Manual for

DMA-2

Digital Module Amplifier for Proportional and Servo Valves (version without feedback)

In operation mode 01 and 02

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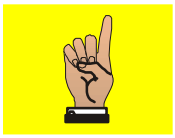
0.1 Copyright



The information in this document is subject to change without notice.

HCS assumes no responsibility for any faults that may appear in this manual.

The general instructions and safety instructions of this manual have to be observed in any case!

0.2 Introduction

The digital amplifier module DMA-2 features leading edge technology. This electronic device meets the industrial standards for EMC. This ensures a high interference security and low interference emission.

The performance characteristics are possible through the use of the most current microprocessor technology. In additional to all control functions, the microprocessor handles closed-loop control. The system features are essentially determined by the software and provide reserve capacity for further developments and adaptations.
The following features distinguish the DMA-2 series:

- Fully digitized amplifier module with the advantage of
  - no on-board potentiometer
  - no jumpers settings required
  - digital setting and display of all parameters by means of PC
  - user safety when programming
- flexible and reliable system:
  - use of a modern 16 Bit µC
  - high power reserve
  - high reliability and safety through the use of a hardware watch-dog and reset module
  - variable settings for magnetic systems making high flexibility possible
- functional use of the interface:
  - change of selected parameters “on-the-fly” without interference or interruptions of the working cycle
  - analyzation of system performance through selection of display parameters with the PC
  - a monitoring program allows direct access to the module with the use of external system controllers (e.g. programmable logic controllers / PLC)

0.3 General Applications

The amplifier module DMA-2 is used for (only without electrical feedback transducers)

- proportional directional valves direct and pilot operated
- proportional flow control valves
- proportional pressure reducing valves
- proportional pressure regulating valves
- cartridge valves
- servo valves with torque motors

For versions for closed loop applications please contact your distributor or HCS GmbH for further information.

1. Safety

1.1 Safety first!

1.1.1 Signs and symbols

Please carefully observe and follow all safety and other instructions in this manual in every situation.

Text under this title indicates risk for life and limb if the instructions are not carefully observed.

Text under this title indicates risk for possible damage of the unit or other capital asset if the instructions are not carefully observed.

TIP

Text under this title contains tips and helpful information for easier use and handling.

We recommend reading this manual carefully before working with the amplifier cards.

1.1.2 Correct product use

The DMA-2 amplifier modules are used for the following:

- Controlling and of proportional and servo valves (pressure, directional control and flow valves); only without feedback.
- To convert set point signals into a current signal to control the proportional solenoids in the aforementioned valves.

The operation of other inductive or resistive loads is not recommended (motors, heaters, etc.). If you are considering any applications like this please contact HCS GmbH.

If used correctly, the safety of the user as well as the safe and proper function of the amplifier module is guaranteed.

1.1.3 Warnings

The amplifier module should not be used in the following cases:

- if noticeably damaged
- when the electrical connections are damaged
- if they do not function correctly
- after incorrect handling or storage

In these cases, the amplifier module must be disabled and secured against accidental restarting.

In the case of applications with critical safety requirements or where accident prevention regulations must be observed, it may be necessary to isolate the components from the solenoids with relays in e-stop circuits. To switch off the enable signal (0 V at terminal X3/1) is insufficient. In these cases, hydraulic and/or mechanical safety measures to stop the drive must be provided (e.g. through switching valves with position monitoring).

If the solenoids must be switched off, the following sequence is recommended:

- All set points should preferably be set to 0. A similar coil to the one on the valves must be switched into the electric circuit in place of the solenoids. This prevents amplifier faults through open inputs and outputs.
- Disable the amplifier during the switching process (enable = 0).

During commissioning, particular attention must be paid to the correct design and realisation of the wiring. This must be checked before applying the supply voltage.

To avoid collisions, the safety devices and limit switches must be activated. All the safety regulations are to be observed.

Monitoring the fault signal (terminal X3/2) is recommended.

Malfunctions can occur with the following:

- Changes to the settings made by the supplier.
- Neglecting of operating parameters (e.g. supply voltage, application of inadmissible signals on inputs or outputs, ambient conditions, wiring, unsafe loads such as motors, contactors, relays, ohm loads, etc.)
- Faults in series-connected controls components and set points or actual values
- Faults in the subsequent hydraulic components
- Removing of solenoids connections.

1.2 General

Please pay attention to our general terms and conditions (available on request)!

1.2.1 Inquiries and ordering

To order the product, the complete order code is requested (order code see section 2.5).
Please forward orders and enquiries to the following listed companies. They are our official distributors/partners. We reserve the right to forward any direct inquiries or orders to our distributors/partners. Nevertheless we will be available for any necessary technical support.

Germany and other countries without distributor/partner:

HCS HYDRAULIC CONTROL SYSTEMS GMBH
Neuffener Str. 29
D-72636 Frickenhausen
Tel: (+49) 7025 – 911 007
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Email: info@h-c-s-gmbh.de
Homepage: www.h-c-s-gmbh.de

Our distributors and partners

SWITZERLAND AND AUSTRIA

GRIBI AG
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www.gribiag.ch

NORWAY

SERVI MOTION CONTROL AS
Haugenveien 2
N-1402 Ski
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Email: nils.harald.flaa@servi.no
www.servi.no

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Email: carlbom@terling.se
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Fax: (001) 734 - 326 6669
Email: sales@ncservo.com
www.ncservo.com

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Fax: (+44) 1527 - 516 777
Email: rgores@hydrafab.com
www.hydrafab.com

1.2.2 Service and repair

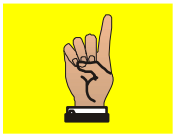
Do not attempt to repair the product yourself. After repair, certain adjustments and test procedures must be performed; this can only be made by qualified and authorised personnel. Products that need repair can be sent to the addresses listed in 1.2.1.

Please enclose a detailed description of the error, malfunction or failure with the sent item and state the serial number and the purchase date. This will speed up the process and guarantees a fast and reliable repair.

In the case of a fault or a malfunction, your distributor can give you instructions on the phone or in writing before accepting a repair order. For service and repair, we offer experienced and qualified personnel. In case you need our assistance, please contact the address listed in section 1.2.1.

1.2.3 Cleaning, storage, transport

The product should only be transported and stored in the original packaging to ensure suitable protection against mechanical damage as well as electrostatic discharge.
If it should be necessary to clean the amplifier, we recommend sending it back to the manufacturer (see addresses in section 1.2.1).



Unpacking and handling should be left to suitably trained personnel. Beware of damaging the module by electrostatic.

1.2.4 Delivery state (default setting)

The product is shipped in a ready-to-use state (default settings). After correct installation and setting of all parameters relevant for the application, the amplifier card is ready for use.

2. Overview and description

2.1 Technical features

The system features of the DMA-2 are the following:

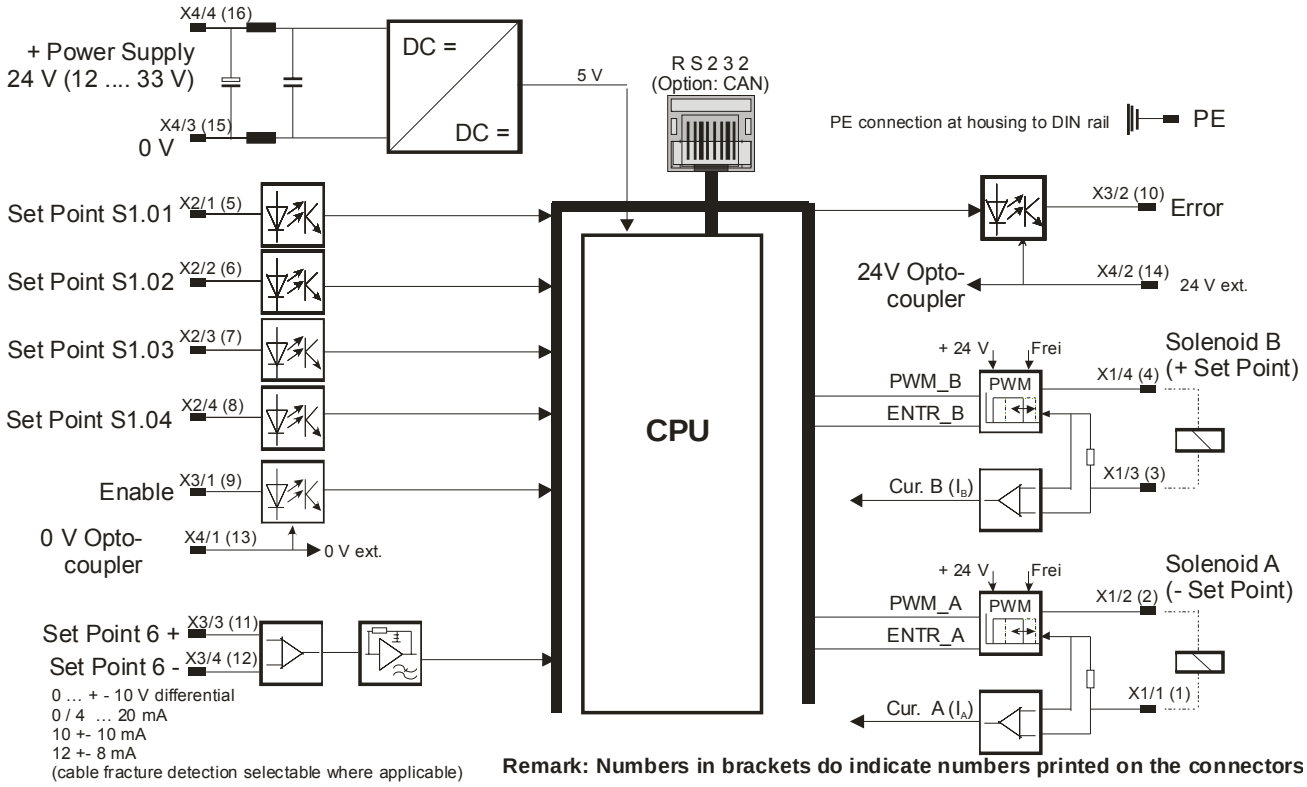
- Analogue input for set point (command signal) selectable by parameter. Possible input signal range:
  - 0 ± 10V (differential input) or single ended set point input for current signals:
  - 0 ... 20 mA or 10 mA ± 10 mA or 4 ... 20 mA or 12 mA ± 8 mA
    selection of cable fracture detection for current input and selection of set point type by means of parameter E15 (E15 and E16 for DMA-22-0**2**). Resolution of analogue input: 12 bit
- 4 recallable digital adjustable set points for 0 …. ± 10 V (2 digital inputs for DMA-22-0**2**).
- Enable signal for output stages.
- Status outputs "error".
- All digital I/O are optically isolated for functional security.
- Function indication through front panel by LEDs.
- Serial interface RS232 with RJ45 connector.
- CAN-Interface or other BUS-Interfaces on request.

The correct connection is shown in the connection diagrams (see section 2.7).

Technical data

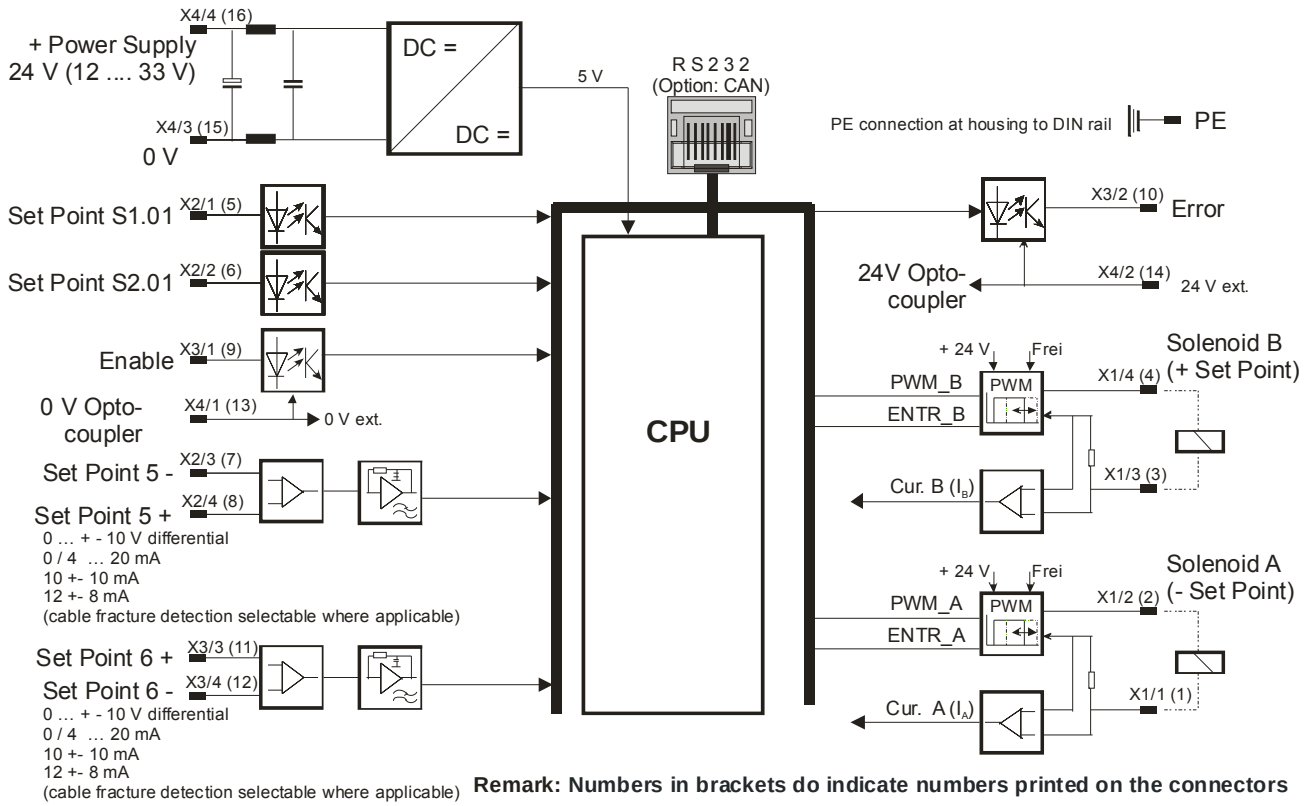
Parameters	Range, characteristics
Supply voltage	DC 24 (12 … 33 V), residual ripple < 10%
Solenoid systems selection	0.8 A / 1.1A / 1.3 A / 1.6 A / 2.4 A / 2.7 A / 3.5 A others on request
Power input	Max. 50 VA
Applicable fuse (quick)	3.15 A
Control voltage for digital inputs	U_{in} > 10 = high (1), U_{in} < 2V = low (0), U_{in} = 2 V …. 10 = not defined, I_{in} @ 24 V < 2,4 mA; Rin = approx. 10 kOhm
Ambient temperature	0 °C … 50 °C(other range on request)
Storage temperature	- 20 °C … 85 ° C
Connection	16 terminals Phoenix Contact type MSTBT 2,5/4-ST BU
EMC	
EMC Immunity / EMC Emissions	EN 61000-6-2: 2001 / EN 50011: 1998
Housing	
Dimensions Material Mounting	22.5 x 100 x 114 mm (w x h x d) PA66-FR in accordance with UL94V0, housing with ventilation for DIN rail mounting in accordance with EN 50022 with integrated PE-connection
Input signals	
Analogue set values	DMA-22-0**1**: 1 input, 12 Bit resolution, differential, 0 … ± 10 V or single ended 0 or 4…20 mA, 10 ± 10 mA, 12 mA ± 8 mA @ 250 Ohm (cable fracture detection selectable where applicable). For DMA-22-0**2**: 2 inputs, 12 Bit resolution, differential, 0 … ± 10 V or single ended 0 or 4…20 mA, 10 ± 10 mA, 12 mA ± 8 mA @ 250 Ohm (cable fracture detection selectable where applicable).
Digital inputs	DMA-22-0**1**: 5 inputs (S1.01, S1.02, S1.03, S1.04, ENABLE) DMA-22-0**2**: 3 inputs (S1.01, S2.01, ENABLE)
Output signals	
Solenoid current	2 output stages for up to 3.5 A; with over-energization and quick de-energization
Digital outputs	1 output (Error), U_{out} @ 10 mA load = U_{Supply} – 6 V
Interface	RS232 with 8-pole RJ45 jack at front of module (Bus options on request)
Operation	By means of RS232 and PC; status LED's: PW (Power), EN (Enable), ER (Error)
Frequencies and cycle times	
PWM Frequency / Cycle time	24 kHz / current controller ca. 0.1 msec

2.3 Hardware-Block Diagrams (for version DMA-22-01-xxxx-S0)



Remark: Numbers in brackets do indicate numbers printed on the connectors

2.3 Hardware-Block Diagram (for version DMA-22-02-xxxx-S0)



Remark: Numbers in brackets do indicate numbers printed on the connectors

2.4 Connection

2.4.1 Exclusion of liability

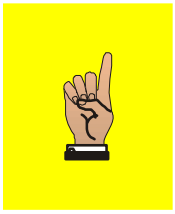
This operating manual represents the knowledge of HCS and during the drafting of this operating manual the greatest possible care was taken. Nevertheless, HCS disclaims any responsibility and liability claims for individual applications of the user. This is particularly true in cases of non-compliance, omissions, faults, misinterpretations and misunderstandings.

2.4.2 General recommendations

The supply voltage for the unit at terminals X4/3 = 0 V and X4/4 = +UB is 18 V to 33V DC, residual ripple <10%.

Output stages are electronically protected against short circuit. The amplifier modules should be protected with a quick-acting preliminary fuse. The solenoids are connected at terminals X1/1 and X1/2 for solenoid A; terminals X1/3 and X1/4 for solenoid B.

If no electrical isolation of the logic inputs or outputs is required, terminal X4/4 may be bridged to terminal X4/2 for 24 V and terminal X4/3 with X4/1 for 0 V.



The assembly contains electronic components. Incorrect handling or operation can lead to damage through electrostatic discharge (ESD). Only trained personnel should work with the unit. All safety instructions must be observed. Damage may result if the module is disconnected while the power supply is still on. Avoid such actions at all cost. The information in this document is subject to change without notice.

2.4.3 EMC

Devices of the DMA-2 series are class “A” equipment and therefore only suitable for industrial surroundings.

The distance between a source of interference (device emitting interference) and an interference sink (a device under the influence of interference) is very important. The greater the distance between the source of interference and the sink, the smaller the effects on the equipment will be. In other words, the closer a device is placed to the source of interference, the greater the interference amplitudes. For this reason, a minimum gap of 0.25 m should be kept between the amplifiers and strong sources of interference.

The following devices are to be regarded as strong sources of interference:

- Switching power supply units
- Frequency converters
- Digital drive modules
- Mains filters with wiring (even if shielded)
- AC/DC commutator motors
- Motor cables (even if shielded)
- Switched inductances, even if anti-interference measures have been taken (solenoid valves, contactors, relays, etc.)

One of the most common input points for interference is wiring. If interfering cables are laid at least 0.25 m away from cables susceptible to interference, the influence on each other can be minimised. Parts of the amplifier wiring may be susceptible to interference (analog set point and actual value, solenoid cables). If these cables are laid parallel over a distance longer more 10 m, the necessary distance between them must be increased. Cables susceptible to interference should never be laid parallel to motor cables. The influence is the least when the cables cross particularly at an angle of 90°.

However, interference can also arise from cables in the amplifier wiring system, in particular solenoid cables.
Examples of devices which are particularly susceptible to interference:

- Office PC’s
- Sensors with small output voltages / currents
- Capacity proximity switches
- Audio equipment (television, hi-fi, radio, etc.)
- Devices which do not meet the EMC guidelines

2.4.4 Specific recommendations for wiring and control cabinets

The following rules and tips are by no means to be complete. Since various electronic components are used in a variety of different ambient conditions, these guidelines only represent a compromise. The actual design of the wiring also depends on the interference emission and interference sensitivity of each individual component.

- Use shielded and twisted-pair cables for the solenoid connections. The shield must be grounded (PE Protective Earth) at both ends. The capacity should be ca. 120 pF/m. If the cables are up 100 m long, their cross-section has to be 1.5 mm^2 and 2.5 mm^2 for cables longer than 100 m.
- Shields of digital signal lines are to be connected at both ends to a PE, a good conductivity of the connection should be provided.
- Set point and actual value connections should have shielded and twisted-pair cables. The analog signal line shields are to be connected, with low impedance, at both ends to PE
- In environments with high interference, use double shielded cables for set point and actual value connections. The inner shield is only grounded at one end, the outer at both ends.
- In the event of low-frequency interference on the analog signal lines (measured value fluctuations), the shield should be connected at one end. Preferably, use a corresponding compensation of potential (see also the following point).
- Analog GND (terminal 26z) is the reference point for set point and actual value signals. All set point and actual value transmitters are to be connected to this terminal to avoid offsets and incorrect measurements.
- Use only cables with a Cu shielding grid and a covering of > 85 %. Avoid screening films. Metal foils must be avoided.
- The shield should not be interrupted along the entire length of the cable. If contactors, safety switches, chokes, etc. have to be used in the wiring, the installation of a metallic housing with a high HF shield may be necessary.
- Shield terminals are to be connected over a large area to the shield rail to function well.
- The shield rail must be installed close to the cable duct in the control cabinet.
- The metallic parts of the electrical cabinet are to be connected with low impedance on large areas. Make the desired connection with mechanical aids such as scratch plates if necessary. Connect the doors of the cabinet with the shortest possible homogeneous tapes (multiple).
- Solenoid valves, contactors, relays, brakes, etc. must be suppressed directly at the interference source. Suitable suppression devices are, for example, RC networks, diodes or varistors.
- Analog and digital signal lines should preferably enter the control cabinet from only one side.
- Non-shielded lines of an electric circuit must be twisted.
- Auxiliary wires are to be grounded at both ends.
- Avoid unnecessarily long lines. This keeps the coupling impedance low.
- Wiring should preferably not be freely hanging in the cabinet. Lay cables, including auxiliary cables, as close as possible to mounting plates and cabinet housing.
- In the case of a potential difference between the shield connections, a compensation conductor of $\langle 10\ mm^2$ should be laid parallel to the shield to reduce the transient current. A multiple connection of the shield to the cabinet casing and thus PE is generally possible. Also, a multiple connection of the shield outside the cabinet is possible.
- If filters are installed, place them close to the source of interference and keep a good surface contact to the cabinet or mounting plate.
- If converters are used, converter filters must be provided. Variable speed motors may have to be connected using shielded lines. All further instructions of the converter manufacturer have to be observed.

The following two pages show illustrations of:

- The most important types of interference and their remedies
- Construction of EMC suitable electric cabinets and systems

The diagrams have been provided by our competent partners for all questions regarding EMC:

NKL GmbH
Birckichstr. 15
D-74549 Wolpertshausen
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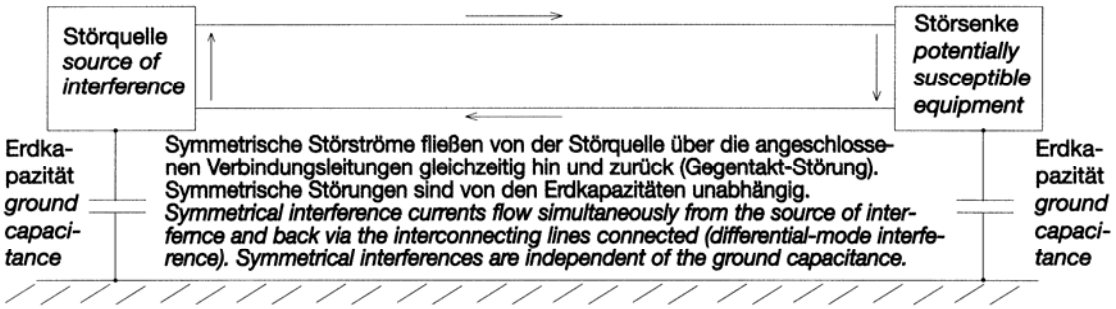
Fax.: (+49) 7971 - 968150

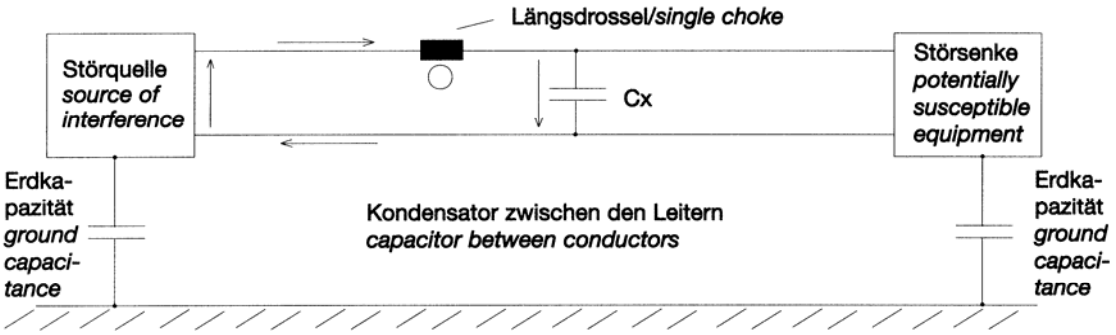
Die wichtigsten Arten von Störungen und Abhilfen:
The most important types of interference and remedies:

Symmetrische Störungen:
Symmetrical interference:



Typische Störquellen, die symmetrische Störungen erzeugen, sind:
Typical sources of symmetrical interferences:

Alle Arten von Gleichrichtern, Thyristor-Steuerungen wie z. B. Phasenanschnitt-Steuerungen, Halbleiter-Relais etc.
Symmetrische Störungen treten in der Praxis hauptsächlich leitungsgebunden im unteren Frequenzbereich bis ca. 1 MHz auf.
All types of rectifiers, thyristor controls such as e. g. generalized phase controls, semiconductor relays, etc.
In practice, symmetrical interfernces occur mainly as conducted interference in the lower frequency range up to about 1 MHz.



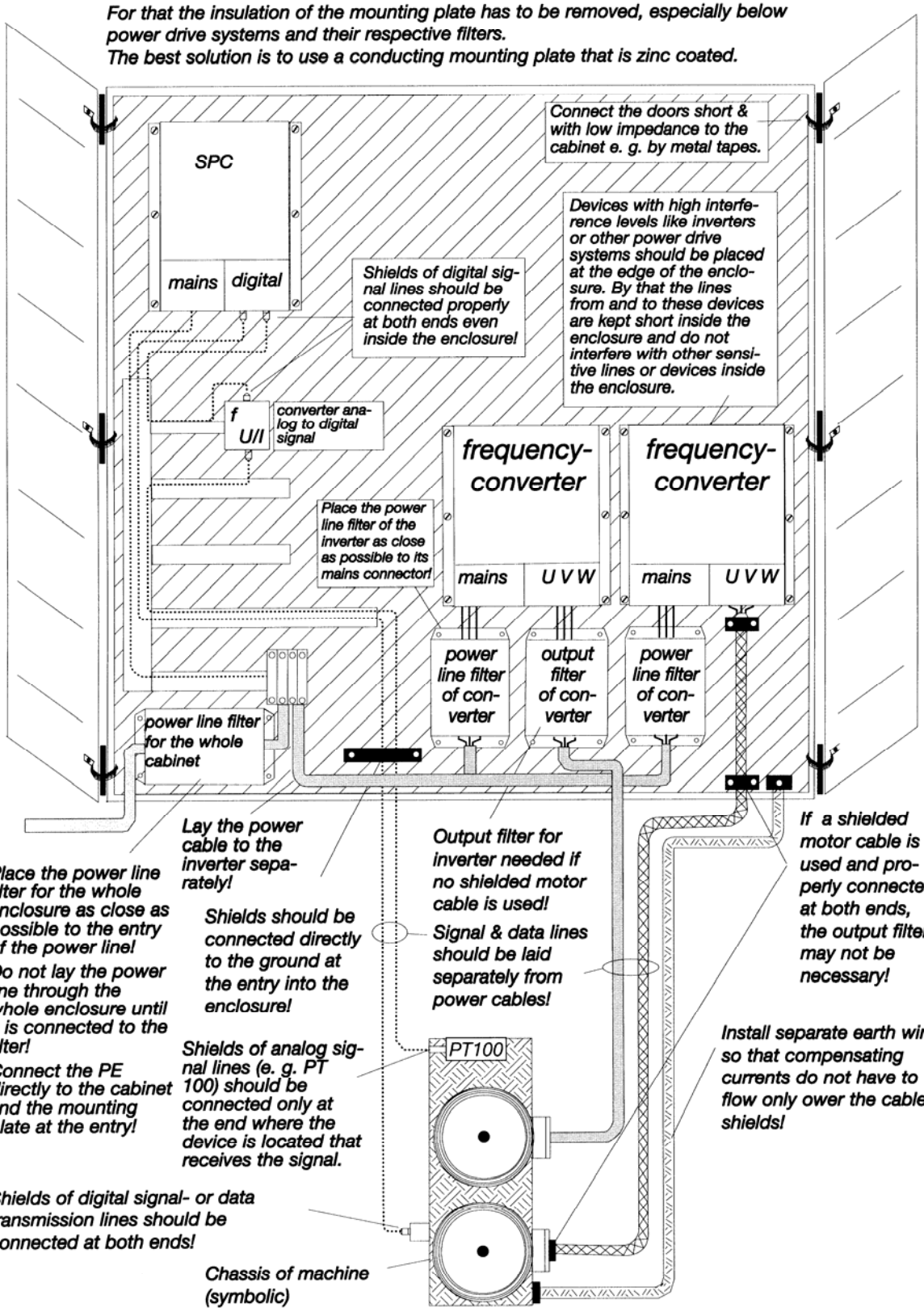
Symmetrische Störungen werden entstört durch:
Symmetrical interferences are suppressed by:

- Kondensatoren zwischen den Anschlüssen („X"-Kondensatoren): Diese schließen die Störströme kurz, bevor sie die Störsenke erreichen.
- *capacitors between the terminals („X" capacitors): they short-circuit the interference currents just before they reach the potentially susceptible equipment.*

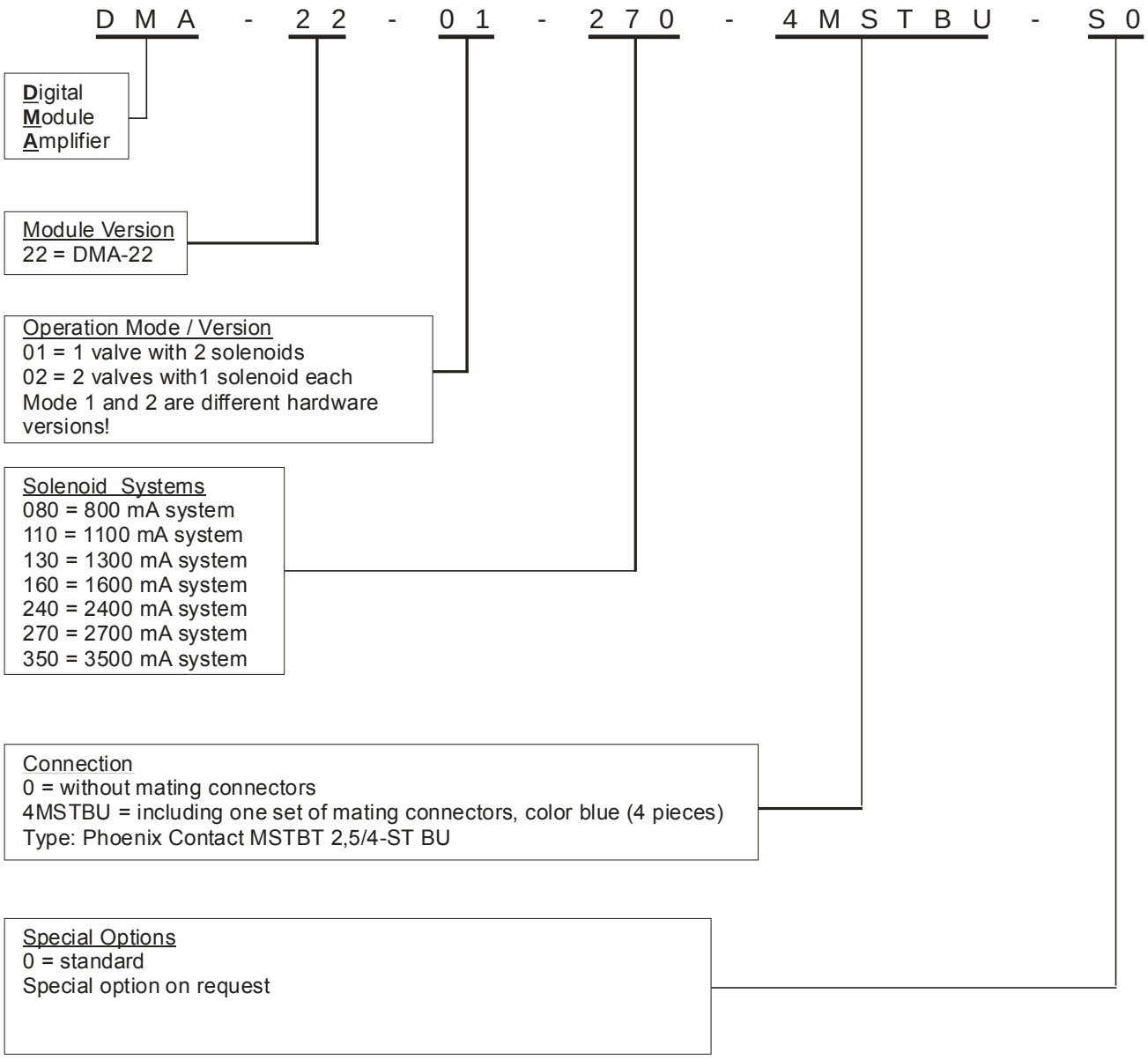
- Einzel-Drosseln im Strompfad der Zu- und Ableitungen. Diese Drosseln sind für symmetrische Störungen wirksam und erhöhen die Impedanz des symmetrischen Störstromkreises.
- *single chokes in the current path of the incoming and outgoing lines. These chokes are effective for symmetrical interferences and inrease the impedance of the symmetrical interference circuit.*

EMC adequate design of switchgear cabinets and facilities

All devices with a metal housing or a connector for PE should be connected properly, i. e. short and with a large contact area to the mounting plate of the cabinet or the chassis of the machine to ensure a proper potential equalisation.
For that the insulation of the mounting plate has to be removed, especially below power drive systems and their respective filters.
The best solution is to use a conducting mounting plate that is zinc coated.



2.5 Ordering code



2.6 Pin assignment

TIP Numbers in brackets do indicate numbers printed on the connectors!

For modules version DMA-22-**01**-xxxx-S0

Connector X1	**Terminal X1/1 (1)**	**Terminal X1/2 (2)**	**Terminal X1/3 (3)**	**Terminal X1/4 (4)**
	Solenoid A-	Solenoid A+-	Solenoid B-	Solenoid B+
Connector X2	**Terminal X2/1 (5)**	**Terminal X2/2 (6)**	**Terminal X2/3 (7)**	**Terminal X2/4 (8)**
	Set point 1 (S1.01)	Set point 2 (S1.02)	Set point 3 (S1.03)	Set point 4 (S1.04)

Connector X3	**Terminal X3/4 (12)**	**Terminal X3/3 (11)**	**Terminal X3/2 (10)**	**Terminal X3/1 (9)**
	Set point 6- (Analogue Input)	Set point 6+ (Analogue Input)	Error	Enable
Connector X4	**Terminal X4/4 (16)**	**Terminal X4/3 (15)**	**Terminal X4/2 (14)**	**Terminal X4/1 (13)**
	Power supply + 24 V	Power supply 0 V	Ext. 24 V	Ext. 0 V

For modules version DMA-22-**02**-xxxx-S0

Connector X1	**Terminal X1/1 (1)**	**Terminal X1/2 (2)**	**Terminal X1/3 (3)**	**Terminal X1/4 (4)**
	Solenoid A-	Solenoid A+-	Solenoid B-	Solenoid B+
Connector X2	**Terminal X2/1 (5)**	**Terminal X2/2 (6)**	**Terminal X2/3 (7)**	**Terminal X2/4 (8)**
	Set point 1 (S1.01)	Set point 2 (S1.02)	Set point 5- (Analogue Input)	Set point 5+ (Analogue Input)

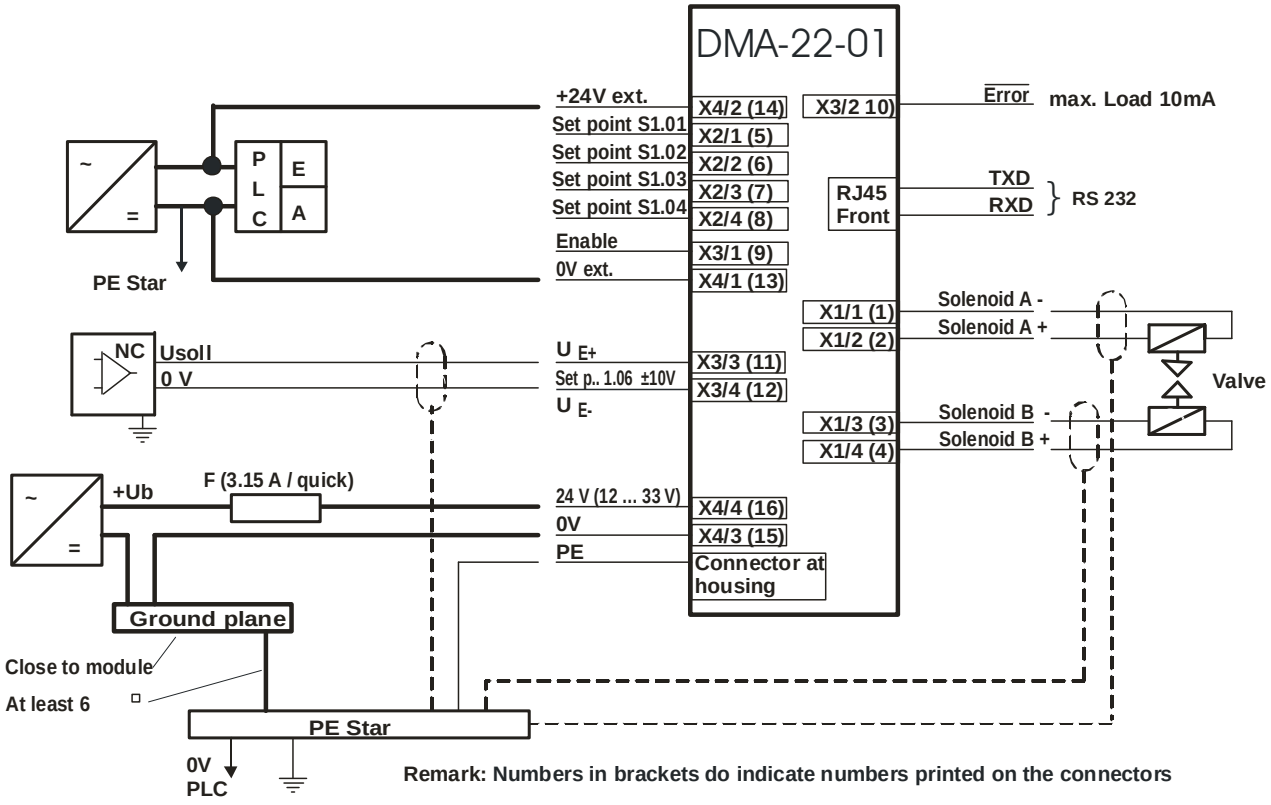
Connector X3	**Terminal X3/4 (12)**	**Terminal X3/3 (11)**	**Terminal X3/2 (10)**	**Terminal X3/1 (9)**
	Set point 6- (Analogue Input)	Set point 6+ (Analogue Input)	Error	Enable
Connector X4	**Terminal X4/4 (16)**	**Terminal X4/3 (15)**	**Terminal X4/2 (14)**	**Terminal X4/1 (13)**
	Power supply + 24 V	Power supply 0 V	Ext. 24 V	Ext. 0 V

The difference between the two versions is at terminals X2/3 and X2/4!

Picture of connectors X1 / X2 and X3 / X4 with numbering 1 o 16 for terminals:

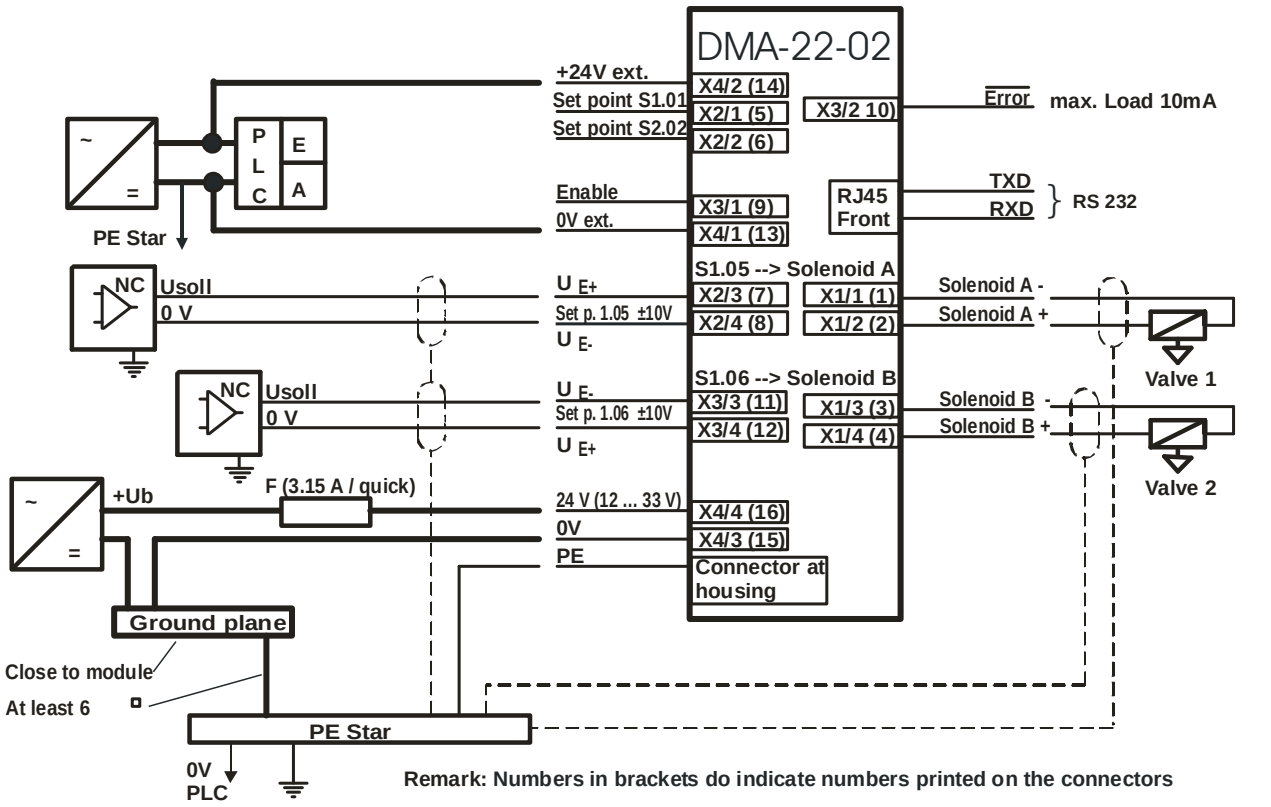
2.7 Connection diagram for DMA-2 in operation mode 1 (version DMA-22-**01**-xxxx-S0)

1 proportional valve with 2 solenoids



2.8 Connection diagram for modules in operation mode 2 (version DMA-22-**02**-xxxx-S0)

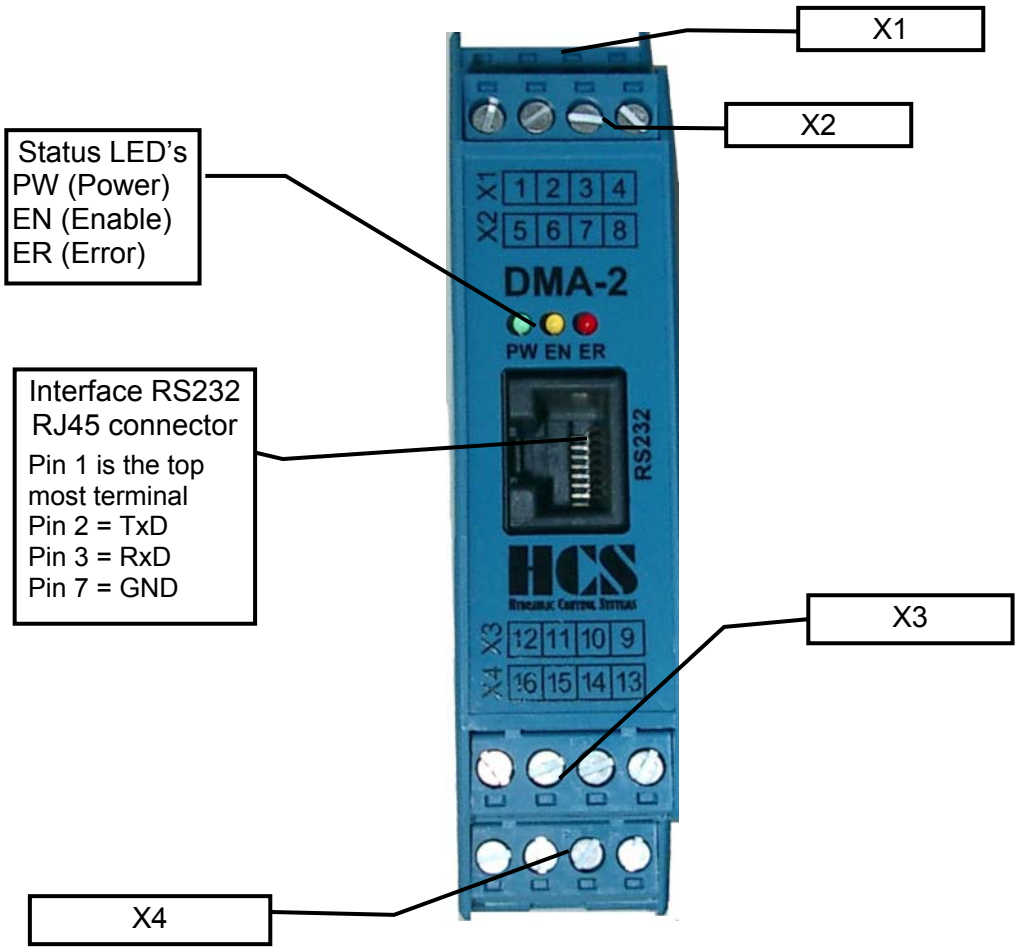
2 proportional valves with 1 solenoid each



3. Commissioning

3.1 Front side elements

The electrical wiring must be checked before switching on the supply voltage. Limit switches and safety devices must be activated to avoid uncontrolled movements. Carefully follow relevant safety regulations. Suitable emergency stop measures must be taken.



Element	Function
Status LED's	display of status
Serial interface	RS232, trough which programming and accessing parameters via PC or communications to machine. Connection for handheld terminal EKB-4

3.2 Parameter setting

Available parameters for version DMA-22-**01**-xxxx-S0:

Display	Set point / ramps /	Controller	Extended
"d1.xx"	**"S1.xx; r1.xx"**	**"C1.xx"**	**"Exx"**
d1.01	S1.01	C1.02	E00
d1.02	S1.02	C1.03	E02
d1.03	S1.03	C1.04	E1.03
d1.04	S1.04	C1.05	E1.04
d1.05	r1.01	C1.06	E1.05
d1.06	r1.02	C1.07	E1.06
d1.07	r1.03	C1.08	E1.07
d1.08	r1.04		E08
d1.09			E09
d1.10			E1.10
			E11
			E12
			E1.13
			E1.14
			E15
			E17
			E21
			E22

Available parameters for version DMA-22-**02**-xxxx-S0:

display	display	Set point / ramps	Set point / ramps	Controller	Controller	Extended General	Extended Branch 1	Extended Branch 2
"d1.xx"	**"d2.xx"**	**"S1.xx; r1.xx"**	**"S2.xx; r2.xx"**	**"C1.xx"**	**"C1.xx"**	**"Exx"**	**"E1.xx"**	**"E2.xx"**
d1.01	d2.01	S1.01	S2.01	C1.02	C1.02	E00	E1.03	E2.03
d1.02	d2.02	r1.03	r2.03	C1.03	C1.03	E02	E1.04	E2.04
d1.03	d2.03	r1.04	r2.04	C1.04	C1.04	E08	E1.05	E2.05
d1.04	d2.04			C1.05	C1.05	E09	E1.06	E2.06
d1.05	d2.10			C1.06	C1.06	E11	E1.07	E2.07
d1.06				C1.07	C1.07	E12	E1.10	E2.10
d1.07				C1.08	C1.08	E15	E1.13	E2.13
d1.08						E17	E1.14	E2.14
d1.09						E21		
d1.10						E22		

Remark: Parameters Exx, E1.xx and E2.xx are accessible in one column!

TIP **A complete list of parameters is available in section 7 including detailed information about the parameters for (version DMA-22-02-xxxx-S0)**

Cursor controlling when using a terminal program (e.g. Hyperterminal)

Within the lines and columns of the menu table, the cursor can be moved by use of the arrow keys. If the cursor is moved to the last possible position in a line or column (left, right, up, down), it will automatically move to the opposite side ("wrap around").

3.3 Operation modes

Two different versions of modules are available. The setting of parameter E00 is related to each of the versions and can **not** be changed because the difference between both versions is due to hardware.

Only the mode relevant parameters are made available.

Mode	Description / Module Version
1	Open loop, 1 proportional valve with 2 solenoid (version DMA-22-**01**-xxxx-S0)
2	Open loop, 2 proportional valves with 1 solenoid (version DMA-22-**02**-xxxx-S0)

3.4 Description of software program

3.4.1 General availability and assignment of parameters

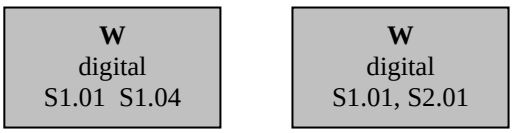
As described above, there are two (hardware) versions and hence two operation modes. In the mode 1, all set points are assigned to only one functional branch. In the mode 2 there are additional set point parameters available for the second branch.

In operation mode 2 all parameters for the second branch (solenoid B) will have the following format: "X2.xx"

In the standard setting with parameter C1.05 = +1, all positive set points activate solenoid B and all negative set points activate solenoid A. Parameter C1.05 = -1 inverts this assignment and with parameter C1.05 = off, all set points are deactivated.

Only trained staff should make changes of the parameters. While adjusting, the drive should be switched off. Every parameter change is immediately effective!

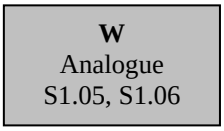
3.4.2 Programmable set points (S1.01 to S1.04; S2.01)



Digital set points are internal programmable set points, activated by digital inputs. Four of these programmable set points can be selected with the respective input. When using the operation mode 1 these set points are assigned and saved in parameters S1.01, S1.02, S1.03 and S1.04. In the operation mode 2 they are assigned and saved in parameters S1.01 and S2.01.

- The inputs are opto-decoupled and can be controlled directly from the PLC.
- If an electrical isolation between the PLC and the amplifier is not required, the customer must bridge terminal X4/1 with X4/2 for 24 V and X4/3 with X4/4 for 0 V
- All four digital set points are passed through the ramp function generator.
- All set points are additive and include the direction information themselves
- If several set points are selected at the same time, the sum of these set points is subsequently processed.
- With binary combinations a total of 16 values can be selected (only available in operation mode 1!).

3.4.3 Analog set points (S1.05, S1.06; E15, E16)



- The set point S1.06 is designed for voltage and current signals. Signal range is:
  0 ... ± 10 V (differential input)
  or single ended set point input for current signals:
  0 ... 20 mA or 10 mA ± 10 mA or 4 ... 20 mA or 12 mA ± 8 mA
  selection of cable fracture detection for current input and selection of set point type by means of parameter E15 (E15 and E16 for DMA-22-0**2**). Resolution of analogue input: 12 bit
- The set point S1.05 is only available in version DMA-22-0**2** and is also designed for voltage and current signals. Signal range is:
  0 ... ± 10 V (differential input)
  or single ended set point input for current signals:
  0 ... 20 mA or 10 mA ± 10 mA or 4 ... 20 mA or 12 mA ± 8 mA
  selection of cable fracture detection for current input and selection of set point type by means of parameter E16. Resolution of analogue input: 12 bit
- If for S1.05 and/or S1.06 the current range is selected than a measuring resistance of 250 Ω is automatically activated.
- In case of activated cable fracture detection a current below the trigger level will switch off the amplifiers enable signal and the error output will automatically drop to 0 V. At the same time the LED “ER” is lit.
- When a current input is selected than the inputs are monitored for over-current. If an over current should occur than the input is automatically switched off in order to prevent damages to the input. At the same time the enable is switched off and the error output will drop to 0 V and the LED “ER” is lit.
- The set points are passed through the ramp function generator (ramp) if E08 = 1. If parameter E08 = 0, the analog set points bypass the ramp function.
- The set points S1.06 / S1.05 are calculated according to their polarity with the other set points.
- The input for S1.06 / S1.05 are designed as a differential input within the operating voltage range of ± 15 V.
- The signal for set point S1.06 / S1.05 must be standardized to ± 10 V otherwise the A/D converter is overloaded
- In the operation mode 2, the set point S1.06 is assigned to the first branch and S1.05 to the second branch (solenoid B). In this case both set points may only have positive values (0 … + 10 V).
- In case of usage of current input signals the inputs are protected for overload. An error will be triggered at currents above approx. 25 mA. Cable fracture detection if activated will trigger and error for currents below approx. 2 mA. For information about error codes refer also to chapter 5.5 and 5.6.

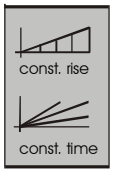
TIP

To suppress interference, unused analog set points must be deactivated with parameter E17.

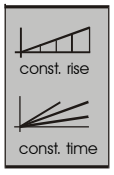
The analog set points S1.05 / S1.06 are not real parameters; they represent external set points.

3.4.4 Ramp function (r1.01 to r1.04; r2.03 to r2.04)

r1.01...r1.04



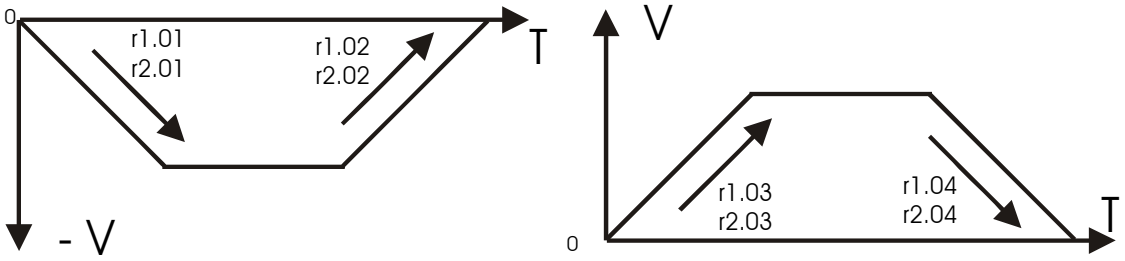
r2.03...r2.04



Digital set points are integrated accordingly to the ramp function generator. For each change of direction, the ramp time can be set independently. Times from 0 to 39.5 s can be set. The resolution is 0.01s.

The ramp characteristic is assigned as follows:

r1.01 or r2.01	ramp from 0 to negative values	r1.03 or r2.03	ramp from 0 to positive values
r1.02 or r2.02	ramp from negative values to 0	r1.04 or r2.04	ramp from positive values to 0

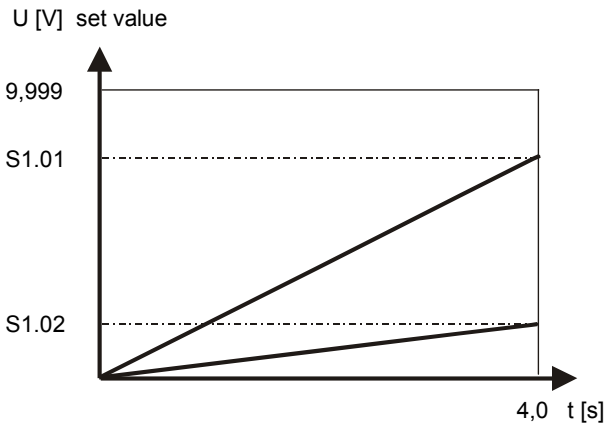


E08 = 0 effects only digital set points, constant time base and linear
E08 = 1 effects all set points, constant rise rate and linear
E08 = 2 ramp function can be switched (only available in operation mode 1!)
The input S1.01 selects ramp r1.01 and r1.02.
The input S1.02 selects ramp r1.03 and r1.04.
If S1.01 and S1.02 are offline, **no** ramp is activated.
If both, S1.01 and S1.02 are online, ramp r1.01 and r1.02 are activated.
The selected parameters S1.01 and S1.02 are still active and must be set to 0 if they should not be used.
The digital inputs S1.03 and S1.04 retain their functions.

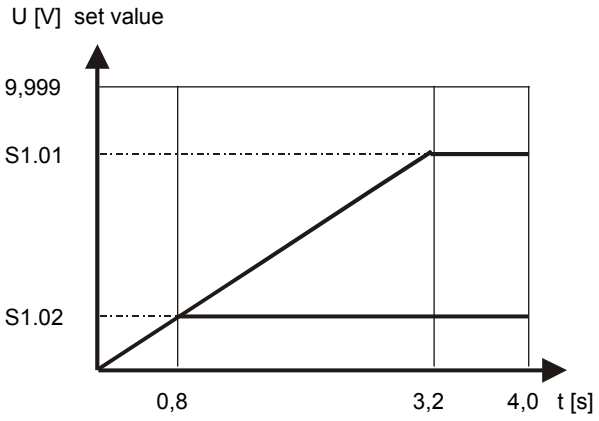
The following examples show the ramp function:

3.4.5 Examples for ramps

Example 1:
E08 = 0, ramp with constant time base
S1.01 = 8.00 V; S1.02 = 2.00 V; r1.03 = 4.00 sec



Example 2:
E08 = 1, ramp with constant rise rate
S1.01 = 8.00 V; S1.02 = 2.00 V; r1.03 = 4.00 sec



TIP **The analog set points S1.05 / S1.06 are excluded from the ramp function.**

The ramp influences the digital set points as well as the analogue set points

3.4.6 Characteristic curve (C1.02; C2.02)

C1.02 C2.02

There are five characteristic curves available for the linearization of the valves characteristics:
Curve #1: general linearization for NC curve
Curve #2: linearization for proportional directional valves with flow characteristic > 10 l/min (NG6)
Curve #3: linearization for proportional directional valves with flow characteristic ′ 10 l/min (NG6)
Curve #4: linearization for proportional directional valves with flow characteristic > 50 l/min (NG10)
Curve #5: linearization for proportional pressure valves

These available characteristic curves can be adjusted according to specific valves or demands. Using a download function, the characteristic curves of the flash-EPROM can be redefined. Please contact the manufacturer if you need this function.

3.4.7 Direction dependant amplification (C1.03, C1.04; C2.04)

C1.03, C1.04 C2.04

The amplification can be programmed with the parameters C1.03 and C1.04, for both directions, “+” and “-” (when using the operation mode 1). In operation mode 2 the parameters C1.04 and C2.04 can be programmed. These parameters are used for amplification adjustment (e.g. the speed of differential cylinders).

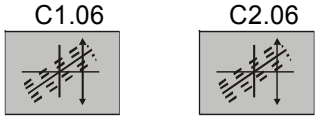
3.4.8 Inverter (C1.05; C2.05)

C1.05 C2.05

The inverter functions are used to exchange the polarity sign of the set points (Cx.05) or to completely deactivate these signals. This enables to change the direction of a valve.

3.4.9 Offset for set point (C1.06; C2.06)

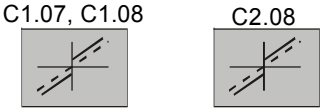
C1.06 C2.06



A drift of the drive or the hydraulic system can be corrected with the offset parameters.
The offset-set point (Cx.06) can be regarded as an additional set point. This allows a very fine positioning of the system e.g. if it is used on a NC axis.

3.4.10 Spool overlap compensation (C1.07, C1.08; C2.08)

C1.07, C1.08 C2.08



These parameters compensate a possible spool overlap independently for each solenoid. The compensation works as an additional set point that is activated as soon as the polarity of the set point changes. Overlaps of valve are empirically around 10 % to 15 % of FS. The setting has a decisive effect on the quality (precision and speed) when positioning the axis drives. The amplification in the small signal range is essentially determined by this function.
The pre-set value is directly applied as a current on the solenoids. The programming is standardized in volt, 10 V equals the maximum set current. Parameters C1.07 and C1.08 are used in the operation mode 1; parameters C1.08 and C2.08 are used in operation mode 2.

3.4.11 Push – pull / Short circuit, over current and open loop detection (E02)

E02

Push-Pull

E 02	Description
off	The function is bypassed, When using the operation mode 2 this parameter is not available
1	The push-pull function is activated, the solenoid current is divided between both solenoids, the set point = 0. If the set point value is raised, the solenoid current of one solenoid is also automatically raised, while the solenoid current of the other solenoid is reduced accordingly. The push-pull function sends an initial current to the solenoid and increases therefore the dynamic response. This function only applies for the appropriate valve types.
2	The amplifier module can handle solenoid systems with one common reference point (two solenoids with only three connection terminals). In order to use this function the common reference point must be connected to X1/2(1) (solenoid A+) and X1/4(4) (solenoid B+). If this selection is chosen than parameters E11 and E12 are not available. For further details please contact the manufacturer. This function is only available in modules with software version V10.04b or higher! Also a special short circuit, overload and open circuit protection is activated. The standard protection will only detect a over current (which also can be caused by a short circuit) between the solenoid lines (A+ to A- or B+ to B-) and only if the (peak) current is exceeding 8 A. This is mainly in order to protect the output stages of the DMA itself! When E02 = 2 is activated than the module can also detect short circuits and overloads between the outputs and GND or power supply lines. Also open circuits can be detected in these cases. This is in order to help prevent critical conditions at the application.
3	This is not applicable and reserved for special applications! This value can not be activated by means of HCSTool.
4	The solenoids with independent connection are used. The difference to E02 = off is that here the special short circuit, overload and open loop protection is also activated and also short circuits and overloads between the outputs and GND or power supply lines is detected. The special short circuit protection as well as the setting E02 =4 is only available in modules with software version V10.05e or higher!

If short circuit and/or overload can occur also between the outputs and either GND or supply and if this can cause any risk or damage than E02 =2 or E02 =4 must be activated.

These settings also must be activated in cases of possible open circuits causing critical conditions in the application.

For E02 = 2 and E02 = 4 an error will only be detected if the difference between the desired current and the actual output current of the modules is > 250 mA and at the same time active for a duration > 100 ms. Only in this cases the output stages will be shut off automatically.

It is always recommended to have a fuse (quick reacting, 3.15 A) in the + power supply line to the DMA.

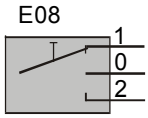
TIP

Error message in case of short circuits, overloads or open circuits is either “- - 3” or “- - 8”.

TIP

E02 = 3 is not applicable and reserved for special applications!
E02 = 3 can not be activated by means of HCSTool.

3.4.12 Type of ramp (E08)



This parameter defines the type of ramp that should be used, see also sections 3.4.4 and 3.4.5.
E08 = 0: constant time base (effects only digital set points)
E08 = 1: constant rise rate (effects all set points, digital and analog)
E08 = 2: ramp function can be switched (attention: is not shown in block structures and diagrams of operation modes) (only available in operation mode 1!)

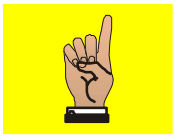
3.4.13 Output stage parameters (E1.03 to E1.07, E2.03 to E2.07, E1.10, E2.10, E09)

Output Stage Control
E1.03 … E1.07, E1.10
E2.03 … E2.07, E2.10 / E09

Each solenoid is activated by a PWM output stage that has over-energization and high-speed de-energization. The solenoid current is measured, compared with the set point (activation value for the output stages) and controlled by a PI controller. This helps to avoid deviations of the solenoid current, e.g. through warming of the coil. Additionally, the programming of the controller has an important influence on the dynamic and static performance. Parameters Ex.04 to Ex.07 set the controller for energization as well as for de-energization.

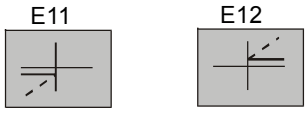
Parameter Ex.03 selects the maximum current and therefore defines the amount of current available at set point = 10 V.

Parameter Ex.10 allows a fine and variable adjustment of the solenoid current and this allows adjusting the already set maximum current. Independently of all the settings, the minimum current is limited to 600 mA in any case.
Parameter E09 sets the time delay of the enable signal. The activation of the output stages will be delayed even though the enable signal is active.



When using the operation modes 2, only valves with a current of 2 x 2.70 A may be used. When connecting solenoids with a higher nominal current, make sure the sum of the two currents is not higher than 5.4 A

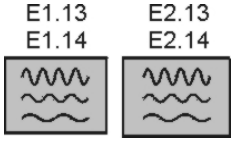
3.4.14 Initial current (E11, E12)



Initial current is used to keep the armature of the magnet always in touch with the spool. This places the spool solidly between the solenoids and prevents the spool being hit by the armature. The initial magnetizing can improve the dynamic behavior of solenoids. Both parameters are not available if E02 = 2!

The programming is done in Volt: the programmable maximum current is 10 V.

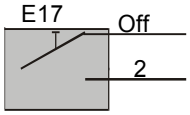
3.4.15 Dither signal (E1.13, E1.14, E2.13, E2.14)



The dither function can be matched to the valve or to the process with the parameters Ex.13 (for the amplitude) and Ex.14 (for the frequency). The frequency of the signal is adjusted stepwise. The dither signal can reduce the hysteresis of the valve or drive and such improve the reaction of the system. This has positive effects on the precision and repeatability.

In general, low frequency signals are more effective, but they can result in noticeable disturbances (noise, oscillations). Values less than 100 Hz are for systems with a low characteristic frequency, higher values are used for systems with a high characteristic frequency. Dither amplitudes are usually set in a range of 2% to 12% (related to current or set point). Dither signals have an influence on the characteristic curve of the current caused by a physical dynamic correlation. In some cases, this has an effect on the linearity from U to I.

3.4.16 Activation of set points (E17)



Parameter E17 is used for the selection or the activation of the set points. The following correlations apply:

E17	Analogue set points	Digital set points
Off	Set point activated: mode 1 → S1.06 mode 2 → S1.05 and S1.06	mode 1 → 4 digital set points activated (S1.01, S1.02, S1.03, S1.04) mode 2 → 2 digital set points activated (S1.01, S2.02)
2	No analogue set point activated	mode 1 → 4 digital set points activated (S1.01, S1.02, S1.03, S1.04) mode 2 → 2 digital set points activated (S1.01, S2.02)

3.4.17 Password (E21)

The password function can be used to lock parameters. Only available via HyperTerminal. This parameter has no locking function and is also not visible when using HCSTool.

To activate the password just set the value "9000" in parameter E21. After pushing the enter button it takes some seconds. After this access will be limited to "d"-parameters and to parameter E21.

To reverse the function set "9000" in E21 again to have full access to all parameters.

3.4.18 Address Setting for Bus-interface (E22)

Parameter only available via HyperTerminal! Only applicable in cases where DMA is used in conjunction with a bus-interface. More information on request!

3.4.19 Display (d1.01 to d1.10; d2.01 to d2.10)

Example:

Parameters are used to display all parameter and internal digital values (for programming, commissioning and diagnosis).

3.5 Other parameters

Due to an eventual lack of clearness, the following parameters are not shown in the sections ”block structures” or ”diagrams of the operation modes”.

3.5.1 Operation mode (E00)

This parameter is predetermined by selection of the module version. For modules version DMA-22-01 it is “1” and for modules version DMA-22-02 it is “2”.

3.5.2 Selection of set point (E15/E16)

These parameters are used in order to select the type of analogue set point. Either a voltage input (0 … ± 10 V) or a current input can be selected. If current input is selected than the measuring resistance (250 Ω) is activated.

Parameter E15 is related to input S1.06 and parameter E16 to S1.05.

The following selection for the input is possible with parameter E15 or E16 (parameter E16 is only available in mode 2).
0 = S1.0x is activated as voltage input; range: 0 … ± 10 V
1 = S1.0x is activated as current input; range: 0 … 20 mA, no cable fracture detection is possible
2 = S1.0x is activated as current input; range: 10 mA +- 10 mA, no cable fracture detection is possible
3 = S1.0x is activated as current input; range: 4 … 20 mA **no** cable fracture detection is activated
4 = S1.0x is activated as current input; range: 4 …. 20 mA cable fracture detection is activated
5 = S1.0x is activated as current input; range: 12 mA +- 8 mA **no** cable fracture detection is activated
6 = S1.0x is activated as current input; range: 12 mA +- 8 mA cable fracture detection is activated.

In case of E15/E16 = 1, 3, 4: only solenoid B is activated. In case of E15/E16 = 2, 5, 6 solenoid A and B are activated

3.6 Evaluation of the current controller parameters

Current controller

e(t) >0: → $t_{pwm}(t) = kp_{err} * e(t) + ki_{err} * e(t)$

kp_{err} = E04; ki_{err} = E05 * T_{ab}

e(t) < 0: → $t_{pwm}(t) = kp_{ent} * e(t) + ki_{ent} * e(t)$

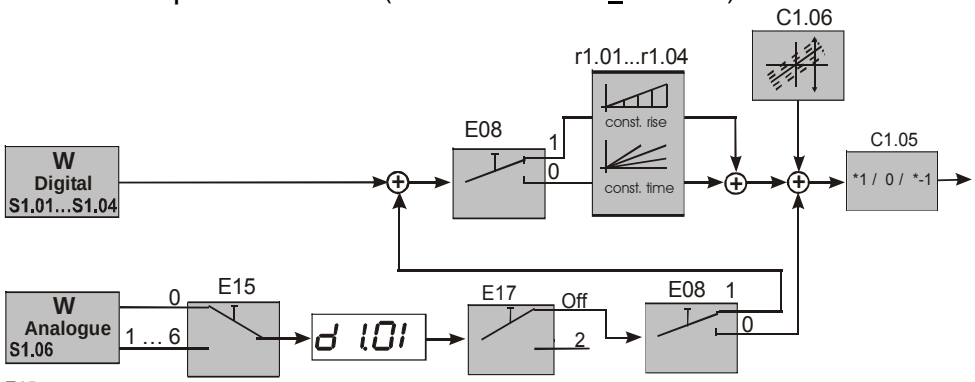
kp_{ent} = E06; ki_{ent} = E07 * T_{ab}

T_{ab} = 85 µs

3.7 Block structures

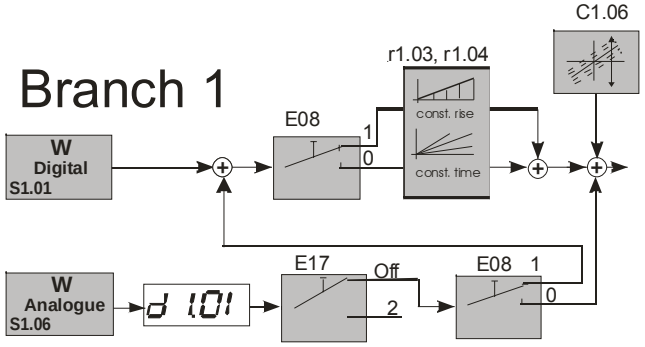
All block diagrams of software functions can be derived by combination of the following blocks.

3.7.1 Set points mode 1 (version DMA-22-01-xxxx-S0)

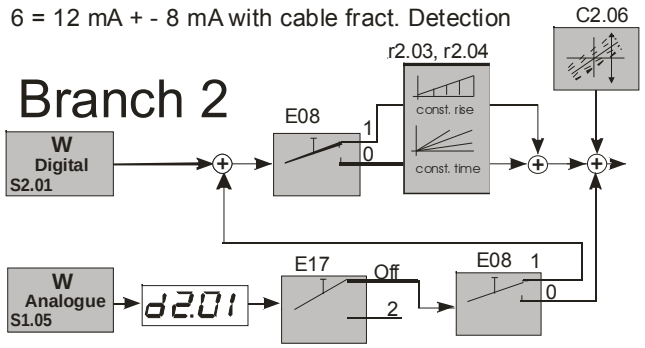


E15:
0 = 0 ... + - 10 V
1 = 0 ... 20 mA
2 = 10 ... + - 10 mA
3 = 4 ... 20 mA without cable fract. detection
4 = 4 ... 20 mA with cable fract. detection
5 = 12 mA + - 8 mA without cable fract. detection
6 = 12 mA + - 8 mA with cable fract. Detection

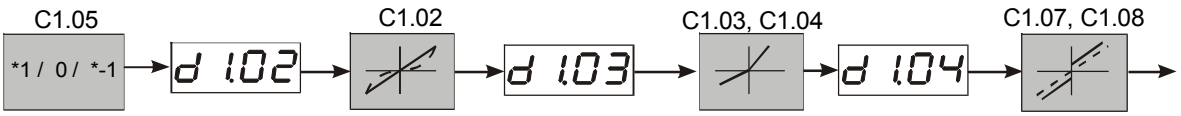
3.7.2 Set points mode 2 (version DMA-22-02-xxxx-S0)



E15 (for S1.06) / E16 (for S1.05):
0 = 0 ... + - 10 V
1 = 0 ... 20 mA
2 = 10 ... + - 10 mA
3 = 4 ... 20 mA without cable fract. detection
4 = 4 ... 20 mA with cable fract. detection
5 = 12 mA + - 8 mA without cable fract. detection
6 = 12 mA + - 8 mA with cable fract. Detection

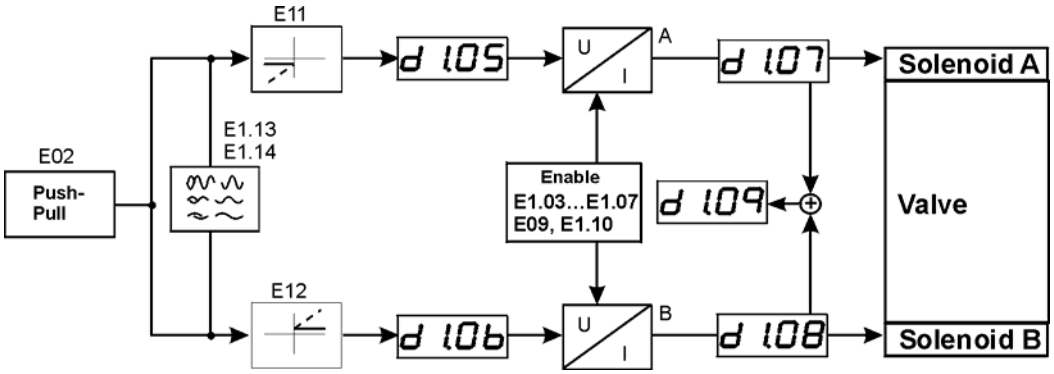


3.7.3 Processing of set points (only shown for version DMA-22-01-xxxx-S0)

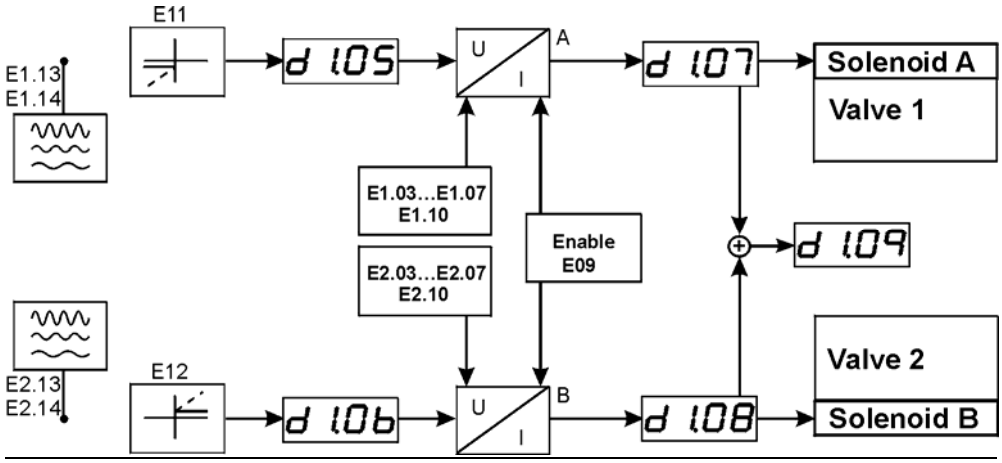


3.7.4 Solenoid current processing and outputs

For version DMA-22-01-xxxx-S0

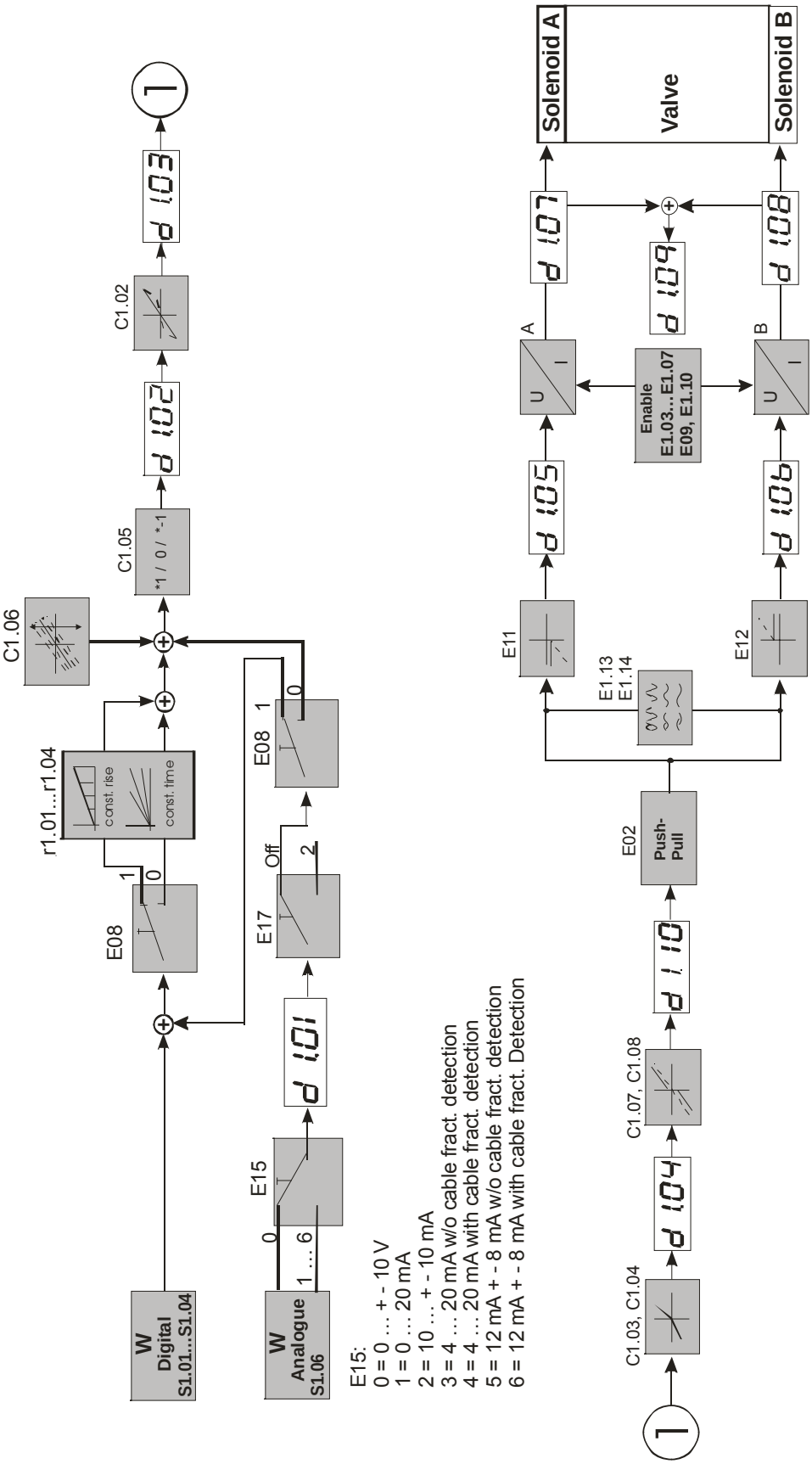


For version DMA-22-02-xxxx-S0

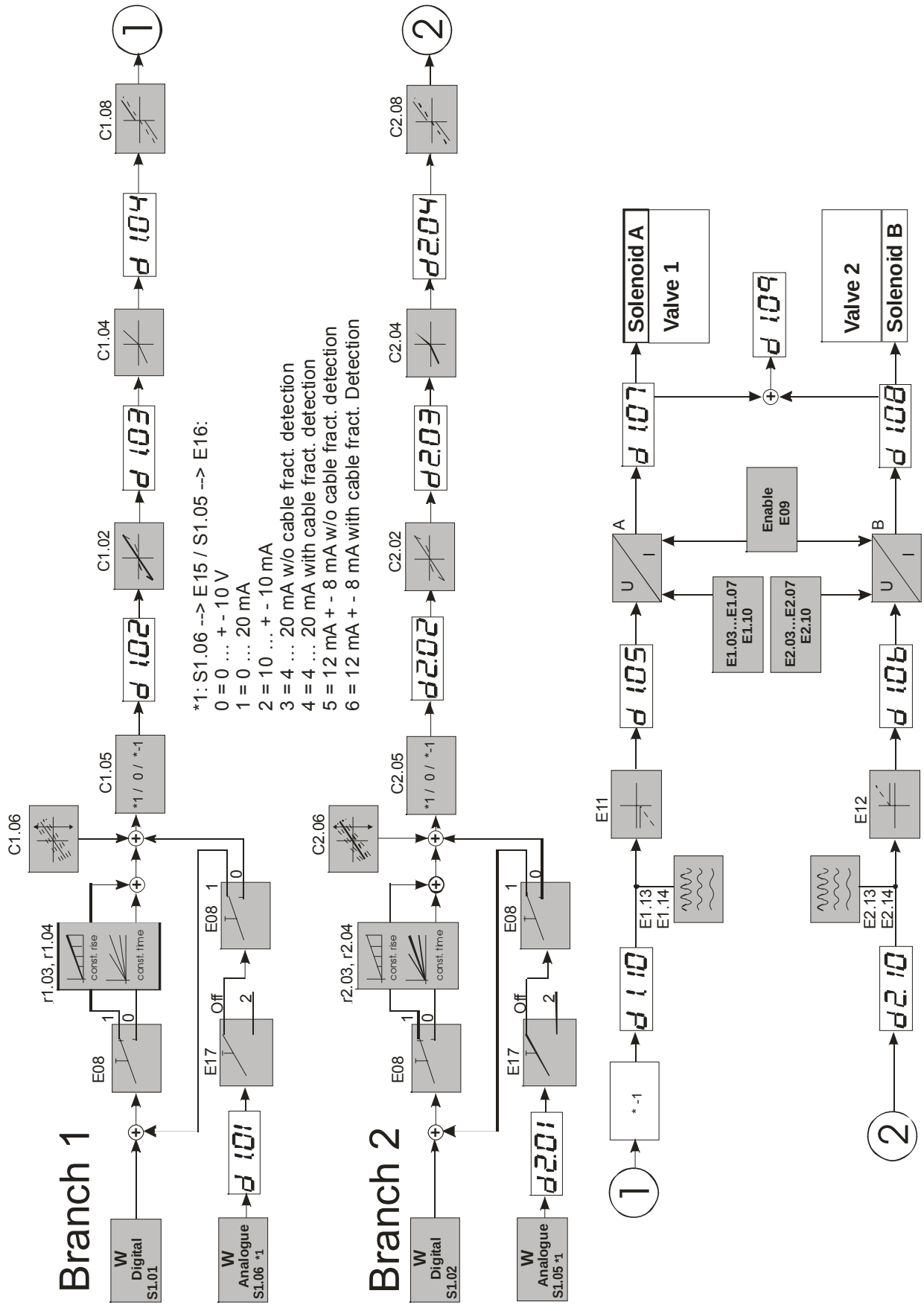


3.8 Software structure diagrams

3.8.1 Mode 1, 1 valve with 2 solenoids (version DMA-22-01-xxxx-S0)



3.8.2 Mode 2, 2 valves with 1 solenoid each (version DMA-22-02-xxxx-S0)

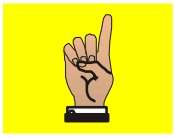


4. Functions

4.1. Display parameter

Internally calculated values can be displayed during normal operation and are especially helpful for commissioning and troubleshooting. The values can either be displayed by use of the program either with "**HCSTool**" monitor function, the handheld unit "**EKB-4**" or with a terminal program (e.g. Hyperterminal) (see also section 6).

The values should be interpreted as voltage or current with a standardised display resolution of 1 mV to 9.999 V for currents between 0.001 A to 4.000 A. The relevant position in the software functions can be taken from the block diagrams.



This is only an auxiliary function. For technical reasons, precise measured values, comparable to a multimeter, are not possible.

Display-Parameter	Function	Display-Parameter branch 2 (additional only for version DMA-22-**02**-xxxx-S0)
d1.01	Sum analogous set values	d2.01
d1.02	Sum set values after ramp function	d2.02
d1.03	Set points after linearization	d2.03
d1.04	Set values after gain adjustment	d2.04
d1.05	Signal to solenoid A	---
d1.06	Signal to solenoid B	---
d1.07	Current solenoid A	---
d1.08	Current solenoid B	---
d1.09	Total current solenoid A and B	---
d1.10	Set point, reference input	d2.10

4.2 Output stages

- PWM output stages are used to reduce power losses.
- The pulse frequency is 24 kHz
- The output stages are equipped with over drive and high-speed breaking to increase dynamic response.
- The output stages are designed for constant currents of 3.5 A. each. In case of single operation using operation mode 2 each output stage can not process more than 2.7 A at the one time.
- Parameter Ex.03 sets the nominal solenoid current. There are different standard settings available (0.8 / 1.1 / 1.3 / 1.6 / 2.4 / 2.7 and 3.5 A). Further, there is an infinitely variable reduction possible with the parameter Ex.10.
- All settings are concurrent for both solenoids in mode 1; in mode 2 it is possible to have a different setting for each one.
- With parameter E02 = 1 a so called push-pull function is activated (only to be used with the appropriate valves or special functions)
- With parameter E02 =2 a double coil system with on common point can be connected (common plus). This is applicable for example for some versions of HAWE *1 proportional valves.
- E02 = 3 Is reserved
- With parameter E02 = 4 solenoids with independent connection terminals are used together with the special short circuit, overload and open circuit detection

Refer also to section 3.4.11 for more details regarding the short circuit, over current and open circuit detection!

***1: HAWE HYDRAULIK GMBH & CO. KG, D- 81673 MÜNCHEN, www.hawe.com**

5 Inputs, outputs and messages

5.1 General

- All inputs and the Error output are electrically isolated through opto-couplers.
- The outputs are short circuit protected.
- If no electrical isolation is required the following terminals must be bridged:

Terminal X4/1(13) may be bridged to terminal X4/2 (14) for 24 V and terminal X4/3 (15) with X4/4 (16) for 0 V.

5.2 Supply

The green LED ”PW” lights up when the supply voltage is present.

5.3 Enable

- After the enable signal has been applied to terminal X3/1, the yellow LED ”EN” lights up. If a time delay had been set in parameter E09, LED ”EN” flashes for the period of the delay.
- Once the time delay elapses, the flashing signal becomes a continuous signal and the output stages are enabled

5.4 Fault (error)

- The current in the output stages is monitored in the amplifier. If one of the possible fault conditions is detected (for details please also refer to section 3.4.11) than the output stages are switched off automatically. At the same time, the signal at the output ”Fault” (terminal X3/2 (9)) is set to 0 V. The red LED ”ER” will be lit and the LED ”EN” is switched off. This will remain until the cause of the error was corrected and the error was reset be disabling the module.
- If the analogue command inputs (S1.05 and/or S1.06) are used as current inputs with cable fracture detection activated than under current is also monitored. The respective error is triggered if the current drops below approx. 2 mA.
- Both inputs are also protected for overload. So if the signal current exceeds approx. 25 mA the inputs will be automatically switched off in order to protect the hardware. Also an error is triggered and the respective error message is generated.
- Malfunction signals should not be corrected by switching off the supply voltage but by taking off the enable signal (after correcting the cause of the malfunction), otherwise a diagnosis is no longer possible.
- It is possible to continue the setting of the module even though the malfunction signal flashes. This allows to find the cause of the error and to correct it. Afterwards, the enable has to be reset (deactivated and activated).
- All fault messages can be monitored with the software **HCSTool**.

5.5 Display and error message

Defined error and other messages:

Display (with software **HCSTool**)	Description of error/message
---1	Error of operation
---2	Wire break at set point S1.06 (current signal < 2 mA)
---3	Excess current or short circuit at the output stages (peak current > 8 A!)
---4	Wire break at set point S1.05 (current signal < 2 mA)
---5	Over current at set point S1.06 (current signal > 25 mA)
---6	Over current at set point S1.05 (current signal > 25 mA)
---7	Not applicable
---8	Over current, short circuit or open circuit at the output stages. The difference between the desired current and the actual current is outside of the defined range. Conditions for error triggering: I_{Error} > 250 mA for t_{Error} > 250 ms.
VerS	When switching on the amplifier, for a short period of time this text is shown. Afterwards, the software version is displayed (e.g. 01.01)

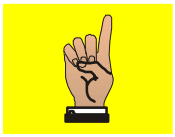
6 Serial interface

6.1 General

Remote operation or remote parameter adjustment may be executed through the serial interface RS232.
The following transmission parameters are applicable:

Transmission rate:	19200 baud
Data format:	8 data-bits, 1 stop-bit, no parity
Terminal emulation:	TTY
Voltage level:	12 V

The amplifier module contains a simple monitoring program, see section 6.3 for details. With the use of the program **HCSTool,** all the parameters may be manipulated. It enables the editing, download and upload parameters and sets of parameters and also has a wide range of other functions. The parameters of the amplifier module can be changed by a superior control (e.g. PLC) with a defined protocol. This way, the amplifier card can be inserted into the machine process in automated systems. For further information about the program **HCSTool** and the protocol please contact the manufacturer.
Also available for parameter setting and for downloading complete parameter sets is a handheld unit (**EKB-4**)



Any change of parameters with the serial interface should be carried out by trained personnel only. If possible, the drive must be stopped during parameter changes. Deactivation of the enable signal is recommended.

6.2 Physical interface data

The connection cable must the following conditions:

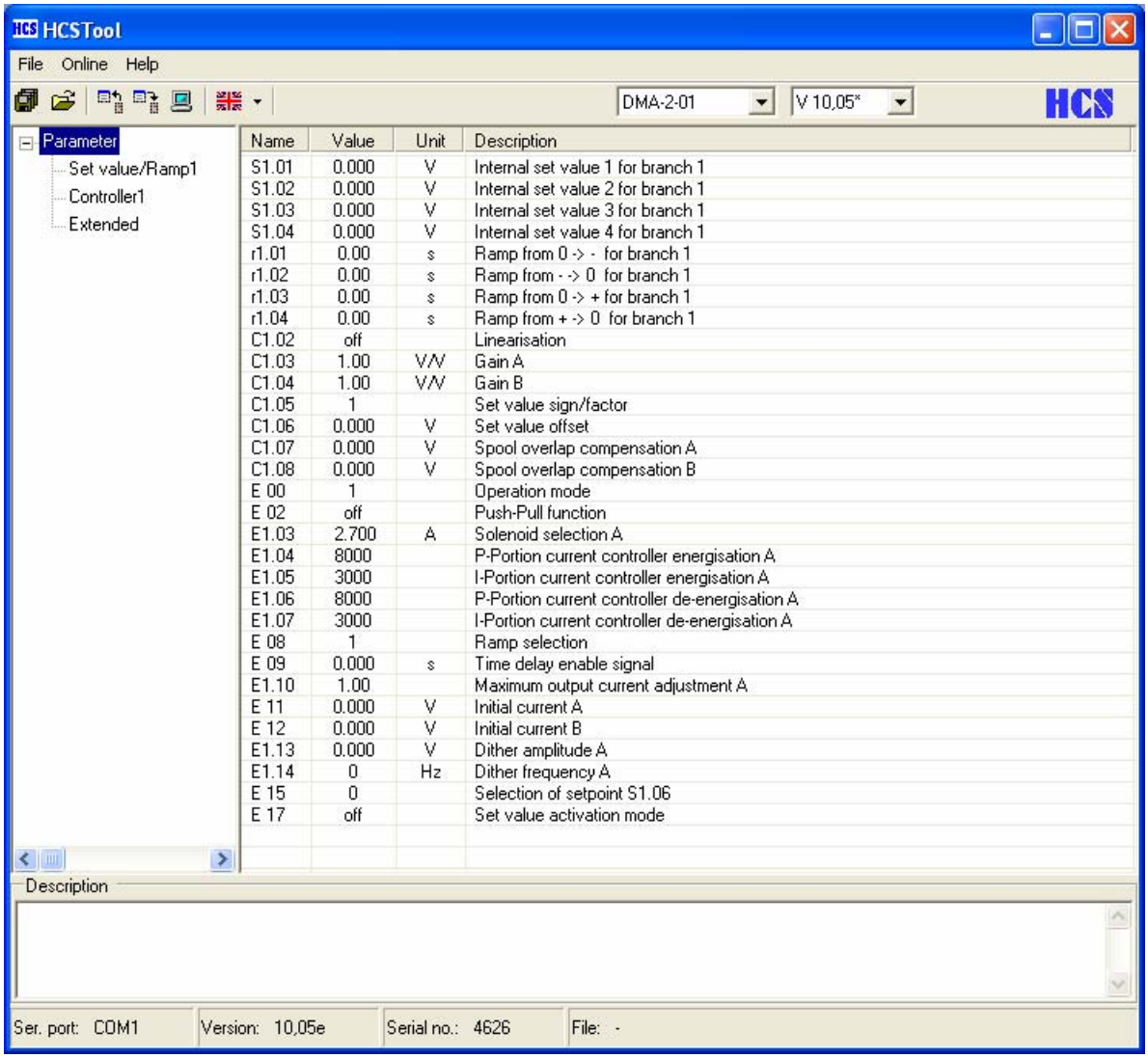
- Use only the original cable and adapter (connection of the cable to the SUB-D connector of the PC) which can be ordered at the manufacturer (article no: 1 860 002 00)
- The connection of the card is a 8-pole RJ45 connector
- Pin 1 is the top most terminal; Pin 2 = TxD, Pin 3 = RxD, Pin 7 = GND

6.3 Using HCSTool

After starting HCSTool the program can either be used “offline” (without having a unit connected) or “online” in direct operation with a module.

After connection of the module with the PC RS232 interface (*1) and a selection of the proper “COM port” it is the best to select the “Upload parameter from device” button to establish communication between the HCSTool and the unit. In this case the software and version of the module will be automatically detected.

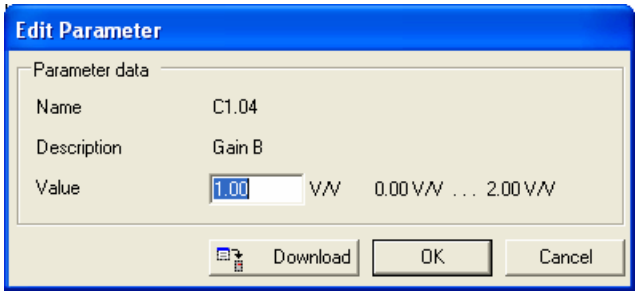
Example of HCSTool main screen (DMA-22-01 with software version V10.05 connected).



Name	Value	Unit	Description
S1.01	0.000	V	Internal set value 1 for branch 1
S1.02	0.000	V	Internal set value 2 for branch 1
S1.03	0.000	V	Internal set value 3 for branch 1
S1.04	0.000	V	Internal set value 4 for branch 1
r1.01	0.00	s	Ramp from 0 -> - for branch 1
r1.02	0.00	s	Ramp from - -> 0 for branch 1
r1.03	0.00	s	Ramp from 0 -> + for branch 1
r1.04	0.00	s	Ramp from + -> 0 for branch 1
C1.02	off		Linearisation
C1.03	1.00	V/V	Gain A
C1.04	1.00	V/V	Gain B
C1.05	1		Set value sign/factor
C1.06	0.000	V	Set value offset
C1.07	0.000	V	Spool overlap compensation A
C1.08	0.000	V	Spool overlap compensation B
E 00	1		Operation mode
E 02	off		Push-Pull function
E1.03	2.700	A	Solenoid selection A
E1.04	8000		P-Portion current controller energisation A
E1.05	3000		I-Portion current controller energisation A
E1.06	8000		P-Portion current controller de-energisation A
E1.07	3000		I-Portion current controller de-energisation A
E 08	1		Ramp selection
E 09	0.000	s	Time delay enable signal
E1.10	1.00		Maximum output current adjustment A
E 11	0.000	V	Initial current A
E 12	0.000	V	Initial current B
E1.13	0.000	V	Dither amplitude A
E1.14	0	Hz	Dither frequency A
E 15	0		Selection of setpoint S1.06
E 17	off		Set value activation mode

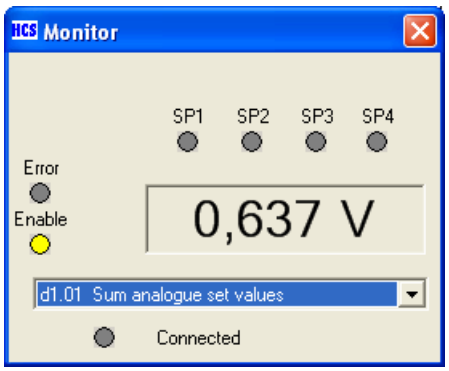
Each parameter can be edited individually and either directly changed in the module (selecting download) or only in the PC list (OK). In the latter case the parameter will be high lighted. Finally all changed parameters can be downloaded.

Example for editing of parameter C1.04:



In order to get information about internal values the display parameters can be used. For this purpose the “Monitor” function must be activated (“Monitoring internal values).

Example:



Remark: The monitor also will display error codes and status of digital inputs.

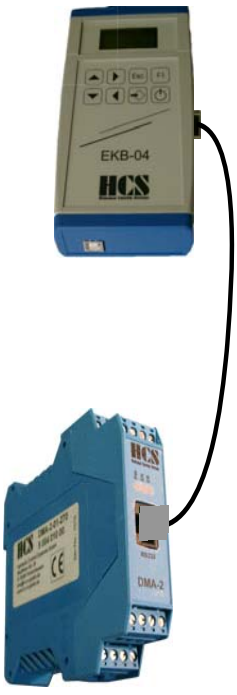
*1: In case of not having a RS232 port available also “USB to RS232” converters can be used. These converters also can be ordered at HCS.

For further information about HCSTool please contact the manufacturer.

6.4 Handheld unit EKB-4

For setting of parameters, displaying internal values and uploading/downloading complete parameter sets the handheld unit EKB-4 can be used.

Connection of EKB-4 with DMA-22:

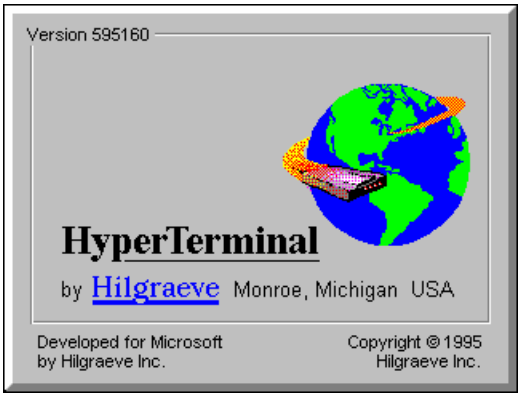


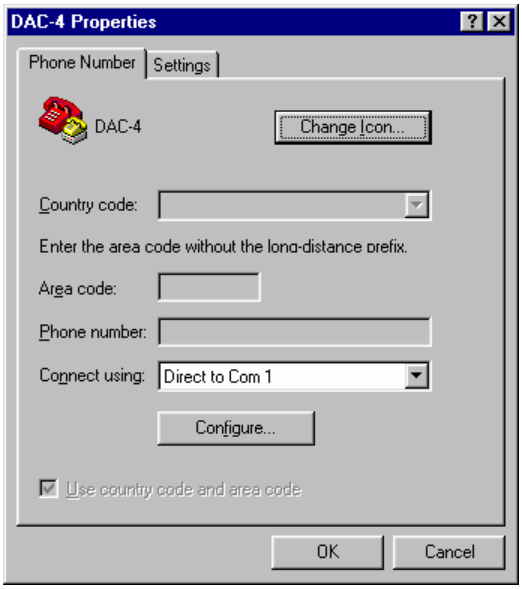
For further information about EKB-4 please contact the manufacturer or refer to the EKB-4 manual.

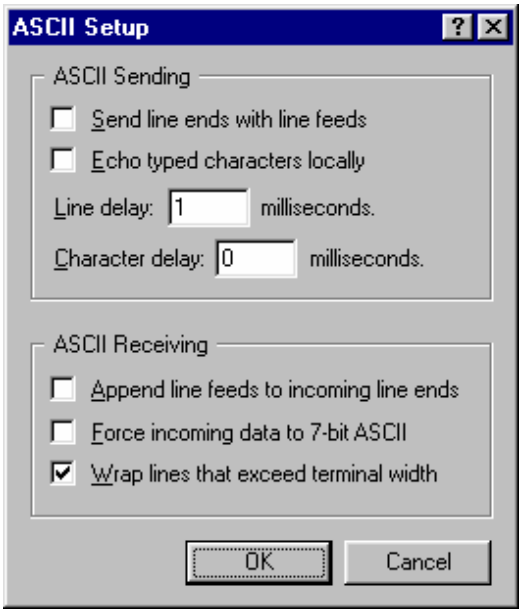
6.5 Communication with terminal program

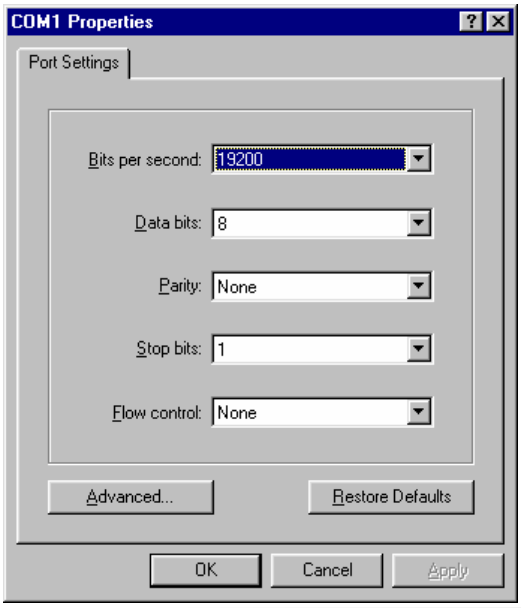
Every program that has TTY emulation may be used. For example the program ”HyperTerminal”, which is part of the WINDOWS distribution can also be used. It can be found under <programs> <accessories> <communication>. If it is not available, it has to be installed from the original WINDOWS CD.

The following adjustments have to be made to HyperTerminal:









Communication with the module in the terminal mode:

When switched on, the module is automatically in terminal mode. The terminal program of the card allows operation as if 6 keys (up, down, left, right, Enter, Esc) were being used. The advantage of using your PC is that the contents of the parameters are shown right next to their identification number. The values sent from the PC to the amplifier module are immediately activated. The cursor keys allow movement through the different lines and columns. Parameter adjustment mode is activated with use of the return key, then define the new value with the numeric keys and then press ”return” to confirm or ”ESC” to change the value again.
If a parameter had been programmed with the return key, its value can be changed with the ↑ key and the ↓ key. Polarity will be shown if necessary.

7 Complete parameter list

7.1 Parameter list for version DMA-22-01-xxxx-S0

Display-Parameters:					
#	Function	Unit	Step	Min	Max.
d1.01	Sum of analogue set value	V	0.001	-9.999	+9.999
d1.02	Sum of all post ramp set values	V	0.001	-9.999	+9.999
d1.03	Set values after linearization	V	0.001	-9.999	+9.999
d1.04	Value after gain adjustment.	V	0.001	-9.999	+9.999
d1.05	Signal A	---	0.001	-9.999	+9.999
d1.06	Signal B	---	0.001	-9.999	+9.999
d1.07	Current A	A	0.001	0.000	5.000
d1.08	Current B	A	0.001	0.000	5.000
d1.09	Total current	A	0.001	0.000	5.000
d1.10	Desired value	V	0.001	-9.999	+9.999

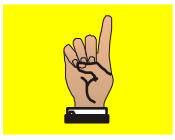
Set value parameters: Digital set values					
#	Function	Unit	Step	Min	Max.
S1.01	Internal set value 1	V	0.001	-9.999	+9.999
S1.02	Internal set value 2	V	0.001	-9.999	+9.999
S1.03	Internal set value 3	V	0.001	-9.999	+9.999
S1.04	Internal set value 4	V	0.001	-9.999	+9.999

Ramp parameters for set values					
#	Function	Unit	Step	Min	Max.
r1.01	Ramp from 0 ⇒ -	S	0.01	0000	39.50
r1.02	Ramp from – ⇒ 0	S	0.01	00.00	39.50
r1.03	Ramp from 0 ⇒ +	S	0.01	00.00	39.50
r1.04	Ramp from + ⇒ 0	S	0.01	00.00	39.50

So.in	Display of status of digital inputs (only available with terminal program)	1000 = S1.01 active 200 = S2.01 active 1200 = S1.01 and S2.01 active

Controller parameters:						
#	Function	Unit	Step	Min	Max.	Code
C1.02	Linearization	---	1	0	5	off = linear; 1 ... 5 = curve
C1.03	Gain A	V/V	00.01	00.00	02.00	---
C1.04	Gain B	V/V	00.01	00.00	02.00	---
C1.05	Set value sign	---	---	- 1	+ 1	- 1 = negative off = off + 1 = positive
C1.06	Set value offset	V	0.001	-9.999	+9.999	---
C1.07	Dead band compensation A	V	0.001	0.000	+9.999	9.999 V = max. current depending on solenoid selection
C1.08	Dead band compensation B	V	0.001	0.000	+9.999	

Extended-Parameters: Basic adjustments						
#	Function	Unit	Step	Min	Max.	Code
E00	Operation mode	---	---	1	1	1 = Open loop one valve **Note:** For version DMA-22-**01**-xxx selection of other operation modes is not applicable
E02	Push-Pull function / Short circuit, over current and open loop detection (for details see section 3.4.11)	---	---	Off	4	Off = off 1 = Push-Pull function active 2 = common Plus for solenoids Note: with special short circ. detection 3 = N/A 4 = 2 Solenoids with indep. connection Note: with special short circ. detection
E1.03	Solenoid selection	---	---	0.800	3.500	0.800 = 0,8 A 1.100 = 1,1 A 1.300 = 1,3 A 1.600 = 1,6 A 2.400 = 2,4 A 2.700 = 2,7 A 3.500 = 3,5 A
E1.04	P-Portion current contr. Energization	---	0001	0000	9999	Default for 2,700 A solenoid
E1.05	I-Portion current contr. Energization	---	0001	0000	9999	Default for 2,700 A solenoid
E1.06	P-Portion cur. contr. de- energization	---	0001	0000	9999	Default for 2,700 A solenoid
E1.07	I-Portion cur. contr. De- energization	---	0001	0000	9999	Default for 2,700 A solenoid
E08	Ramp selection	---	1	0	2	0 = digital set v. (time constant) 1 = all set v. (rise constant.) 2 = selectable ramp function
E09	Time delay enable signal	s	0.001	0.000	+9.999	---
E1.10	Solenoid current adaptation	---	00.01	00.50	01.10	Variable adjustment of max. current
E11	Initial current solenoid A	V	0.001	0.000	+3.000	3.000 V = 30 % of max. rated current
E12	Initial current solenoid B	V	0.001	0.000	+3.000	
E1.13	Dither Amplitude	V	0.001	0.000	+3.000	3.000 V = 30 % of max. rated current
E1.14	Dither Frequency	Hz	1	1	300	---
E15	Selection set point input S1.06 Remark: Selection 1, 3, 4: only solenoid B will be activated Selection 2, 5, 6 solenoid A and B will be activated cfd → cable fracture detection!	---	1	0	6	0 = S1.06 voltage input active 1 = 0 … 20 mA without cfd 2 = 10 mA ± 10 mA without cfd 3 = 4 … 20 mA without cfd 4 = 4 …. 20 mA with cfd 5 = 12 mA +- 8 mA without cfd 6 = 12 mA +- 8 mA with cfd
E17	Set value activation mode	---	1	off, 1	3	off = 4 digital, 1 analogue active 2 = only 4 digital active
E21	Password	---	0001	0000	9999	To protect parameters
E22	Bus-interface address setting	Only for DMA with bus-interface. More information on request!				



Parameters E21 and E22 are only accessible with HyperTerminal!

7.2 Parameter list for version DMA-22-02-xxxx-S0

Display-Parameters: (Branch 1)					
#	Function	Unit	Step	Min	Max.
d1.01	Sum of analogue set value	V	0.001	-9.999	+9.999
d1.02	Sum of all post ramp set values	V	0.001	-9.999	+9.999
d1.03	Set values after linearization	V	0.001	-9.999	+9.999
d1.04	Value after gain adjustment.	V	0.001	-9.999	+9.999
d1.05	Signal A	---	0.001	-9.999	+9.999
d1.06	Signal B	---	0.001	-9.999	+9.999
d1.07	Current A	A	0.001	0.000	5.000
d1.08	Current B	A	0.001	0.000	5.000
d1.10	Desired value	V	0.001	-9.999	+9.999

Display-Parameters: (Branch 2)					
#	Function	Unit	Step	Min	Max.
d2.01	Sum of analogue set value	V	0.001	-9.999	+9.999
d2.02	Sum of all post ramp set values	V	0.001	-9.999	+9.999
d2.03	Set values after linearization	V	0.001	-9.999	+9.999
d2.04	Value after gain adjustment.	V	0.001	-9.999	+9.999
d2.10	Desired value	V	0.001	-9.999	+9.999

Set value parameters: Digital set values and ramp parameters for set values					
#	Function	Unit	Step	Min	Max.
S1.01	Internal set value 1 (Branch 1)	V	0.001	-9.999	+9.999
r1.03	Ramp from 0 ⇒ + (Branch 1)	S	0.01	00.00	39.50
r1.04	Ramp from + ⇒ 0 (Branch 1)	S	0.01	00.00	39.50
S2.01	Internal set value 2 (Branch 2)	V	0.001	-9.999	+9.999
r2.03	Ramp from 0 ⇒ + (Branch 2)	S	0.01	00.00	39.50
r2.04	Ramp from + ⇒ 0 (Branch 2)	S	0.01	00.00	39.50
So.in	Display of status of digital inputs (only available with terminal program)	1000 = S1.01 active 200 = S2.01 active 1200 = S1.01 and S2.01 active			

Controller parameters: (Branch 1)						
#	Function	Unit	Step	Min	Max.	Code
C1.02	Linearization	---	1	0	5	off = linear; 1 ... 5 = curve
C1.04	Gain B	V/V	00.01	00.00	02.00	---
C1.05	Set value sign	---	---	- 1	+ 1	- 1 = negative off = off + 1 = positive
C1.06	Set value offset	V	0.001	-9.999	+9.999	---
C1.08	Dead band compensation B	V	0.001	0.000	+9.999	
Controller parameters: (Branch 2)						
#	Function	Unit	Step	Min	Max.	Code
C2.02	Linearization	---	1	0	5	off = linear; 1 ... 5 = curve
C2.04	Gain B	V/V	00.01	00.00	02.00	---
C2.05	Set value sign	---	---	- 1	+ 1	- 1 = negative off = off + 1 = positive
C2.06	Set value offset	V	0.001	-9.999	+9.999	---
C2.08	Dead band compensation B	V	0.001	0.000	+9.999	

Extended-Parameters: Basic adjustments						
#	Function	Unit	Step	Min	Max.	Code
E00	Operation mode	---	1	1	2	2 = Open loop two valves
E1.03	Solenoid selection A	---	---	0.800	3.500	0.800 = 0,8 A 1.100 = 1,1 A 1.300 = 1,3 A 1.600 = 1,6 A 2.400 = 2,4 A 2.700 = 2,7 A 3.500 = 3,5 A
E2.03	Solenoid selection B	---	---	0.800	3.500	0.800 = 0,8 A 1.100 = 1,1 A 1.300 = 1,3 A 1.600 = 1,6 A 2.400 = 2,4 A 2.700 = 2,7 A 3.500 = 3,5 A
E1.04	P-Portion current contr. Energization A	---	0001	0000	9999	Default for 2,700 A solenoid
E2.04	P-Portion current contr. Energization B	---	0001	0000	9999	Default for 2,700 A solenoid
E1.05	I-Portion current contr. Energization A	---	0001	0000	9999	Default for 2,700 A solenoid
E2.05	I-Portion current contr. Energization B	---	0001	0000	9999	Default for 2,700 A solenoid
E1.06	P-Portion cur. contr. de- energization A	---	0001	0000	9999	Default for 2,700 A solenoid
E2.06	P-Portion cur. contr. de- energization B	---	0001	0000	9999	Default for 2,700 A solenoid
E1.07	I-Portion cur. contr. De- energization A	---	0001	0000	9999	Default for 2,700 A solenoid
E2.07	I-Portion cur. contr. De- energization B	---	0001	0000	9999	Default for 2,700 A solenoid
E08	Ramp selection	---	1	0	2	0 = digital set v. (time constant) 1 = all set v. (rise constant.)
E09	Time delay enable signal	s	0.001	0.000	+9.999	---
E1.10	Solenoid current adaptation A	---	00.01	00.50	01.10	Variable adjustment of max. current
E2.10	Solenoid current adaptation B	---	00.01	00.50	01.10	Variable adjustment of max. current
E11	Initial current solenoid A	V	0.001	0.000	+3.000	3.000 V = 30 % of max. rated current
E12	Initial current solenoid B	V	0.001	0.000	+3.000	
E1.13	Dither Amplitude A	V	0.001	0.000	+3.000	3.000 V = 30 % of max. rated current
E2.13	Dither Amplitude B	V	0.001	0.000	+3.000	3.000 V = 30 % of max. rated current
E1.14	Dither Frequency A	Hz	1	1	300	---
E2.14	Dither Frequency B	Hz	1	1	300	---
E15	Selection set point input S1.06 Remark: Setpoint S1.06 is only effecting solenoid A cfd → cable fracture detection!	---	1	0	6	0 = S1.06 voltage input active 1 = 0 … 20 mA without cfd 2 = 10 mA ± 10 mA without cfd 3 = 4 … 20 mA without cfd 4 = 4 …. 20 mA with cfd 5 = 12 mA +- 8 mA without cfd 6 = 12 mA +- 8 mA with cfd
E16	Selection set point input S1.06 Remark: Setpoint S1.06 is only effecting solenoid B cfd → cable fracture detection!	---	1	0	6	0 = S1.06 voltage input active 1 = 0 … 20 mA without cfd 2 = 10 mA ± 10 mA without cfd 3 = 4 … 20 mA without cfd 4 = 4 …. 20 mA with cfd 5 = 12 mA +- 8 mA without cfd 6 = 12 mA +- 8 mA with cfd
E17	Set value activation mode	---	1	off, 1	3	off = 2 digital, 2 analogue active 2 = only 2 digital active
E21	Password	---	0001	0000	9999	To protect parameters
E22	Bus-interface address setting	Only for DMA with bus-interface. More information on request!				

Parameters E21 and E22 are only accessible with HyperTerminal!

8 Declaration of Conformity

EC Declaration of Conformity

This is to confirm that the product

DMA-2

and all versions fulfil the requirements of the European guideline

89/336/EWG

Applicable standards:

EN 50011: 1998	**Emissions**
EN 61000-6-2: 2001	**Immunity**

Dipl.-Ing. (FH) Peter Deuschle
General Manager
01.07.2007

End

Notes: