm^2
	125 kBaud:	0.50 - 0.60 mm^2
Cable capacitance	60 pF/m max.	
Resistivity	1 MBaud:	70 max. Ω/km
	500 kBaud:	60 max. Ω/km
	250 kBaud:	60 max. Ω/km
	125 kBaud:	60 max. Ω/km
Number of cores	5	
Shield	Complete shielding, no paired shielding	
Twisting	Core pair CL and CH twisted.	
Material	Copper	
Temperature class	60 °C	

Allowed Cable Lengths			
Baud Rate	**Max. Cable Length**	**Max. Tap Line Length**	**Max. Overall Tap Line Length**
1 MBaud	30 m	0.3 m	3 m
500 kBaud	100 m	1 m	39 m
250 kBaud	200 m	3 m	78 m
125 kBaud	200 m	-	-

JX2 System Bus Cable - Cable Confection # 530		
	Shield	
		
BUS-OUT	Connect shield with the greatest possible surface area! Use metallized housing only!	**BUS-IN**
Pin	**Signal**	**Pin**
1	CMODE0	1
2	CL	2
3	GND	3
4	CMODE1	4
5	TERM	5
6	Vacant	6
7	CH	7
8	Vacant	8
9	Do not connect	9

7.9 Analog Input

7.9.1 Function

Both the male connector X18 and the female connector X19 let you connect analog inputs. These analog inputs have got a resolution of 12 bit. The converted value of the measured voltage can be read from a register of the JetMove by the application program or processed by the firmware of the JetMove in an additional controller. This lets you, for example, implement a pressure control loop in which the motor controlled by the JetMove generates the pressure. A pressure sensor in the machine is connected to the analog input of the JetMove to deliver the actual pressure value for the control loop.

The cable for the analog input must be integrated into the male / female connector of the JX2 system bus cable.

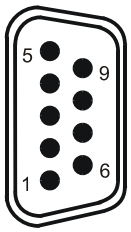
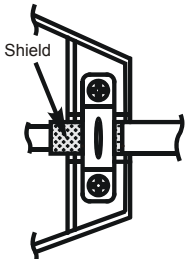
7.9.2 Specifications

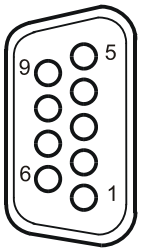
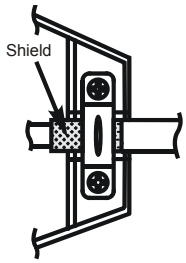
Specification of the mating connector for the male connector X18 / female connector X19

- Axis A: 9-pin female SUB-D connector
- Axis B: 9-pin male SUB-D connector
- Metallized enclosure

Specification of the analog input cable

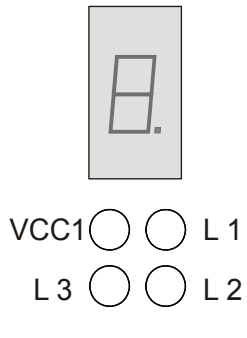
- Cable size: 2 * 0.14 mm² min. (AWG 26(2))
- Cores have to be twisted and shielded
- Shielding has to be connected to the connector housings on both sides.
- Material: Copper
- Temperature class: 60 °C

Pin Assignment - Analog Input Connector for Axis A	
	Shield
	
X18	Connect shield with the greatest possible surface area! Use metallized housing only!
Pin	**Signal**
6	Analog signal (0 - 10 V to pin 8)
8	Reference of the analog signal (not connected with 0 V of the controller)

Pin Assignment - Analog Input Connector for Axis B	
	Shield
	
X19	Connect shield with the greatest possible surface area! Use metallized housing only!
Pin	**Signal**
6	Analog signal (0 - 10 V to pin 8)
8	Reference of the analog signal (not connected with 0 V of the controller)

8 Status Monitoring

The amplifier LEDs indicate the operating status of the digital servo amplifier.



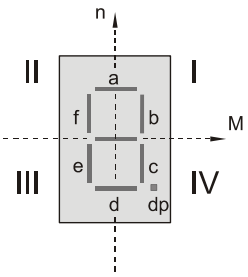
LEDs at JetMove D203			
LED	**Color**	**Status**	**Description**
VCC1	Green	is lit	Logic module voltage is OK
L1	Yellow	is lit	Axis is standing still (speed = 0)
L2	Yellow	is lit	A voltage of 24 V is applied to the input of the positive limit switch (LIMIT+).
L3	Yellow	is lit	A voltage of 24 V is applied to the input of the negative limit switch (LIMIT-).

Notice!

The 7-segment display of the output stage indicates the operating and fault conditions of the digital servo amplifier JetMove D203. The various display modes are set by the Motion Setup. Mode 0 (default) is used for normal operation and mode 1 for commissioning.

JetMove D203 - Seven-Segment Display Mode 0: Normal Operation		
Display	**Status**	**Description**
0	NOT READY TO BE SWITCHED ON	Initialization of amplifier functions
1	SWITCH-ON INHIBIT	Initialization completed. Safe state. Is achieved after initialising and after acknowledging errors. The drive controller can be switched on.
2	READY TO BE SWITCHED ON	Drive controller has been disabled by software command. The drive controller can be switched on.
3	SWITCHED ON	DC link monitoring is activated.
4	OPERATION_ENABLED	The drive controller has been enabled.

JetMove D203 - Seven-Segment Display Mode 0: Normal Operation		
Display	**Status**	**Description**
7	QUICK STOP ACTIVATED	A quick stop has been activated. The drive is being decelerated to n = 0 and then locked.
E	ERROR REACTION ACTIVATED	A fault has been recognized. An adjustable error reaction may be active.
F	MALFUNCTION	The drive controller is locked, error can be acknowledged.
F X. X.	ERROR NUMBER	Fault with number X. X. has occurred.
.	Flashing dot	Warning activated
0.	NULL	Boot sector has been activated
E.	E	OS flash gets deleted
L.	L	OS loader gets loaded
P.	P	OS is transferred to the flash memory
U.	U	Boot sector is waiting for OS update



JetMove D203 - Seven-Segment Display Mode 1: Commissioning		
Display	**Description**	
g	$\mathbf{n}_{\text{Actual Value}}$ < 0.5 % $\mathbf{n}_{\text{max.}}$	--
b	**M > 0**, **n > 0** --> quadrant I	Mode of operation - Motor
c	**M < 0**, **n > 0** --> quadrant II	Mode of operation - Generator
e	**M < 0**, **n < 0** --> quadrant III	Mode of operation - Motor
f	**M > 0**, **n < 0** --> quadrant IV	Mode of operation - Generator
a	Positive current limit has been reached	--
d	Negative current limit has been reached	--

9 Diagnostics

9.1 Error Messages

INFO

In the case of a error message, the letter "F" and two successive numbers appear on the 7-segment display every second.

Fault Message Table for the JetMove D203				
Error Number	**Type of Error**	**Description**	**Response to Errors**	**Troubleshooting**
F 00	Hardware Errors	Internal hardware defect	– Immediate pulse disable	– Cut drive controller from power lines – Return the amplifier for repair
F 01	Internal voltage supply error	One or more power supply voltages are beyond their limits	– Immediate pulse disable	– Cut drive controller from power lines – Return the amplifier for repair
F 03	Motor cable breakage	The motor cable is broken Please be careful: The motor cable is tested when the drive controller is enabled for the first time	– Immediate locking of controller	– Check the motor cable connections – Acknowledge failure
F 04	Overvoltage in the DC link	A DC link voltage of> 480 V has been detected	– Immediate locking of controller	– Check input voltage supply – If the motor is used as generator, reduce the regenerating power – Acknowledge failure

Fault Message Table for the JetMove D203				
Error Number	**Type of Error**	**Description**	**Response to Errors**	**Troubleshooting**
F 05	Current overload	The output current has been greater than 2.5 x the rated current or ground fault during operation	– Immediate locking of controller	– Check cable and motor for a short circuit and ground fault – Check current control parameters. If necessary, correct parameters – Acknowledge failure
F 06	Ballast resistor overload	The ballast resistor has been overloaded	– Immediate locking of controller	– Let the amplifier cool down – After cooling down, acknowledge failure – Reduce regeneration power
F 07	Amplifier overtemperature	The amplifier has reached the maximum temperature	– Immediate locking of controller	– Let the amplifier cool down – After cooling down, acknowledge failure – Reduce power of drive system
F 08	Motor overtemperature	The motor has reached the maximum temperature	– Immediate locking of controller	– Let the motor cool down – After cooling down, acknowledge failure – Reduce the power of the drive
F 09	Encoder failure	Encoder breakage or initialization error	– Immediate locking of controller	– For extended diagnostics purposes use motion setup – Check the encoder line and all plug-in connections – Acknowledge failure
F 10	Overspeed	The actual shaft speed has exceeded a value of 1.25 x maximum speed	– Immediate locking of controller	– Check motor and encoder connections – Check speed controller parameters. If necessary, modify parameters – Acknowledge failure
F 11	Current overrange	A current temporarily too high has been detected	– Immediate locking of controller	– Reduce K_p of the current controller by 10 to 20 % – Acknowledge failure

Fault Message Table for the JetMove D203				
Error Number	**Type of Error**	**Description**	**Response to Errors**	**Troubleshooting**
F 13 (combined with F00)	Internal checksum error	An internal checksum error has occurred	– Immediate locking of controller	– Switch the 24 V supply off and on again – If the error occurs repeatedly, return the amplifier for repair
F 14 (combined with F 00)	Internal communication error	An internal communication error has occurred	– Immediate locking of controller	– Switch the 24 V supply off and on again – If the error occurs repeatedly, return the amplifier for repair
F 15	The hardware enable is missing	The software enable is given without a hardware enable	– Immediate locking of controller	– Disable the drive by means of the software – Acknowledge failure
F16	Power input over current	The current at the power input was to high	– Immediate locking of controller	– Check input voltage – Reduce mechanical power of the motor – Acknowledge failure
F 17	Trip of software limit switch	Actual position is outside the range of software limits and software limit switches are active	– Stop with max. current (torque)	– Check destination position – Acknowledge failure – Run axis back inside the range of software limits (software limit switches will be active automatically by entering this range)
F 18	Trip of hardware limit switch	One hardware limit switch was activated	– Stop with max. current (torque)	– Check destination position – Check reference position – Acknowledge failure – Run axis back inside the range of hardware limits (software limit switches will be active automatically at leaving the switch)

Fault Message Table for the JetMove D203				
Error Number	**Type of Error**	**Description**	**Response to Errors**	**Troubleshooting**
F 20	Undervoltage DC link voltage	The DC link voltage is less than the minimum value	– Stop with emergency stop ramp	– Check the voltage of the power line – Check the parameter "U_{ZK} min. trip" – Acknowledge failure
F 21	Overvoltage DC link voltage	The DC link voltage has exceeded the maximum value	– Stop with emergency stop ramp	– Check the voltage of the power line – In generator operation reduce braking power – Acknowledge failure
F 22	The drive has stalled	The drive could not overcome the n=0 threshold within the time limit specified by the parameter "blocking-triping time"	– Immediate locking of controller	– Eliminate the cause of stalling – Acknowledge failure
F 23	Tracking error	The tracking error has exceeded the limit defined in the parameter "tracking error limit" for the time specified in "tracking window time"	– Stop with emergency stop ramp	– Check the drive mechanism – Check steepness of acceleration/ deceleration ramps and amplifier parameters in relation to the parameters "tracking error limit" and "tracking window time" – Acknowledge failure
F27 (combined with F01)	Internal supply error	one or more internal supply voltages has fallen below their limit	– Immediate locking of controller	– Note the number of error – Return the amplifier for repair
F28	Error in power charging circuit	The input current limitation circuit is defective.	– Immediate locking of controller	– Check the voltage of the power line – Note the number of error – Return the amplifier for repair
F29	Mains power too high	The average mains power is too high	– Immediate locking of controller	– Acknowledge failure – Reduce the average load of the motor

Fault Message Table for the JetMove D203				
Error Number	**Type of Error**	**Description**	**Response to Errors**	**Troubleshooting**
F30	I²t Error	The average power loss of the motor was more than the max. value configured by nominal motor current, overload factor and motor time constant Refer to “I²t calculation" on page 44.	– Immediate locking of controller	– Let the motor cool down – Acknowledge failure – Check the configuration of nominal motor current, overload factor and motor time constant – Reduce the average load of the motor
F31	Motor overload protection according to UL	The average motor power loss was higher than has been defined according to UL Refer to chapter 5.2.3 "Motor overload calculation to UL", page 45.	– Immediate locking of controller	– Let the motor cool down – Acknowledge failure – Reduce the average load of the motor
F38	Asymmetric encoder signal	The analog sine-cosine signals have not got the same amplitude.	– Immediate locking of controller	– Check wiring or encoder signals – Acknowledge failure
F39	Error at commutation finding	Measuring the commutation offset could not be completed with results being guaranteed.	– Immediate locking of controller	– Check parametering – Check wiring or encoder signal – Acknowledge failure
F40	Overload of motor brake	The internal semiconductor switch signals overload (current >> 2 A).	– Stop with emergency stop ramp	– Check wiring or motor brake – Acknowledge failure
F41	Overload of encoder supply	Either the encoder supply has been overloaded (short circuit), or the sensor lines are short-circuited.	– Stop with emergency stop ramp	– Check wiring or encoder – Acknowledge failure

Fault Message Table for the JetMove D203				
Error Number	**Type of Error**	**Description**	**Response to Errors**	**Troubleshooting**
F 42	Malfunction of encoder 2 (only for the option CNT)	Broken encoder line or initialization error of the encoder	– Immediate motor power disable	– Check the encoder line and all plug-in connections – Acknowledge the error
F 43	Communication error	Termination after a max. number of lost cyclic data transmissions	– Stop with emergency stop ramp	– Check the communication connection
F 44	Communication error	CAN controller is in Error Passive state. The error counter value exceeds 127.	– Stop with emergency stop ramp	– Check the communication connection
F 45	Communication error	CAN controller is in Bus OFF state. The error counter value has reached 255.	– Stop with emergency stop ramp	– Check the communication connection
F 46	External error in encoder	A smart encoder (EnDat 2.2) may have sent an error message	– Immediate motor power disable	– Check the parameters – Check the encoder

9.2 Warnings

If the dot in the seven-segment display is flashing, one or several warnings have been recognized. Please check in the motion setup or by making enquiries in the PLC program which warning is active by means of the motion commands.

10 Connection Diagrams

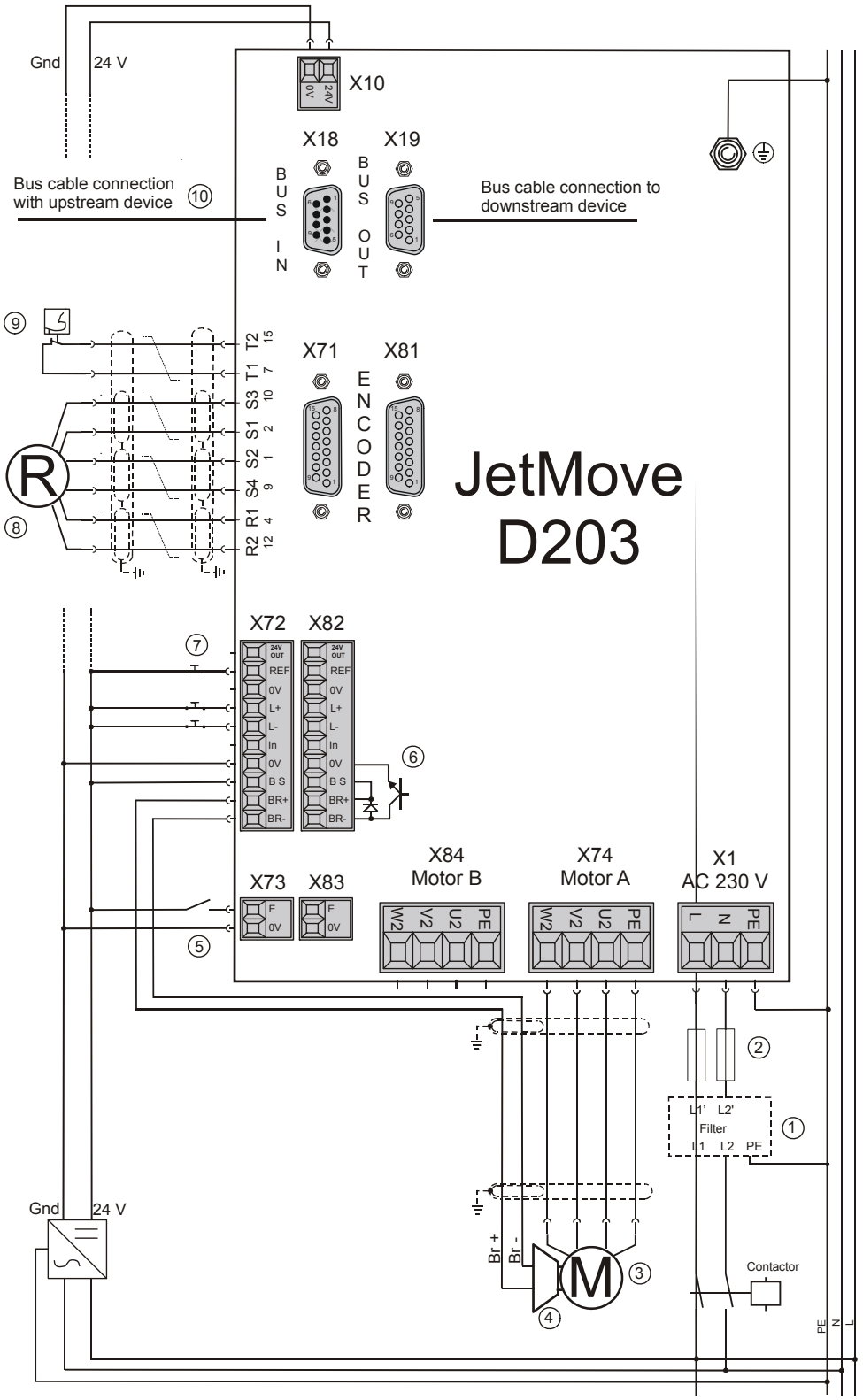


Fig. 19: Connection diagram JM-D203, type of position transducer: Resolver

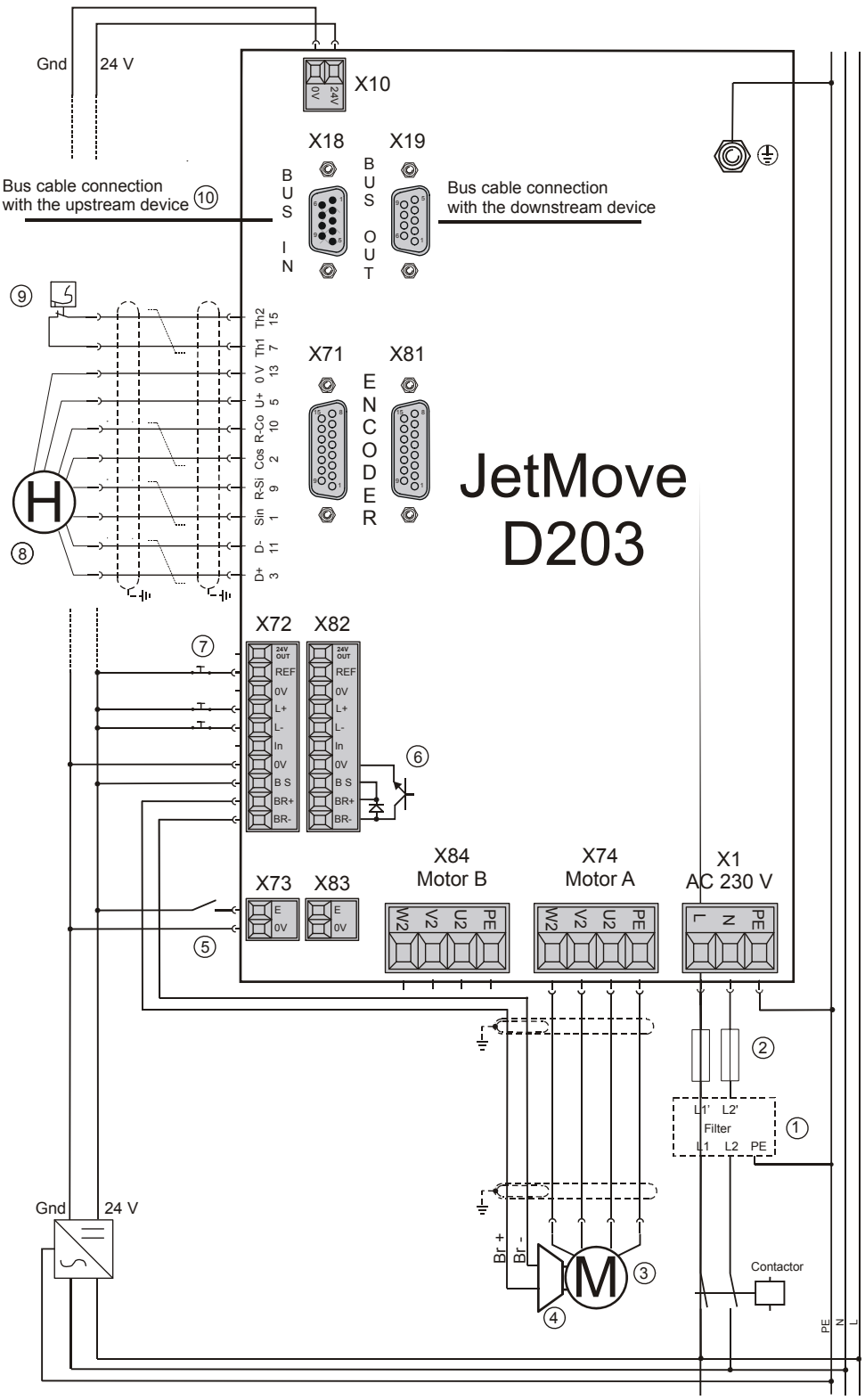


Fig. 20: Connection diagram JM-D203, type of position transducer: HIPERFACE

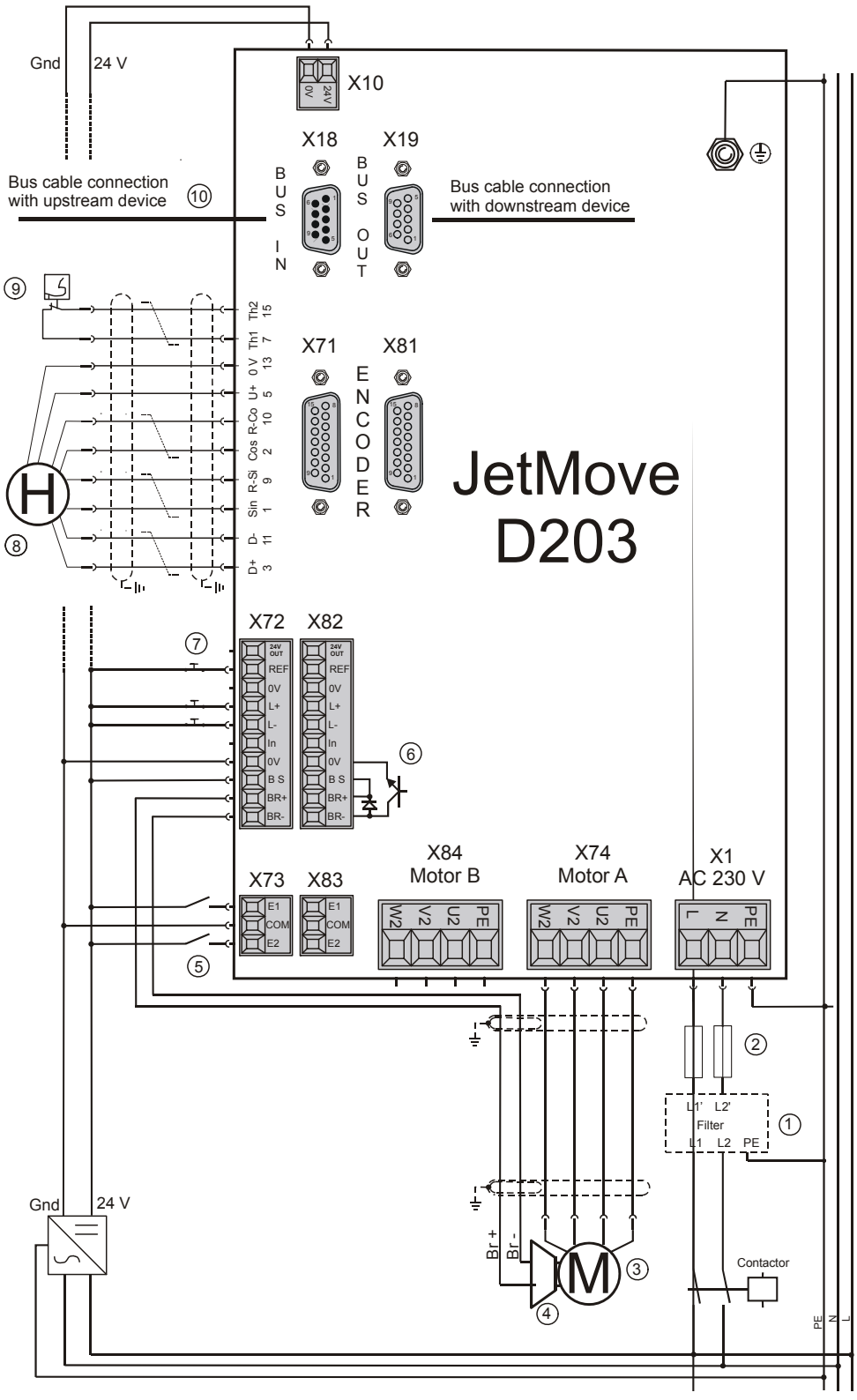


Fig. 21: Connection diagram JetMove D203, of the following option: S1

Key to wiring diagrams:

1	Line filter (optional) (refer to “Line filter" on page 39)
2	Mains protection (refer to “Overload Protection" on page 38)
3	Motor
4	Motor holding brake (option)
5	– Connecting without the option -S1 (Safe Torque Off): The input for enable is connected in single-channel mode. – Connecting with the option -S1 (Safe Torque Off): Enable1 and Enable2 are connected in dual-channel mode.
6	The motor holding brake is controlled via an internal semiconductor-switch. A free-wheeling diode has been integrated.
7	To use initiators for end position and reference inputs, a 24 V power supply unit and a 0 V ground have been made available as terminals.
8	Position transducer (resolver or HIPERFACE encoder)
9	Motor-temperature protection (see “Thermal sensor integrated in the motor" on page 43)
10	At using the option -JC24x, the Bus-In connector X18 must not be applied, as the system bus is connected with the JM-D203 internally.

11 Option -S1: STO

For information on the "Safe Torque Off (STO)" option refer to the corresponding Function Description which can be downloaded from our homepage: https://www.jetter.de/en/downloads/motion-systems/jetmove-series/jetmove-2xx.html

jm-2xx_sto-option_fb_xxx_function_description

Functional description with safety instructions to be observed and measures concerning "STO".
Item # 60878628

INFO

At Jetter AG, the safety function "STO" is referred to as "Safe Standstill" in the order list for example.

12 Option -JC24X

12.1 Electrical Installation

NOTICE

- Make sure that the connecting cables are correctly wired when installing the integrated controller -JC24X.
  Reverse polarity of the digital inputs and outputs leads to damages of the integrated controller -JC24X.
- You can use our prefabricated programming, HMI and connecting cables for the Jetter system bus. For more information refer to chapter 12.10.1 "Overview of interface cables", page 119.
- For installation according to EMC, the chapter 1.4 "Instructions on EMC", page 20 must be read and followed.
- Connect a HMI and your integrated controller using the interface cable JN-DK via the SER2 interface.
- Connect the -JC24X integrated controller to your computer using the JN-PK programming cable via an SER1 or SER2 interface or via Ethernet.
- For the Ethernet connection, set the required IP address using the address switches.
- Install JetSym on your computer.
- Launch JetSym and set the communication parameters.
- Energize the JM-D203-JC240 and transmit a JetSym program from your computer to the integrated controller -JC24X.
- Check the controller for proper functioning.

12.2 Power Supply

12.2.1 Requirements

Power Supply Unit - Requirements	
Voltage range	DC 24 V (20 ... 28.8 V) Residual ripple: <5 % filtered SELV
Maximum current consumption at terminal X30: DC 24 V 6 A: – Digital Outputs	 6 A

CAUTION

CAUTION

- The maximum supply voltage must not exceed DC 30 V since a higher supply voltage may cause damages to the JC24X.
- If the JC24X is not supplied with sufficient power (under-voltage), malfunctions of the digital outputs may occur.

INFO

Protection against polarity reversal:
The -JC24X is protected against reverse polarity. As a test, a voltage of 24 volt with reversed polarity was applied to the test object for 10 s.

12.2.2 Description of connections

Terminal Specifications

- 2-pin plug-in screw terminal COMBICON RM 3.5 (for printed-circuit boards) (AWG 24 ... AWG 14)
- Allowed conductor size: 0.25 ... 2.5 mm^2 (AWG 24 ... AWG 14) with bootlace ferrules in a plastic sleeve: 0.14 ... 0.5 mm^2 (AWG 26 ... AWG 20)
- Torque (for input plug screws): 0.2 Nm
- The maximum stripping length for input lines is 8 mm
- The accepted VDE guidelines have to be followed
- Slot-head screw driver: 0.4 x 2.5 mm

Connecting Cable Specifications

- Will not be needed

Cable Shielding

- Not required

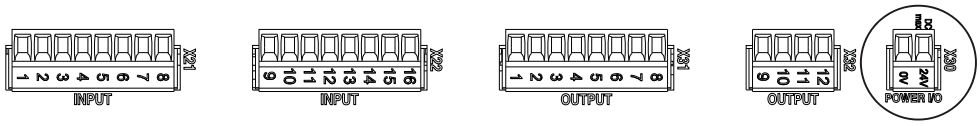
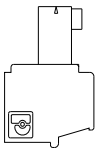


Fig. 22: JM-D203-JC24X: Connection of the input and output voltage supply

Assignment of the 2-Pin Plug-In Screw Terminal			
View	**Pin**	**Signal**	**Comment**
X 30  	X30.24 V	DC 20 ... 28.8 V	Power supply for digital outputs Peak current 6 A
	X30.0 V	GND	High-impedance connection to the enclosure (1 MOhm / 10 nF)

12.3 Digital Inputs

12.3.1 Technical data

Technical Data - Digital Inputs	
16 digital inputs	DC 24 V -15 % ... +20 %
Type	PNP
Input terminals	Plug-in terminal blocks
LEDs, inputs 1-16	24 volt are applied to the input. The LEDs are only lit, if the JM-D203 -JC24X is connected to the voltage supply.
Heat loss of logic circuit	0.3 Watts
Rated input voltage	DC 24 V -15 % ... +20 %
Voltage range	0 ... 30 V
Input current typically	Approx. 7.5 mA
Input resistance	3.0 kΩ
Input delay time	approx. 3 ms (from 0 to 1, and from 1 to 0)
Signal voltage ON	17 V min.
Signal voltage OFF	5 V max.
Signal processing	Dynamic
Electrical isolation	Electrical isolation to logic is available

INFO

All digital inputs and outputs have got the same reference potential.

A digital output may directly (without additional load) be connected to a digital input.

12.3.2 Description of the LEDs

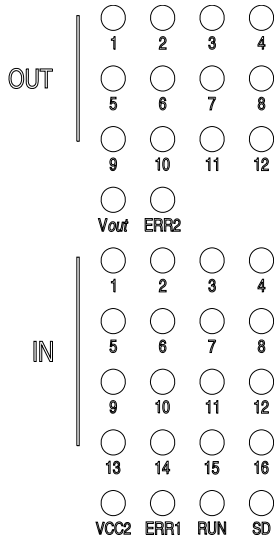


Fig. 23: LEDs of the digital inputs of the -JC24X

LEDs of Digital Inputs		
Designation	**Color**	**Description**
IN 1 ... 16	yellow	Digital input 1 through 16 **ON:** Signal voltage ON **OFF:** Signal voltage OFF

12.3.3 Description of connections

Terminal Specifications

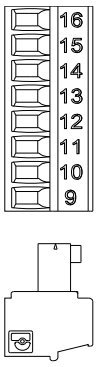
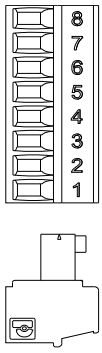
- 8-pin plug-in screw terminals COMBICON RM 3.5
  (for printed-circuit boards)
- Allowed conductor size: 0.25 ... 2.5 mm^2 (AWG 24 ... AWG 14)
  with bootlace ferrules in a plastic sleeve: 0.14 ... 0.5 mm^2 (AWG 26 ... AWG 20)
- Torque (for input plug screws): 0.2 Nm
- The maximum stripping length for input lines is 8 mm
- The accepted VDE guidelines have to be followed
- Slot-head screw driver: 0.4 x 2.5 mm

Connecting Cable Specifications

- Not required

Cable Shielding

- Not required

Pin Assignment of 8-Pin Plug-In Screw Terminals			
View	**Pin**	**Signal**	**Number**
X22 	X22.16	Digital input # 16	116
	X22.15	Digital input # 15	115
	X22.14	Digital input # 14	114
	X22.13	Digital input # 13	113
	X22.12	Digital input # 12	112
	X22.11	Digital input # 11	111
	X22.10	Digital input # 10	110
	X22.9	Digital input # 9	109
X21 	X21.8	Digital input # 8	108
	X21.7	Digital input # 7	107
	X21.6	Digital input # 6	106
	X21.5	Digital input # 5	105
	X21.4	Digital input # 4	104
	X21.3	Digital input # 3	103
	X21.2	Digital input # 2	102
	X21.1	Digital input # 1	101

The connection of the digital inputs of the -JC24X is shown in Fig. 24.

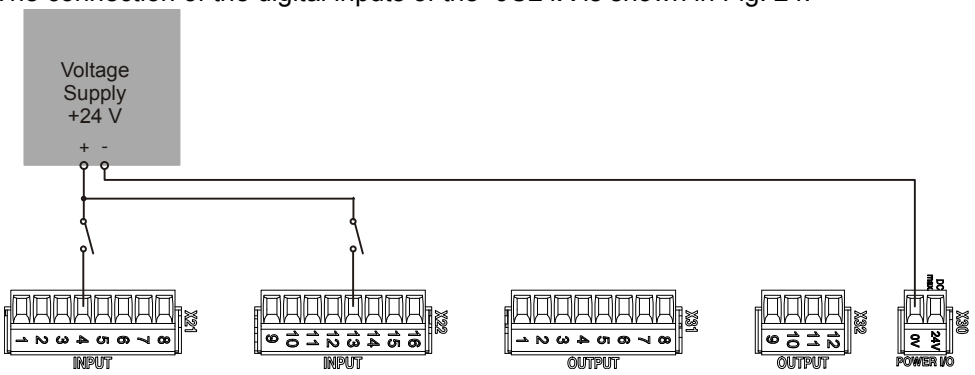


Fig. 24: External circuit of the digital inputs 4 and 13

12.3.4 Numbering system of digital inputs located on expansion modules

Numbering System of Digital Inputs	
Digital Inputs of JX2-ID8	**Number**
Input # 1	I/O module number * 100 + 1
Input # 2	I/O module number * 100 + 2
...	...
Input # 8	I/O module number * 100 + 8

First non-intelligent expansion module I/O module number = 2

12.4 Digital Outputs

12.4.1 Technical data

Technical Data - Digital Outputs	
8 digital outputs	DC 24 V, 0.5 A, pnp
Output terminals	Plug-in terminal blocks
LEDs for inputs 1 - 8	24 V output, switched; The LED is lit, if the output has been activated, and if the supply voltage has been connected to X30.
Type of outputs	Transistor, pnp
Rated voltage	DC 24 V -15 % ... +20 %
Voltage range	20 ... 30 V
Load current	0.5 A max. per output
Output power of outputs	144 Watts
Electrical isolation	Electrical isolation to logic is available
Protective circuit	Short circuit, overvoltage, overtemperature, polarity reversal
Protection against inductive loads	Yes
Principle of operation	Non-latching
Signal voltage ON	Typ. V_{supply} -1.5 V

INFO

All digital inputs and outputs have got the same reference potential.

A digital output may directly (without additional load) be connected to a digital input.

12.4.2 Description of the LEDs

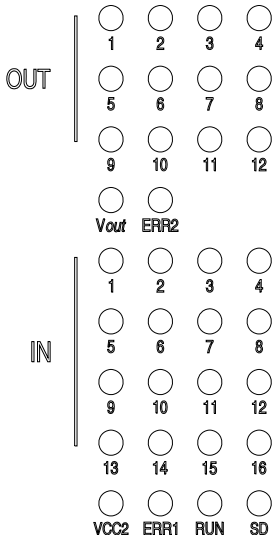


Fig. 25: LEDs of the digital outputs of the -JC24X

LEDs of Digital Outputs		
Designation	**Color**	**Description**
OUT 1 ... 12	Yellow	Digital output 1 through 8 **ON:** Signal voltage ON **OFF:** Signal voltage OFF
ERR2 Collective error report	Red	**ON:** Overload, short circuit, overtemperature of one or more outputs. Error states can be queried in register 2008.
Vout	Green	**ON:** External voltage supply of the digital outputs is provided.

12.4.3 Description of connections

Terminal Specifications

- 8-pin , respectively 4-pin plug-in screw terminals COMBICON RM 3.5 (for printed-circuit boards)
- Allowed conductor size: 0.25 ... 2.5 mm^2 (AWG 24 ... AWG 14) with bootlace ferrules in a plastic sleeve: 0.14 ... 0.5 mm^2 (AWG 26 ... AWG 20)
- Torque (for input plug screws): 0.2 Nm
- The maximum stripping length for input lines is 8 mm
- The accepted VDE guidelines have to be followed
- Slot-head screw driver: 0.4 x 2.5 mm

Connecting Cable Specifications

- Not required

Cable Shielding

- Not required

Occupation of 8-Pin, Respectively 4-Pin Plug-In Screw Terminals

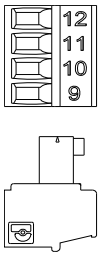
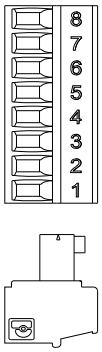
View	Pin	Signal	Number
X32 	X32.12	Digital output # 12	112
	X32.11	Digital output # 11	111
	X32.10	Digital output # 10	110
	X32.9	Digital output # 9	109
X31 	X31.8	Digital output # 8	108
	X31.7	Digital output # 7	107
	X31.6	Digital output # 6	106
	X31.5	Digital output # 5	105
	X31.4	Digital output # 4	104
	X31.3	Digital output # 3	103
	X31.2	Digital output # 2	102
	X31.1	Digital output # 1	101

Fig. 26 shows the connection details of the digital outputs of the -JC24X.

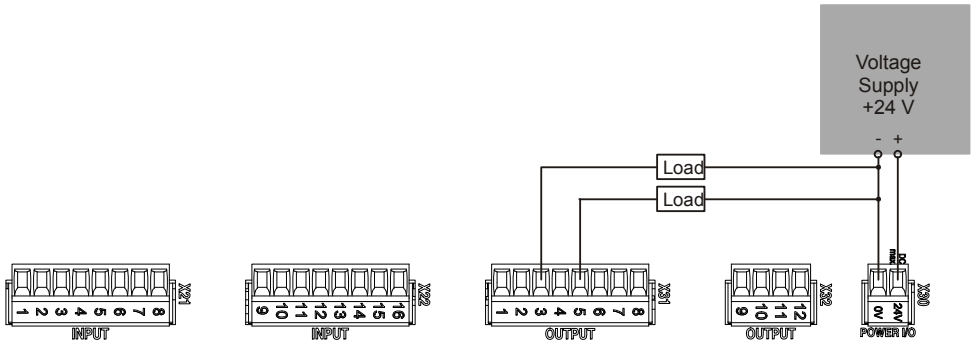


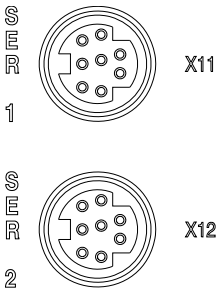
Fig. 26: External circuit of the digital outputs 3 and 5

12.4.4 Numbering system of digital inputs located on expansion modules

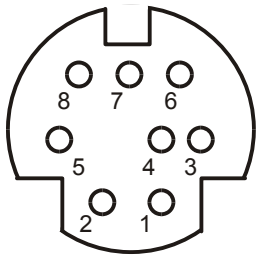
Numbering System of Digital Outputs	
Digital Output JX2-OD8	**Number**
Output 1	I/O module number * 100 + 1
Output 2	I/O module number * 100 + 2
...	...
Output 8	I/O module number * 100 + 8

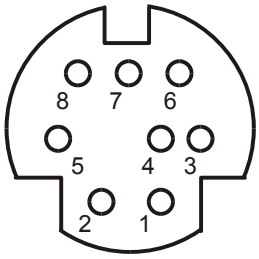
First non-intelligent expansion module: I/O module number = 2

12.5 Serial Interfaces



The integrated controller -JC24X has been equipped with two serial interfaces.
The first serial interface is an RS-232.
The second serial interface can **either** be used as an RS-232 **or** as an RS-422.
These interfaces can serve for communication between the -JC24X and the PC on which the JetSym programming interface has been installed. Yet, they also serve as a connection between the integrated controller and the HMI.

RS-232 Ser1 and Ser2 (8-Pin MiniDIN Jack)			
Ser1 or Ser2 Jack	**Pin**	**Signal**	**Comment**
	1	-	RS-422 (Ser2 only)
	2	GND	Ground
	3	-	RS-422 (Ser2 only)
	4	RxD	RS-232
	5	-	RS-422 (Ser2 only)
	6	DC 24 V	Power supply of the HMI (Ser2 only)
	7	-	RS-422 (Ser2 only)
	8	TxD	RS-232

RS-422 Ser2 (8-Pin MiniDIN Jack)			
Ser1 or Ser2 Jack	**Pin**	**Signal**	**Comment**
	1	RDA	RS-422
	2	GND	Ground
	3	RDB	RS-422
	4	-	RS-232
	5	SDB	RS-422
	6	DC 24 V	Supply of the HMI
	7	SDA	RS-422
	8	-	RS-232

12.6 Ethernet Interface

12.6.1 Connecting to the RJ45 jack

The integrated controller -JC24X is connected to the Ethernet through its RJ45 jack.

There are two types of interconnecting cables used for 10/100 MBit/s twisted pair Ethernet.

- Straight-through twisted pair cables
- Crossover cables (transmitting and receiving lines are crossed)

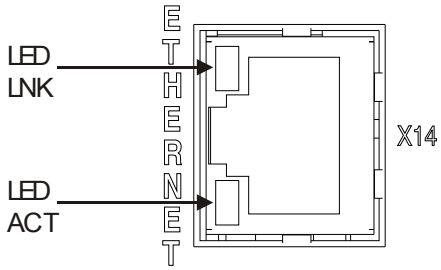


Fig. 27: Ethernet connection

The LEDs of the RJ45 Ethernet Jack	
Designation	**Description**
LNK	Linkage: The integrated controller integrated controller-JC24X is linked with an Ethernet
ACT	Activity: The integrated controller -JC24X transmits, respectively receives, data via Ethernet

INFO

LED "LNK" is lit green:

The correct cable has been used between the Ethernet network and the -JC24X.

LED "ACT" is lit yellow:

The integrated controller -JC24X carries out data exchange via Ethernet.

12.6.2 Connection between -JC24X and PC

Direct connection between a PC and a -JC24X is established by means of a crossover cable.

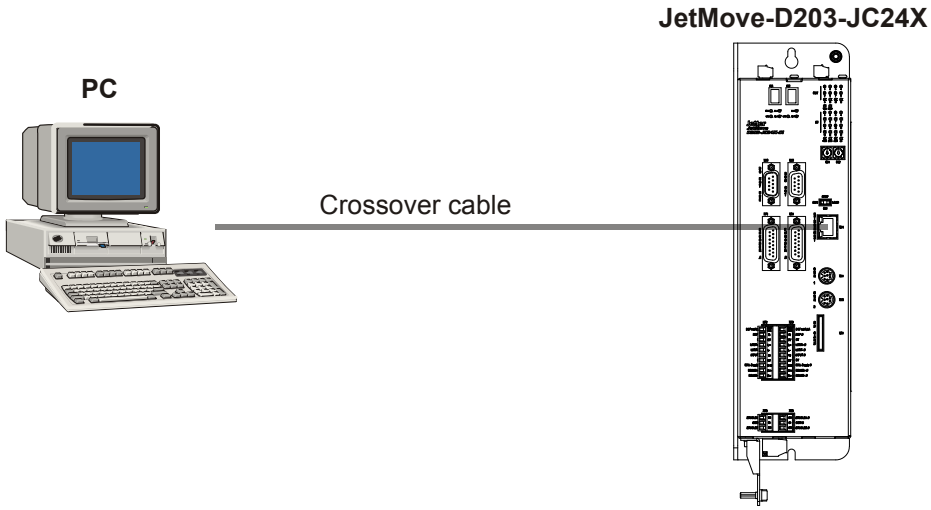


Fig. 28: Ethernet connection between PC and JetControl

12.6.3 Connection between -JC24X, switch, and PC

If connection between a PC and -JC24X is established through a switch, straight-through cables have to be used.

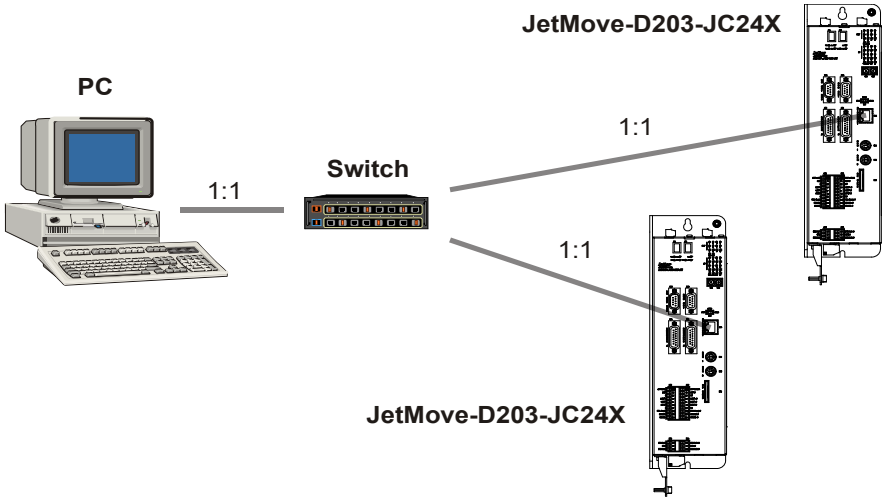


Fig. 29: Ethernet connection between -JC24X and switch

12.6.4 Connection via several switches

The switches have to be interconnected by means of crossover cables. The connections between -JC24X and switch, as well as between PC and switch, have to be made by means of straight-through cables.

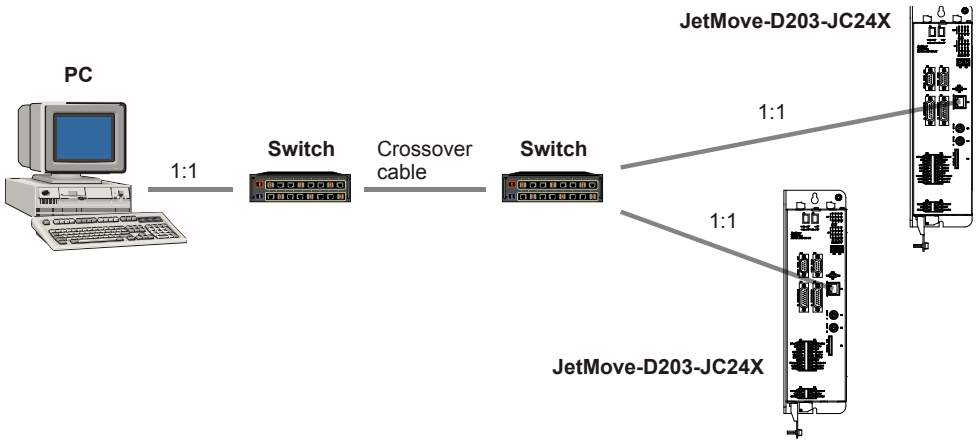


Fig. 30: Ethernet connection from switch to switch

INFO

Terminals have to be interconnected by means of crossover cables:

- PC to PC
- -JC24X to PC
- -JC24X to -JC24X
- etc.

Terminals with infrastructure components (e.g. switch) have to be interconnected via straight-through cables:

- PC to switch
- -JC24X to switch
- etc.

Infrastructure components have to be interconnected by means of crossover cables:

- Switch to switch
- Switch to router
- etc.

INFO

As in most cases connections are established between an infrastructural component and a terminal, switches/hubs are provided with an uplink port. An uplink port allows to connect two infrastructural components using a straight-through cable. Thus, the uplink port eliminates the need for a special crossover cable. On some switches/hubs a switch is used to toggle the uplink port between straight-through and crossover cable.

If the proper cable is not available, the uplink port of a switch/hub can be used.

Some devices are provided with an automatic crossover function which ensures automatic adjustment to the cable and distant station.

12.7 Status LEDs, Mode Selector

12.7.1 LEDs

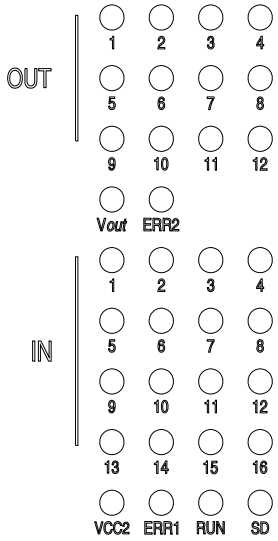


Fig. 31: Status LEDs

Status LEDs	
Vout (green)	Supply voltage for the digital output driver is OK
ERR2 (red)	Error in the output driver Overload, short circuit, overtemperature of one or more outputs
VCC2 (green)	Supply voltage for the logic circuit is OK
ERR1 (red)	Error; error description in register 2008
RUN (green)	Operating system of the integrated controller is active
SD (yellow)	Read or write access is being made to the SD card

LED - OS Booting Sequence		
No.	**LED ERR1 = red RUN = green**	**Description**
1	red	Boot loader is checking the validity of the program loader
2	red, green	Program loader is copied from flash memory to RAM
3	both are OFF	The program loader is launched in the RAM
4	red	Program loader is checking the validity of the OS
5	red, green	The OS is unzipped and copied to RAM
6	both are OFF	The OS is launched in the RAM
7	red	Initialization of the OS is started
8a	green, flashing	Mode selector set to STOP OS is okay, but application program is halted
8b	green, flashing; increased flashing rate	Mode selector set to RUN OS is okay, startup delay (register 2032) is elapsing, application program is being checked
9	 red, flashing green, lit	Mode selector set to RUN OS is okay, but there is no valid application program to be executed OS is okay, application program is being executed

LED - Error Messages	
After switching on, both LEDs, red (ERR1) and green (RUN) are flashing simultaneously.	The mode selector is in LOAD position. Boot loader is running. OS will not be checked and launched.
After switching on, red (ERR1) flashes three times; after this, both LEDs, red (ERR1) and green (RUN) are flashing simultaneously.	The mode selector is in RUN or STOP position. Boot loader is running. There is no valid OS.
The red LED (ERR1) and the green LED (RUN) are flashing alternately during runtime.	Serious OS error
The red LED (ERR1) is lit during runtime of the operating system.	Error: Error description in register 2008.

The present status of the LED can be queried from register 10182.

12.7.2 The mode selector

When the integrated controller is powered-up, the position of the mode selector is read out.

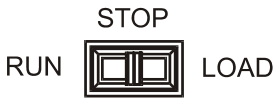


Fig. 32: Settings of the mode selector S11

By means of the built-in mode selector, the starting behavior of the integrated controller can be influenced.

Start-Up Process

Mode Selector	
Position	**Description**
LOAD	The boot process proceeds as far as to the boot loader
STOP	The application program is not started
RUN	The application program is started

Once the start-up procedure has been completed, the position of the mode selector has no longer influence on the controller functions. The current position of the mode selector can be scanned in register 10181.

12.8 Setting the IP Address

There are four ways of assigning an IP address to a -JC24X. The actually used IP address can be read from register 2931.

12.8.1 Default IP address

If, at switching on the integrated controller, both address switches are in position '0', the JetControl will have the default IP address 192.168.10.15.
In case of any uncertainties with regard to the IP address used, you can use this "loophole" to set the JetControl to a defined state.

12.8.2 IP address from the configuration memory

If, at switching on the integrated controller, both address switches are in position 'F', the -JC24X will have the IP address which has been stored to the configuration memory.
The configuration memory can be accessed via the configuration file "/System/cfgvar.ini" or via registers 10131 through 10145 and 10200 through 10219.

Configuration File

To gain access to the configuration file "/System/cfgvar.ini" via FTP the user must have administrator rights.
This file has the same structure as a Windows *.INI file:

```
[CFGVAR]
Version       = 5
IP_Address    = 192.128. 10. 97
IP_SubNetMask = 255.255.255. 0
IP_DefGateway = 192.128. 10.  1
BasePort      = 50000
IP_DNS        = 192.118.210.209
HostNameType  = 1
HostName      = JM-D203-JC24X
```

NOTICE!

In no case change the version number.

Registers

Registers 10131 through 10145 and 10200 through 10219 provide an alternative way of accessing the configuration memory.
To gain access to the configuration file via registers, first of all, the password value 2002149714 (0x77566152) has to be loaded into password register 10159. Then, registers 10132 through 10145 and 10200 through 10219 are modified. Finally, the changes to the configuration memory have to be saved by entering an arbitrary value into register 10100.

Register	Description	Value Used in the Example
10100	Saving the configuration values	
10131	Version number	5
10132	IP address, MSB	192
10133	IP address, 3SB	128
10134	IP address, 2SB	10
10135	IP address LSB	97
10136	Subnet mask, MSB	255
10137	Subnet mask, 3SB	255
10138	Subnet mask, 2SB	255
10139	Subnet mask LSB	0
10140	Default Gateway, MSB	192
10141	Default Gateway, 3SB	128
10142	Default Gateway, 2SB	10
10143	Default Gateway LSB	1
10144	Port number of JetIP server	50000
10145	IP address of DNS server	0xC076D2D1 (192.118.210.209)
10159	Password	2002149714 (0x77566152)
10200	HostNameType	1
10201 through 10219	HostName (Format of a text variable)	JM-D203-JC24X

NOTICE!

Do not change the version number contained in register 10131.

12.8.3 IP address based on the address switch position

In all other address switch positions, the IP address is taken out of the configuration memory; the least significant byte is substituted by the position of the address switches.

The IP address of a -JC24X is made up according to the following pattern:

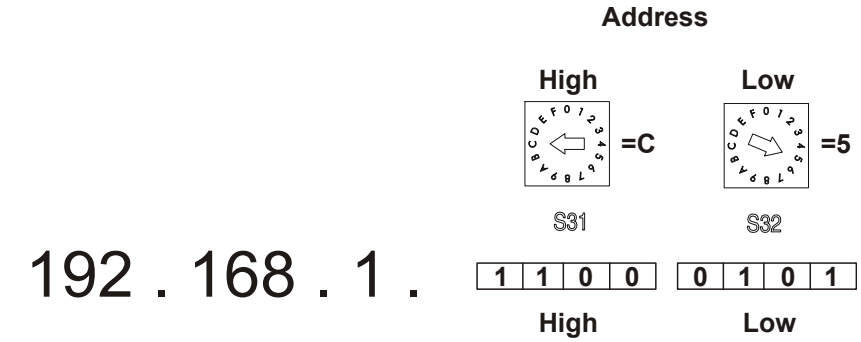


Fig. 33: IP address pattern

- The first three bytes (e.g. 192.168.1) are taken out of the configuration memory.
- The higher-order nibble of the fourth byte is set by means of the address switch "High" (value range: 0 through 15).
- The low-order nibble of the fourth byte is set by means of the address switch "Low" (value range: 0 through 15).

Example 1: Determining the IP Address Resulting from the Address Switch Positions

Then multiply the value of the address switch "High" by 16 and add it to the value of the address switch "Low".

(The hexadecimal value A corresponds to the decimal value 10, B = 11, C = 12, D = 13, E = 14, and F = 15

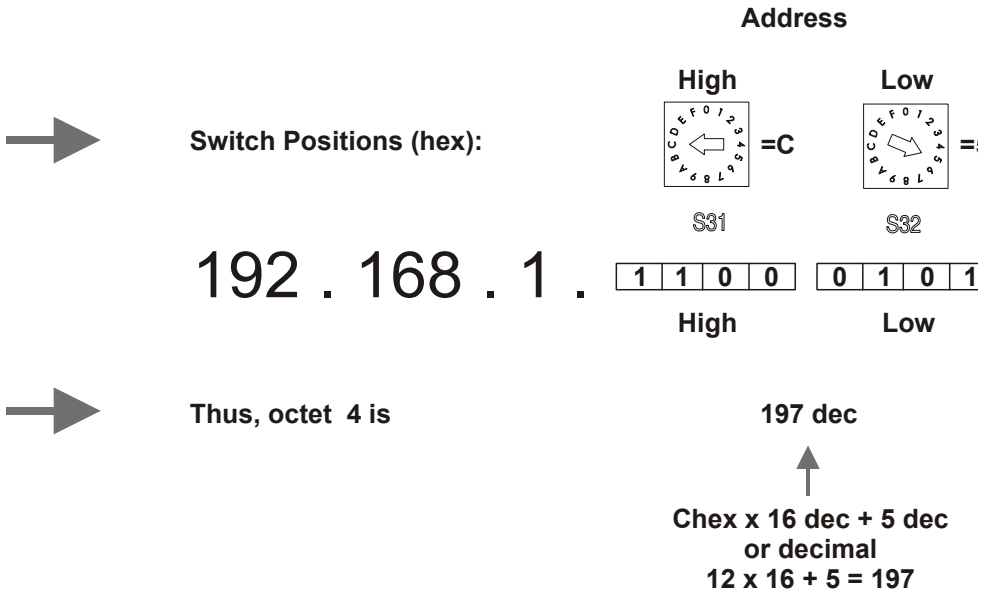


Fig. 34: Determining the IP address based on address switch positions

Example 2: Setting a Specific IP Address

The two last octets of the IP address **192.168.1.78** are to be converted into a hexadecimal value.

Decimal/Hexadecimal Conversion																
Dec	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hex	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Decimal numbers greater than 15 are converted according to the following example for the 4th octet:

78 : 16 = 4,... -> Turn address switch "High" to position 4

78 - (4 x 16) = 14

The decimal number 14 is converted according to the table above:

14 dec -> E hex -> The address switch "Low" has to be turned to position "E"

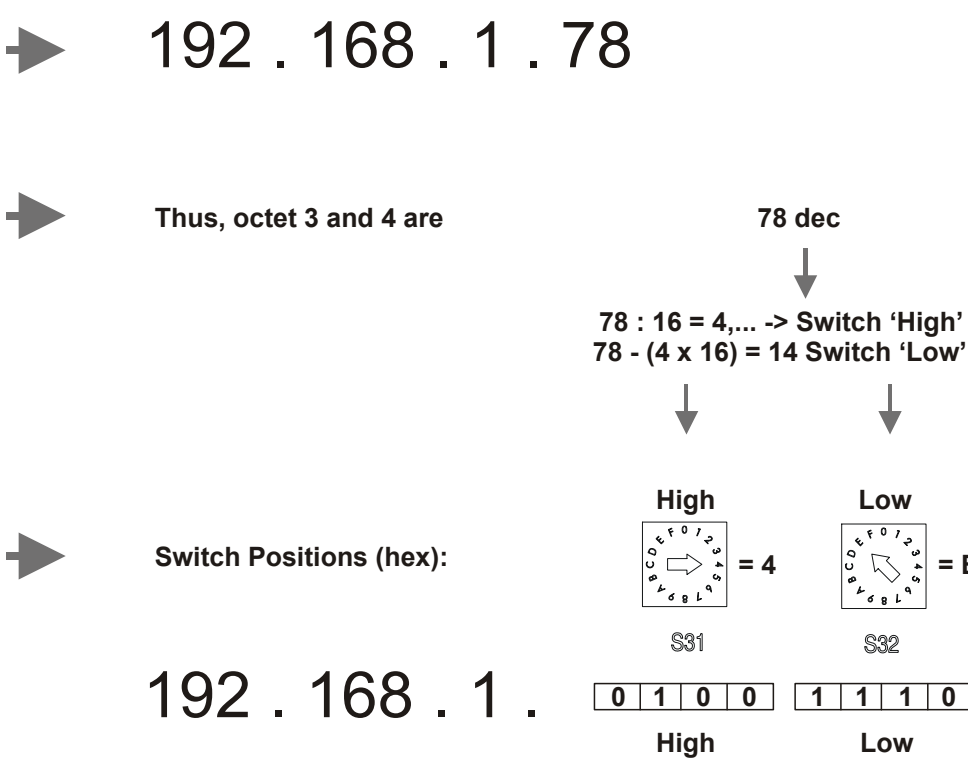


Fig. 35: Setting a specific IP address

To create the IP address, the address switch positions are read in once during the boot process.
The current address switch setting can be read from register 10180.

12.8.4 Setting the IP address via special function

During operation, the IP address of the integrated controller, on which the function is executed, can be changed by means of special function 122. When this function has been completed without errors, the new IP address can be read out of register 2931. However, the configuration file "/System/cfg_var.ini" or registers 10132 and 10135 are not affected by this function (the address switches for setting the address have not been switched neither), so that after the next reboot the settings defined here will be activated again.

SYSTEM FUNCTION 122	
Declaration	SYSTEMFUNCTION (122, InReg, OutReg)
Parameter	InReg: Number of the register containing the new IP address.
Return values	OutReg: Number of the register to which the result is stored. = 0: No error > 0: Error

NOTICE!

Since this function directly accesses the interface on a low level, it should only be activated during times when no network communication takes place. Failure to do so may result in data loss.

12.9 ON Delay

Register 2032: ON Delay	
Functioning Principle	**Description**
Read	Actual ON delay, resolution 100 ms
Write	New ON delay value
Value range	10 ... 600
Value following a reset	Latest set value

The switch-on delay function ensures that the -JC24X waits a defined time period before it initializes the system bus, and launches the application program. This delay time is set in steps of 100 ms in register 2032.

Example 3: On delay via register 2032

A value of 60 in register 2032 means that the -JC24X will wait 6 seconds before initializing the system bus.

INFO

- If modules connected to the system bus require a certain time until they get initialized, the ON delay via register 2032 provides the necessary delay time.
- If JX-SIO modules are connected to the system bus, we recommend to set register 2032 to the value of 60.
- A flashing RUN LED indicates that the delay time caused by switch-on delay is running. With advancing delay time the flashing intervals of the RUN-LED become shorter and shorter.

12.10 Interface Cables

12.10.1 Overview of interface cables

- Programming cable for JetControl:

Length 5 m:	Cable Conf. # 196 5M	Article # 60860013

- HMI cables JN-DK-Xm as a connection between -JC24X and the HMIs LCD 110, LCD 16, LCD 23, LCD 25, LCD 27, and LCD 34:

Length 2.5 m:	Cable Conf. # 192 2.5 m	Article # 60860011
Length 5 m:	Cable Conf. # 193 5 m	Article # 60860012

- HMI cables KAY_0386-xxxx as a connection between -JC24X and the HMI LCD 60:

Length 2.5 m:	KAY_0386-0250	Article # 60864359
Length 5 m:	KAY_0386-0500	Article # 60864360

- HMI cable adaptor KAY_0533-0025 for LCD 52, LCD 54 and LCD 54Z:

Length 25 cm:	KAY_0533-0025	Article # 60864897

- Jetter system bus connecting cable:

Length 0.2 m:	Cable Conf. # 530 0.2 m	Article # 10309001
Length 0.5 m:	Cable Conf. # 530 0.5 m	Article # 10309002
Length 1.0 m:	Cable Conf. # 530 1.0 m	Article # 10309003
Length 1.5 m:	Cable Conf. # 530 1.5 m	Article # 10309004
Length 2.0 m:	Cable Conf. # 530 2.0 m	Article # 10309006
Length 2.5 m:	Cable Conf. # 530 2.5 m	Article # 10309016
Length 3.0 m:	Cable Conf. # 530 3.0 m	Article # 10309015
Length 4.0 m:	Cable Conf. # 530 4.0 m	Article # 10309007
Length 5.0 m:	Cable Conf. # 530 5.0 m	Article # 10309008

12.10.2 Serial programming cable

Specification of Connectors

On the side of the integrated controller
- 8-pin MiniDIN connector (male)
  Type: KMDLA - 8P
  Manufacturer: KYCON
- Allowed conductor size: 0.128 ... 0.051 mm^2

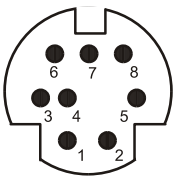
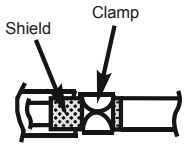
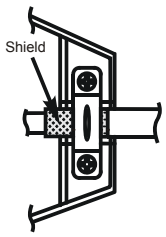
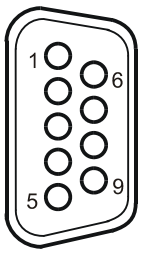
On the PC side
- 9-pin female SUB-D connector in metallized housing (quality grade 3).
- Allowed conductor size: 0.25 ... 0.128 mm^2

Connecting Cable Specifications

- Number of cores: 3
- Core cross-sectional area: 0.14 mm^2
- Cable length: 5 m (cable confection # 196 5m)
- Max. cable length: 15 m

Cable Shielding

- Complete shielding, no paired shielding
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area (shield twisted, clamped under the strain relief clamps, and wrapped with copper foil).

<table>
<tr><th colspan="4">Programming Cable</th></tr>
<tr><td>Controller</td><td colspan="2">Shield</td><td>PC</td></tr>
<tr><td rowspan="2">SER1, SER2
 
</td><td> 
</td><td> 
</td><td rowspan="2">COM 1, COM 2
 
</td></tr>
<tr><td colspan="2">Connect shield with the greatest possible surface area!
Use metallized housing only!</td></tr>
<tr><td>Pin</td><td colspan="2">Signal</td><td>Pin</td></tr>
<tr><td>8</td><td>TxD</td><td>RxD</td><td>2</td></tr>
<tr><td>4</td><td>RxD</td><td>TxD</td><td>3</td></tr>
<tr><td>2</td><td colspan="2">GND</td><td>5</td></tr>
<tr><td colspan="4">On the PC side (COM1, COM2), pins 7 and 8, as well as pins 1, 4 and 6 must be short-circuited.</td></tr>
</table>

12.10.3 HMI cable for LCD 16 - 34 and 110

Specification of Connectors

On the side of the integrated controller

- 8-pin MiniDIN connector (male)
  Type: KMDLA - 8P
  Manufacturer: KYCON
- Allowed conductor size: 0.128 ... 0.051 mm^2

On the HMI side

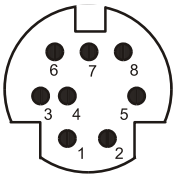
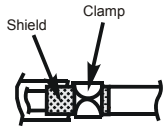
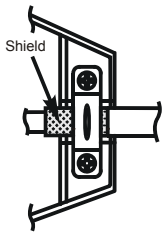
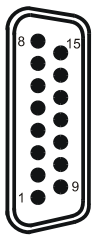
- 15-pin male SUB-D connector in metallized housing (quality grade 3).
- Allowed conductor size: 0.25 ... 0.128 mm^2

Connecting Cable Specifications

- Number of cores: 6
- Core cross-sectional area: 0.14 mm^2
- Cable length: 2.5 m (cable confection # 192 2,5m)
- Cable length: 5 m (cable confection # 192 5m)
- Max. cable length: 400 m

Cable Shielding

- Complete shielding, no paired shielding
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area (shield twisted, clamped under the strain relief clamps, and wrapped with copper foil).

HMI Cable for LCD 16 - 34, LCD 110			
Integrated Controller	**Shield**		**HMI**
SER2 			
	Connect shield with the greatest possible surface area! Use metallized housing only!		
Pin	**Signal**		**Pin**
6	DC +24 V		15
2	GND		12
5	SDB	RDB	6
7	SDA	RDA	7
3	RDB	SDB	4
1	RDA	SDA	5

INFO

It is recommended to buy the cables from Jetter AG.
A defective cable can lead to destruction of the JC-24X or of the HMI.

12.10.4 HMI cable KAY_0386-xxxx

Specification of Connector/Socket

On the side of the integrated controller

- 8-pin MiniDIN connector (male)
  Type: KMDLA - 8P
  Manufacturer: KYCON
- Allowed conductor size: 0.128 ... 0.051 mm^2

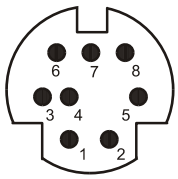
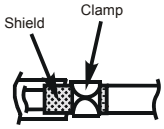
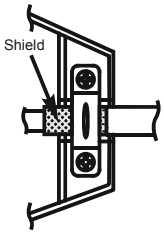
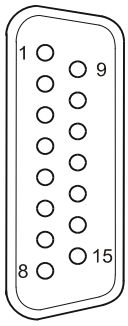
On the HMI side
- 15-pin female SUB-D connector in metallized housing (quality grade 3).
- Allowed conductor size: 0.25 ... 0.128 mm^2

Connecting Cable Specifications

- Number of cores: 5
- Core cross-sectional area: 0.14 mm^2
- Cable length: xxxx cm
- Max. cable length: 400 m

Cable Shielding

- Complete shielding, no paired shielding
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area (shield twisted, clamped under the strain relief clamps, and wrapped with copper foil).

<table>
<tr><th colspan="4">HMI Cable KAY_0386-xxxx</th></tr>
<tr><td>Integrated Controller</td><td colspan="2">Shield</td><td>LCD60</td></tr>
<tr><td rowspan="2">SER1, SER2
 
</td><td> 
</td><td> 
</td><td rowspan="2">COM 2
 
</td></tr>
<tr><td colspan="2">Connect shield with the greatest possible surface area!
Use metallized housing only!</td></tr>
<tr><td>Pin</td><td colspan="2">Signal</td><td>Pin</td></tr>
<tr><td>1</td><td>RDA</td><td>SDA</td><td>14</td></tr>
<tr><td>2</td><td>GND</td><td>GND</td><td>5</td></tr>
<tr><td>3</td><td>RDB</td><td>SDB</td><td>15</td></tr>
<tr><td>5</td><td>SDB</td><td>RDB</td><td>13</td></tr>
<tr><td>7</td><td>SDA</td><td>RDA</td><td>12</td></tr>
<tr><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">short-circuited</td><td>11</td></tr>
<tr><td>10</td></tr>
</table>

12.10.5 HMI cable KAY_0533-0025

The HMIs LCD 52, LCD 54, and LCD 54Z are equipped with a non-detachable cable connecting the LCD with the integrated controller. On the integrated controller side, this cable has a 15-pin male SUB-D connector. For connection of the HMI to the 8-pin MiniDIN female connector of the -JC 24x (interface SER2), a cable adapter will be needed.

Specification of Connector/Socket

On the side of the integrated controller

- 8-pin MiniDIN connector (male)
  Type: KMDLA - 8P
  Manufacturer: KYCON
- Allowed conductor size: 0.128 ... 0.051 mm^2

On the HMI side

- 15-pin female SUB-D connector in metallized housing (quality grade 3).
- Allowed conductor size: 0.25 ... 0.128 mm^2

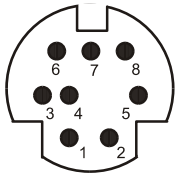
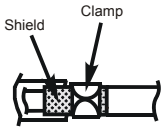
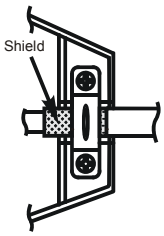
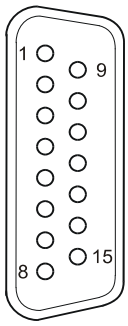
Connecting Cable Specifications

- Number of cores: 6
- Core cross-sectional area: 0.14 mm^2
- Cable length: 25 cm

Cable Shielding

- Complete shielding, no paired shielding
- The shield must be connected to the connector housings on both ends of the cable with the greatest possible surface area (shield twisted, clamped under the strain relief clamps, and wrapped with copper foil).

Cable Adapter for Connecting a LCD 52, LCD 54, and LCD 54Z

Integrated Controller	Shield		LCD Cable
			
	Connect shield with the greatest possible surface area! Use metallized housing only!		
Pin	**Signal**		**Pin**
6	DC +24 V		4
2	GND		7
5	SDB	RDB	10
7	SDA	RDA	11
3	RDB	SDB	12
1	RDA	SDA	13

INFO

It is recommended to buy the cable adapter from Jetter AG.
A defective cable can lead to destruction of the -JC24X or of the HMI.

12.11 Anybus-CC

The expansion by an Anybus-CC module makes easy communication with other bus systems possible. Only one Anybus-CC module at a time can be integrated into the JetMove D203-JC24X devices. There are various Anybus-CC modules for various bus systems.

12.11.1 Installation instructions

INFO

For mounting or dismounting, the module has to be de-energized.

12.11.2 Prying the break-away shield

In the delivered condition of the JetMove D203-JC24X, the optional Anybus-CC module has not been installed yet. For installing the module, the break-away shield has to be removed. Use a flat-headed screwdriver to pry the shield. Insert the screwdriver into the slot of the shield and move it forward and backward several times, until the shield breaks away.

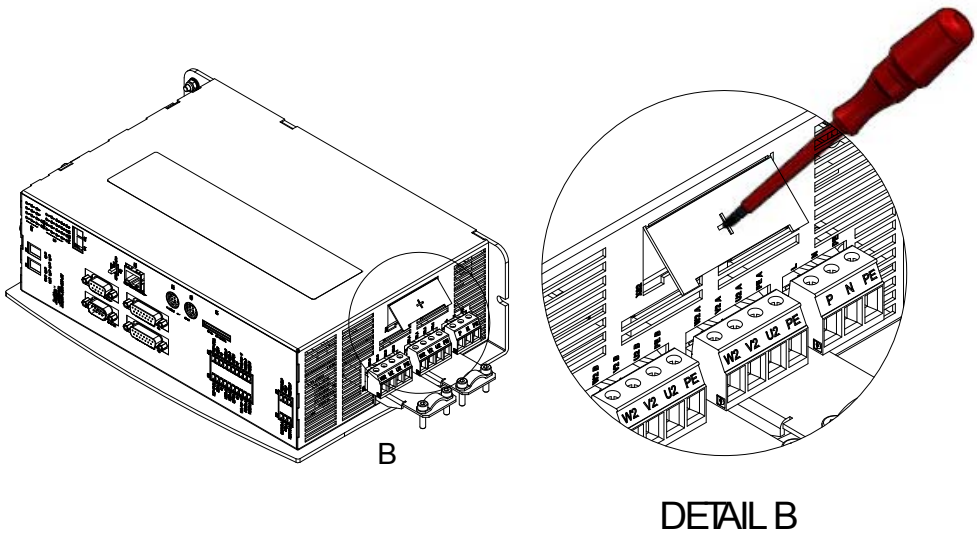
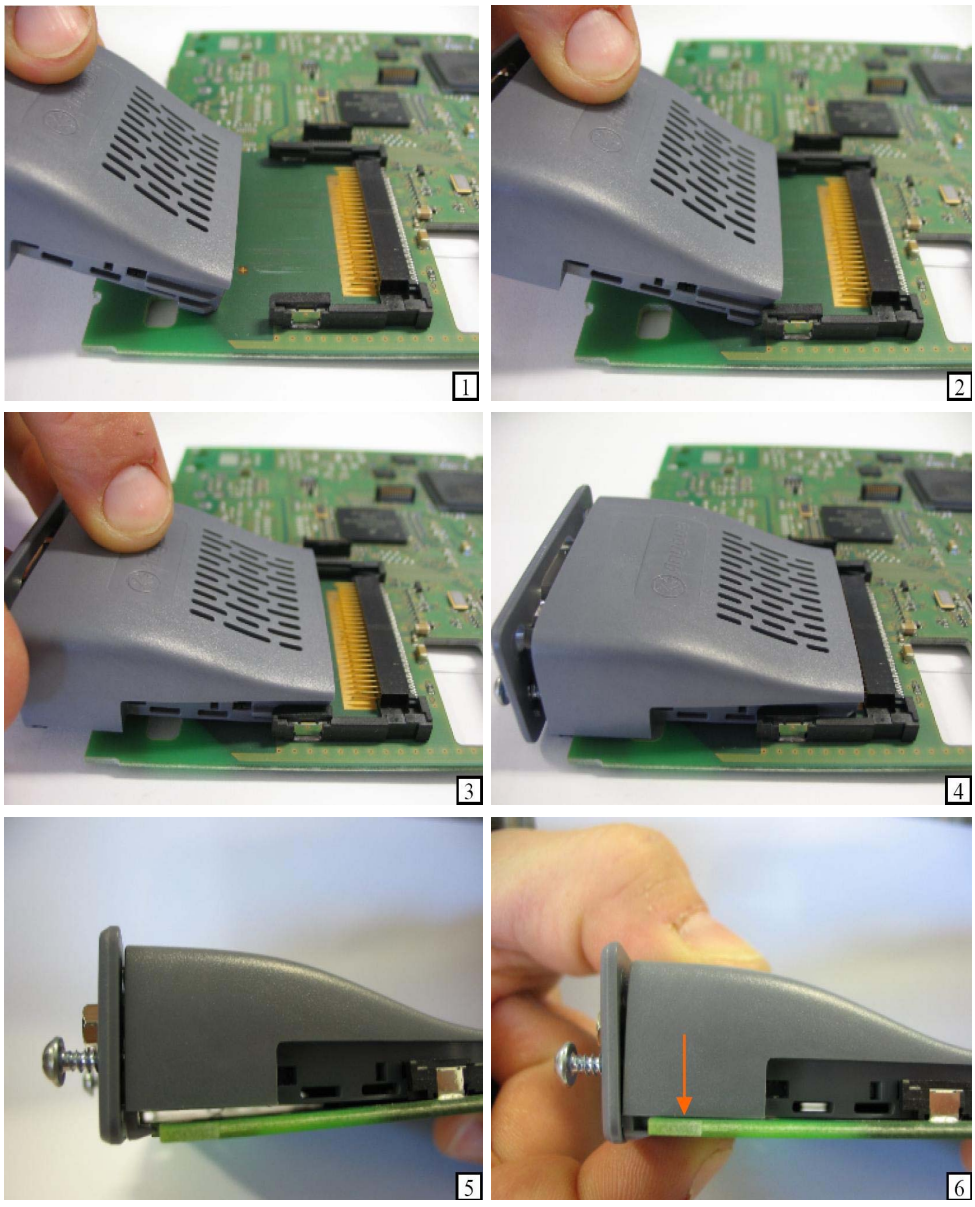


Fig. 36: Installing the Anybus-CC: Prying the break-away shield

12.11.3 Inserting the Anybus-CC module

Slide the fixing bolts into the Anybus-CC module before inserting it into the JM-D203 -JC24X. In order to correctly insert the module, it has to be pushed into the adapter (1-2, 8) in an obtuse angle (which is limited by the opening in the enclosure). If the module is positioned in the guideway of the adapter, pull it toward the board (3, 9). At the very end, press the module onto the board (5-6, 10-11) and push it into the adapter.
Fix the two torx screws (T8) of the module with a tightening torque of 0.25 Nm max.



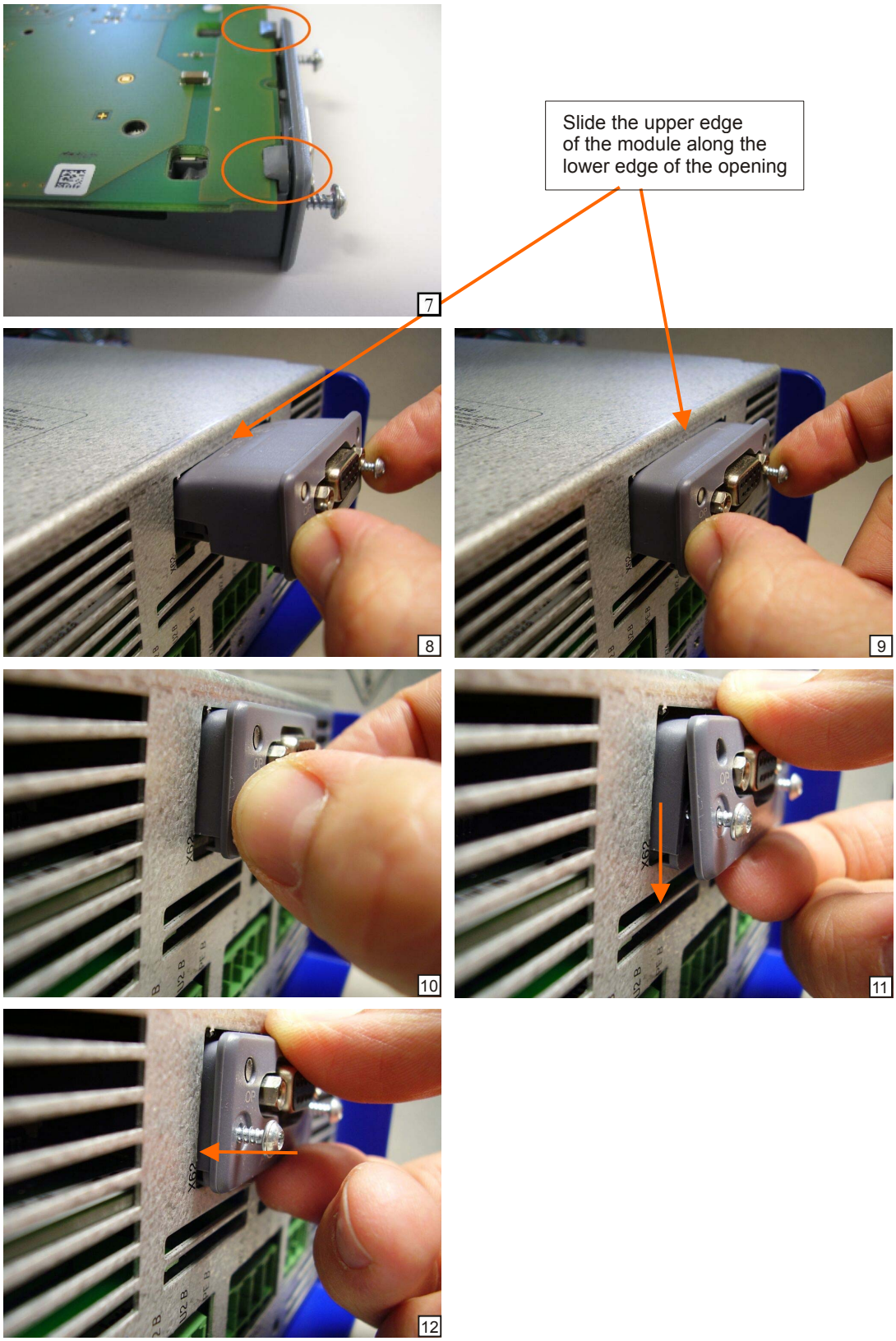


Fig. 37: Series of illustrations: Inserting the Anybus-CC module

To remove the module, loosen the screws and pull out the module.

13 Ordering Information

13.1 List of Documentation

The documents listed below are available for download from the website of Jetter AG at http://www.jetter.de.

Programming

jetmove_d203_jc24x_ba_xxxx_manual.pdf
User manual for the integrated controller -JC24X
Article #: 60870814

jetmove_2xx_at_jetcontrol_bi_xxxx_user_information.pdf
Register description and parametering example
Article #: 60868237

13.2 Options

Designation	Description	Article #
JM-D203-S1	– Dual-axis servo amplifier – Safe Torque Off	10000487
JM-D203-JC243-S1	– Dual-axis servo amplifier – With integrated controller, 3 intelligent modules (1 external module can be added) – Safe Torque Off	10000523
JM-D203-JC243-S1-W	– Dual-axis servo amplifier – With integrated controller, 3 intelligent modules (1 external module can be added) – Safe Torque Off – Web option	10000538
JM-D203-JC243-S1-EIP	– Dual-axis servo amplifier – With integrated controller, 3 intelligent modules (1 external modules can be added) – Safe Torque Off – Ethernet IP option	10000606

JM-D203-JC246-S1	– Dual-axis servo amplifier – With integrated controller, 6 intelligent modules (4 external modules can be added) – Safe Torque Off	10000539
JM-D203-JC246-S1-W	– Dual-axis servo amplifier – With integrated controller, 6 intelligent modules (4 external modules can be added) – Safe Torque Off – Web option	10000540
JM-D203	– Dual-axis servo amplifier	10000618
JM-D203-JC243	– Dual-axis servo amplifier – With integrated controller, 3 intelligent modules (1 external module can be added)	10000619
JM-D203-JC243-W	– Dual-axis servo amplifier – With integrated controller, 3 intelligent modules (1 external module can be added) – Web option	10000621
JM-D203-JC243-EIP	– Dual-axis servo amplifier – With integrated controller, 3 intelligent modules (1 external module can be added) – Ethernet-IP option	10000620
JM-D203-JC246	– Dual-axis servo amplifier – With integrated controller, 6 intelligent modules (4 external modules can be added)	10000622
JM-D203-JC243-W	– Dual-axis servo amplifier – With integrated controller, 6 intelligent modules (4 external modules can be added) – Web option	10000623
JM-D203-JC243-EIP	– Dual-axis servo amplifier – With integrated controller, 6 intelligent modules (4 external modules can be added) – Ethernet-IP option	10000624
SD-CARD 128 MB	SD card as a memory extension for the option JC24X	60869385
 Anybus CC Profibus DPV1	Anybus CC Profibus DPV1 slave for installation at a later time into option -JC24x	60869400

13.3 Motor Power Cable with Mating Connector SC

Connecting cables for Jetter motors without brake:

Length 2.5 m:	Cable Conf. # 26.1 2.5 m	Article # 60335300
Length 5 m:	Cable Conf. # 26.1 5 m	Article # 60336300
Length 7.5 m	Cable Conf. # 26.1 7.5 m	Article # 60854700
Length 10 m	Cable Conf. # 26.1 10 m	Article # 60334300
Length 15 m	Cable Conf. # 26.1 15 m	Article # 60334900
Length 20 m	Cable Conf. # 26.1 20 m	Article # 60335400
Length 30 m	Cable Conf. # 26.1 30 m	Article # 15000057
Length 35 m	Cable Conf. # 26.1 35 m	Article # 60335900
Length 40 m	Cable Conf. # 26.1 40 m	Article # 60336100
Length 45 m	Cable Conf. # 26.1 45 m	Article # 15000062
Length 50 m	Cable Conf. # 26.1 50 m	Article # 60867722

Cables of other lengths can partially be obtained ex warehouse.

Connecting cables for Jetter motors with brake:

Length 2.5 m:	Cable Conf. # 24.1 2.5 m	Article # 60333100
Length 5 m:	Cable Conf. # 24.1 5 m	Article # 60333600
Length 7.5 m	Cable Conf. # 24.1 7.5 m	Article # 60333800
Length 10 m	Cable Conf. # 24.1 10 m	Article # 60332700
Length 15 m	Cable Conf. # 24.1 15 m	Article # 60332900
Length 20 m	Cable Conf. # 24.1 20 m	Article # 60854280
Length 30 m	Cable Conf. # 24.1 30 m	Article # 60333300
Length 50 m	Cable Conf. # 24.1 50 m	Article # 60867723

Cables of other lengths can partially be obtained ex warehouse.

13.4 Resolver Cable

The resolver cable of the designation KAY_0823-xxxx can be ordered in the following standard lengths in meters:

1	1.2	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5
7	7.5	8	9	10	11	12	13	14	15	16	17	18
20	22	24	25	30	50							

The order number xxxx designates the length in cm.
Example: A resolver cable of 5 meters length has got the designation KAY_0823_0500.

13.5 HIPERFACE Cable

The HIPERFACE cable of the designation KAY_0923-xxxx can be ordered in the following standard lengths in meters:

1	1.2	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5
7	7.5	8	9	10	11	12	13	14	15	16	17	18
20	22	24	25	30	50							

The order number xxxx designates the length in cm.
Example: A HIPERFACE cable of 5 meters length has got the designation KAY_0923_0500.

13.6 System Bus Cables

Jetter system bus connecting cable:

Length 0.2 m:	Cable Conf. # 530 0.2 m	Article # 10309001
Length 0.5 m:	Cable Conf. # 530 0.5 m	Article # 10309002
Length 1.0 m	Cable Conf. # 530 1.0 m	Article # 10309003
Length 1.5 m	Cable Conf. # 530 1.5 m	Article # 10309004
Length 2.0 m	Cable Conf. # 530 2.0 m	Article # 10309006
Length 2.5 m	Cable Conf. # 530 2.5 m	Article # 10309016
Length 3.0 m	Cable Conf. # 530 3.0 m	Article # 10309015
Length 4.0 m	Cable Conf. # 530 4.0 m	Article # 10309007
Length 5.0 m	Cable Conf. # 530 5.0 m	Article # 10309008

Other lengths can be obtained on request.

Appendices

Appendix A:Recent Revisions

Recent Revisions Made in Edition 2.10.1:

Chapter	Comment	Revised	Added	Deleted
Front page	Most recent JetMove picture	✓		
Introduction	System Requirements		✓	
5.1	Supply cable, motor cable, encoder	✓		
12.11	Anybus-CC module		✓	

Recent Revisions Made in Edition 2.10.3:

Chapter	Comment	Revised	Added	Deleted
Front page	New formatting	✓		
1.1.2	JetMove is not a safety-related part		✓	
1.1.3	Qualified staff	✓		
2.1	Installation accessories	✓		
5.1	Filter designations	✓		
11	Safe Torque Off	✓		
12.1	Interface cable/cables	✓		
13.1	List of documentation	✓		
Appendix D	Index	✓		
	Addresses	✓		

Appendix B: Glossary

AC	**A**lternating **C**urrent
CE	**C**ommunautés **E**uropéennes European Union
DC	**D**irect **C**urrent
DIN	**D**eutsches **I**nstitut für **N**ormung e.V. = German Industry Standard
DSP	**D**igital **S**ignal **P**rocessor
EU	**E**uropean **U**nion
EC Low Voltage Directive	To be considered when using electric devices of a rated voltage between 50 and 1.000 V AC and between 75 and 1.500 V DC.
Electro-Magnetic Compatibility (EMC)	Definition according to the EMC regulations: "EMC is the ability of a device to function in a satisfactory way in an electro-magnetic environment without causing electromagnetic disturbances itself, which would be unbearable for other devices in this environment."
EN	**E**uropäische **N**orm, that is: European Standard
ESD	**E**lectro **S**tatic **D**ischarge
Hazard analysis	Extract from the Machinery Directive 98/37/EC: The manufacturer is under an obligation to assess the hazards in order to identify all of those which apply to his machine; he must then design and construct it taking account of his assessment.
Hardware enable	Before the axis can be started up by software enable, hardware or pulse enable has to be active. This means that a high signal (24 V) has to be connected to the enable input or inputs (restart lockout).
HIPERFACE	**Hi**gh **Per**formance Inter**face** HIPERFACE designates a sensor-transducer system by Sick / Stegmann. The SinCos motor feedback system with the standardized HIPERFACE interface is often used in digital drive technology. Unlike the resolver, the SinCos motor feedback system with HIPERFACE interface contains electronic components. Over several motor rotations, a HIPERFACE will report the absolute position values; this cannot be performed by a resolver. A HIPERFACE is far more precise than a resolver, but also more expensive.
IEC	**I**nternational **E**lectrotechnical **C**ommission
IGBT	**I**nsulated **G**ate **B**ipolar **T**ransistor
IP	**I**nternational **P**rotection

JetMove	JetMove is the name of a series of digital servo amplifiers produced by Jetter AG. For example, JetMove D203, where – D stands for "Dual", in the sense of controlling two motors – 203 identifies a rated current of 3 A
Jetter system bus	The Jetter system bus is a system-bus system of a cable length of 200 m max. , and of fast data transmission rates of 1 Mbit/s. In addition to this, the Jetter system bus is highly immune to interferences. Therefore, the Jetter system bus is suited to realise field bus applications in a limited space.
JetWeb	Control technology comprising control systems, motion systems, HMIs, visualization devices, remote I/Os and industrial PCs. Programming by means of multitasking and a modern sequence-oriented language. Communication by means of Ethernet TCP/IP and making use of the Web technologies.
Motor circuit-breaker	A circuit-breaker with monitoring functions of phases and temperature of a motor.
NN	**N**ormal **N**ull = Sea Level
PE	**P**rotective **E**arth , respectively "Protective Earth Conductor"
PCB	Printed circuit board
Resolver	Feedback unit at a servo motor for determining the absolute position within one revolution. Other than a HIPERFACE, the resolver will not provide any information on how many revolutions the motor has performed so far. A resolver could be envisaged as a transformer; the couplings of its secondary windings (sine and cosine) change in relation to the position of the motor shaft. Basically, a resolver consists of a rotor with one coil and a stator with two coils. The stator windings are displaced by 90° (sine and cosine). The resolver itself does not contain any electronic components.
SELV	Safe Extra Low Voltage: Voltage, which, under all operating conditions will not exceed a peak or DC voltage of 42.4 V. This voltage is either measured between two conductors or between one conductor and earth. The circuit, in which this voltage occurs, must be separated from the mains power supply by a safety isolating transformer or some equivalent.
Software Enable	A superordinated controller issues a software command to enable an axis, which causes the motor to be energized. Hardware enable (restart lockage) has to be there before giving the software enable.
SUB-D	Type name of a plug-in connector
t_r/t_h	**t**ime **r**ise / **t**ime **h**old: "rise time of a pulse / total hold time of a pulse"

t_r/t_n	**t**ime **r**ise/**t**ime **n**ormal:"rise time of a pulse/total duration of a pulse" "rise time of a pulse / total duration of a pulse"
TN network	Supply network which is solidly earthed in the neutral point and which is equipped with a protective earth conductor.
TT network	Supply network which is solidly earthed in the neutral point, yet, which is not equipped with a protective earth conductor. Earthing is carried out by means of a local protective earth.
UL	**U**nderwriters **L**aboratories Inc.
VDE	**V**erband **d**er **E**lektrotechnik e.V. = Association of Electrical Engineering
DC link voltage	DC circuit within a servo drive on the basis of which the motor currents are generated.
ϑ_{NAT}	Transition temperature, at which the thermal sensor changes by several K within a range of +/- 5 K.Ω .

Units:

A	Ampere
mA	Milliampere (1 mA = 10^{-3} A)
dB	Dezibel
g	gram
h	Hour
Hz	Hertz
K	Kelvin
m	Meter
cm	Centimeter (1 cm = 10^{-2} m)
mm	Millimeter (1 mm = 10^{-3} m)
s	Second
V	Volt
µV	Microvolt (1 µV = 10^{-6} V)
W	Watt
Ω	Ohm
°C	degrees centigrade (temperature unit)
°	Degrees (angular dimension)
Ws, J	Watt seconds, Joule

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