SSD Parvex SAS
8, avenue du Lac - B.P. 249
F-21007 Dijon Cedex
www.SSDdrives.com

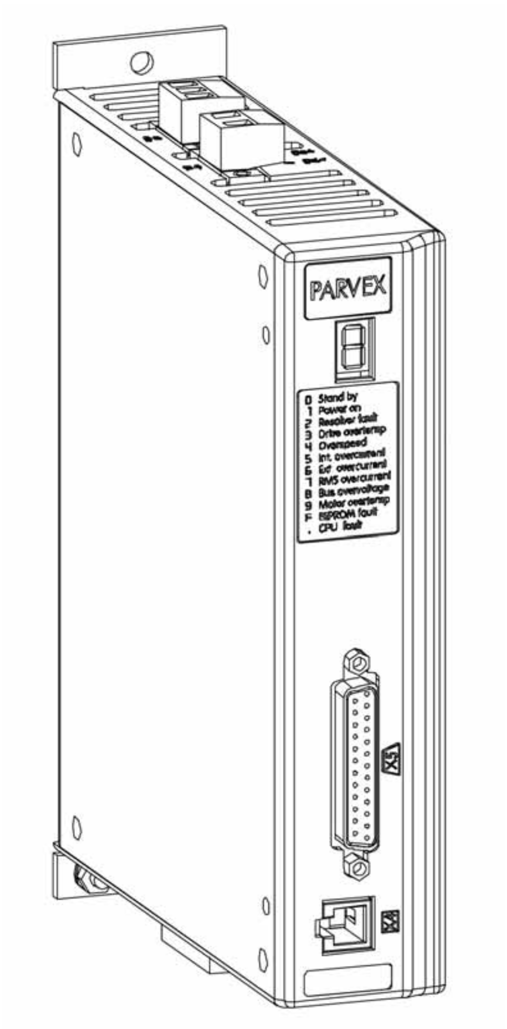
PARVEX

DIGIVEX μ^{micro} Drive

DIGITAL SERVOAMPLIFIER

User and commissioning manual

PVD 3547 GB – 01/2004



PRODUCT RANGE

1 - « BRUSHLESS » SERVODRIVES

	TORQUE OR POWER RANGES
• **BRUSHLESS SERVOMOTORS**, LOW INERTIA, WITH RESOLVER	
Very high torque/inertia ratio (high dynamic performance machinery):	
⇒ NX -HX - HXA	1 to 320 N.m
⇒ NX - LX	0,45 to 64 N.m
High rotor inertia for better inertia load matching:	
⇒ HS - LS	3,3 to 31 N.m
Varied geometrical choice :	
⇒ short motors range HS - LS	3,3 to 31 N.m
⇒ or small diameter motors : HD, LD	9 to 100 N.m
Voltages to suit different mains supplies :	
⇒ 230V three-phase for «série L - NX»	
⇒ 400V, 460V three-phase for «série H - NX»	
• **"DIGIVEX DRIVE" DIGITAL SERVOAMPLIFIERS**	
⇒ SINGLE-AXIS DSD	
⇒ COMPACT SINGLE-AXIS DµD, DLD	
⇒ POWER SINGLE-AXIS DPD	
⇒ MULTIPLE-AXIS DMD	
• "PARVEX MOTION EXPLORER" ADJUSTING SOFTWARE	

2 - SPINDLE DRIVES

- **SPINDLE SYNCHRONOUS MOTORS**

⇒ "HV" COMPACT SERIES

⇒ "HW" ELECTROSPINDLE,frameless, water-cooled motor — From 5 to 110 kW up to 60,000 rpm

- **"DIGIVEX" DIGITAL SERVOAMPLIFIERS**

3 - DC SERVODRIVES

- **"AXEM", "RS" SERIES SERVOMOTORS** — 0.08 to 13 N.m
- **"RTS" SERVOAMPLIFIERS**
- **"RTE" SERVOAMPLIFIERS** for DC motors + resolver giving position measurement

4 - SPECIAL ADAPTATION SERVODRIVES

- **"EX" SERVOMOTORS** for explosive atmosphere
- **"AXL" COMPACT SERIES SERVOREDUCERS** — 5 to 700 N.m

5 - POSITIONING SYSTEMS

- **Numerical Controls** « **CYBER 4000** » 1 to 4 axes
- **"CYBER 2000"** NC 1 to 2 axes
- **VARIABLE SPEED DRIVE - POSITIONER**

⇒ SINGLE-AXIS DSM

⇒ POWER SINGLE-AXIS DPM

⇒ MULTIPLE-AXIS DMM

- ADJUSTMENT AND PROGRAMMING SOFTWARE PARVEX MOTION EXPLORER

CONTENTS

Characteristics and dimensions subject to change without notice.

YOUR LOCAL CORRESPONDENT

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8 Avenue du Lac / B.P 249 / F-21007 Dijon Cedex
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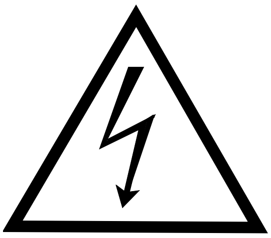
www.SSDdrives.com

SAFETY

Servodrives present two main types of hazard :

- **Electrical hazard**



Servoamplifiers may contain non-insulated live AC or DC components. Users are advised to guard against access to live parts before installing the equipment.

Even after the electrical panel is de-energized, voltages may be present for more than a minute, until the power capacitors have had time to discharge.

Specific features of the installation need to be studied to prevent any accidental contact with live components :
- Connector lug protection ;
- Correctly fitted protection and earthing features ;
- Workplace insulation
  (enclosure insulation humidity, etc.).

General recommendations :

- Check the bonding circuit;
- Lock the electrical cabinets;
- Use standardised equipment.

- Mechanical hazard

Servomotors can accelerate in milliseconds. Moving parts must be screened off to prevent operators coming into contact with them. The working procedure must allow the operator to keep well clear of the danger area.

All assembly and commissioning work must be done by **qualified** personnel who are familiar with the safety regulations (e.g. VDE 0105 or accreditation C18510).

Upon delivery

All servoamplifiers are thoroughly inspected during manufacture and tested at length before shipment.

- Unpack the servoamplifier carefully and check it is in good condition.
- Also check that data on the manufacturer's plate complies with the data on the order acknowledgement.

If equipment has been damaged during transport, the addressee must file a complaint with the carrier by recorded delivery mail <u>within 24 hours</u>.

<u>Caution</u>:

The packaging may contain essential documents or accessories, in particular :

- User Manual,
- Connectors.

Storage

Until installed, the servoamplifier must be stored in a dry place safe from sudden temperature changes so condensation cannot form.

Special instructions for setting up the equipment

CAUTION

For this equipment to work correctly and safely it must be transported, stored, installed and assembled in accordance with this manual and must receive thorough care and attention.

Failure to comply with these safety instructions may lead to serious injury or damage.

The cards contain components that are sensitive to electrostatic discharges. Before touching a card you must get rid of the static electricity on your body. The simplest way to do this is to touch a conductive object that is connected to earth (e.g. bare metal parts of equipment cabinets or earth pins of plugs).

1. GENERAL

1.1 Digital Servodrive

These drives comprise:

- Sinusoidal emf, permanent magnet brushless servomotors, with resolvers for position measurement (NX, LX range servomotors).
- A box-type electronic control system including:
- A power supply function that receives 230 V single-phase mains input.
- A servomotor control function (power and resolver) which is used to control axis motors.
- This module also controls energy regeneration through internal resistance.

Two connection arrangements are proposed for servomotors:

- Terminal box + resolver connector.
- Power connector + resolver connector.

1.2 General characteristics

Input voltage: 230 V (see § 4.4.1)

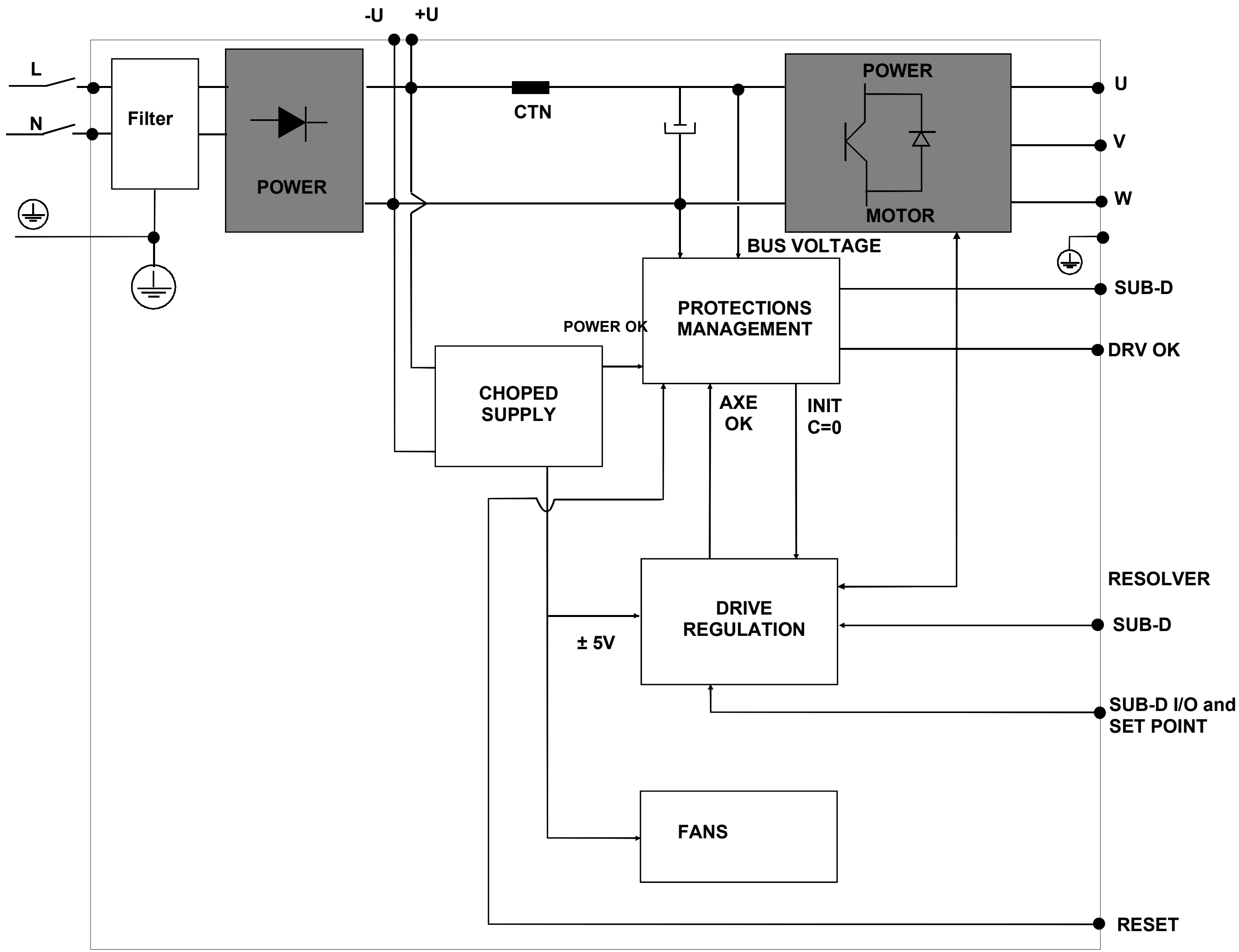
TYPE	MAINS SUPPLY	CONTROLLABLE POWER	SINE PEAK PERMANENT CURRENT	MAXIMUM PEAK CURRENT	PARVEX PRODUCT NUMBER
DµD 2/4	*230 V - single-phase 50/60 Hz*	*375 W*	*2 A*	*4 A*	*DUD13M02R*

1.3 Operating principle

1.3.1 Block diagram

This block diagram features two parts:

- A power supply section providing dc voltage to the power bridge and auxiliary power supplies (regulation, fans).
- A drive control and monitoring management section.
-
-


-U
+U
L
N
Filter
POWER
CTN
POWER
MOTOR
U
V
W
BUS VOLTAGE
SUB-D
PROTECTIONS
MANAGEMENT
POWER OK
DRV OK
CHOPED
SUPPLY
AXE
OK
INIT
C=0
RESOLVER
DRIVE
REGULATION
SUB-D
± 5V
SUB-D I/O and
SET POINT
FANS
RESET

1.3.2 Power supply function

- Receives the 230 V single-phase mains supply through the terminal block B3, converts it into a 310 V dc voltage and generates the auxiliary supplies (± 5V) required for regulation.

1.3.3 Servomotor control function

1.3.3.1 Presentation

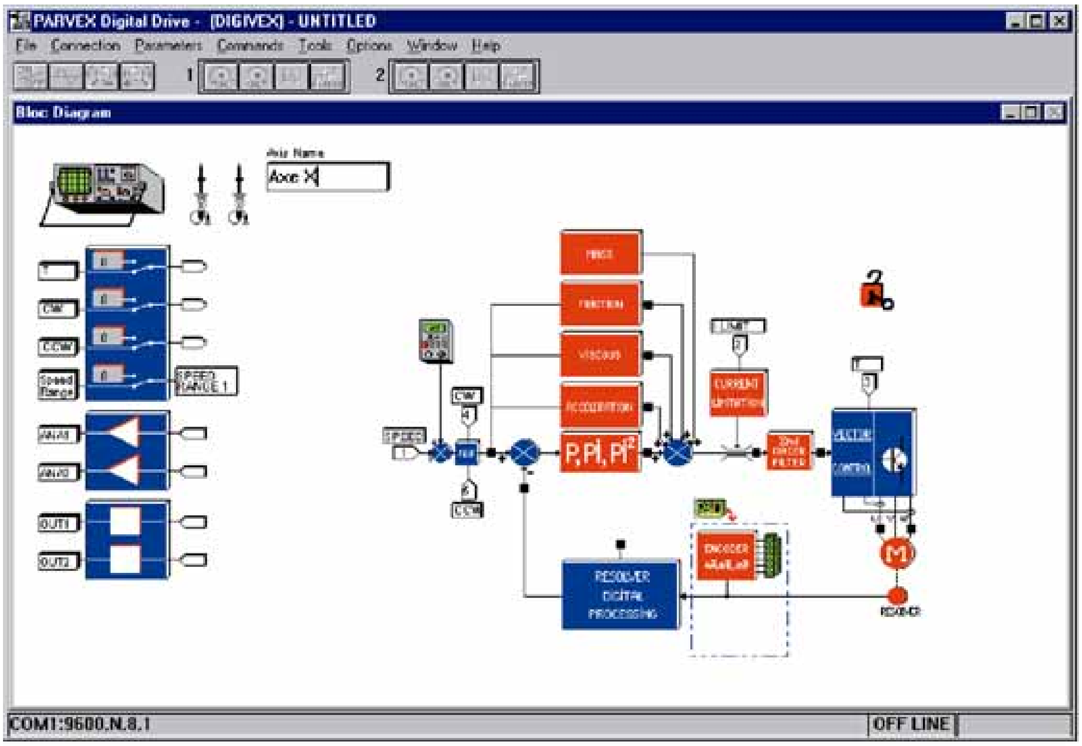
The DIGIVEX μ^{micro} Drive, DµD, servoamplifier is a four-quadrant transistor control module for controlling (brushless) synchronous motors with resolvers.

Customization of the motor - drive unit and the setting of the servo-controlled parameters are carried out using a PC with Parvex Motion Explorer software under Windows.

These parameters are stored in an EEPROM permanent memory.

1.3.3.2 Functionalities, block diagram

The diagram shows the main drive functions and setting parameters.



- On the right of the diagram is the motor - resolver - power unit.

Parameters can be set for:

⇒ motor selection, which dictates drive rating.
⇒ general resolver characteristics

The selection of the motor - drive combination automatically determines some parameters, current limitation, $I^2 = f(t)$ protection, standard servocontrol parameters.

- Ahead of current control.
  - ♦ Second order filter for reducing the effects of high frequency resonance
  - ♦ External reduction of current limitation

- Resolver digital processing (non-parametric) and the encoder emulation function (number of points adjustable from 16 to 16384).

- Regulation type selection: torque or speed.

- Speed loop unit, where the following parameters can be set:
  ⇒ maximum speed for the application (limited by the maximum motor speed).
  ⇒ scaling (1 V = N rpm).
  ⇒ corrector type selection - proportional, proportional and integral, proportional and double integration.

- Predictive action related to speed control

These actions, outside the speed loop, directly affect the torque set point. As they are outside, they have little effect on loop stability. Conversely, they allow anticipated action, without waiting for speed loop reaction.

These predictive actions (or predictors) are:

- Gravity: compensation for vertical masses.

- Dry friction: a given friction value is set, the corresponding torque set point is applied, its sign being that of the speed set point.

- Viscous friction: compensation for friction values proportional to speed (hydraulic or electrical system drive).

- Acceleration: changes in the speed set point (drift) are monitored and action is taken directly on the torque set point via a coefficient K, the inertia image.

- Analog input speed reference (13 bits + sign), non-parametric.

- On the left of the block diagram, all logic and analog inputs / outputs.

The parameter setting software is used for:

- - assigning certain functions to these inputs/outputs.
- - forcing them to a logic status. The inputs are then disconnected from the outside.

1.3.3.3 Logic input forcing

The software is used to force a logic input to a value, thus the N=0, TORQUE inputs can be:

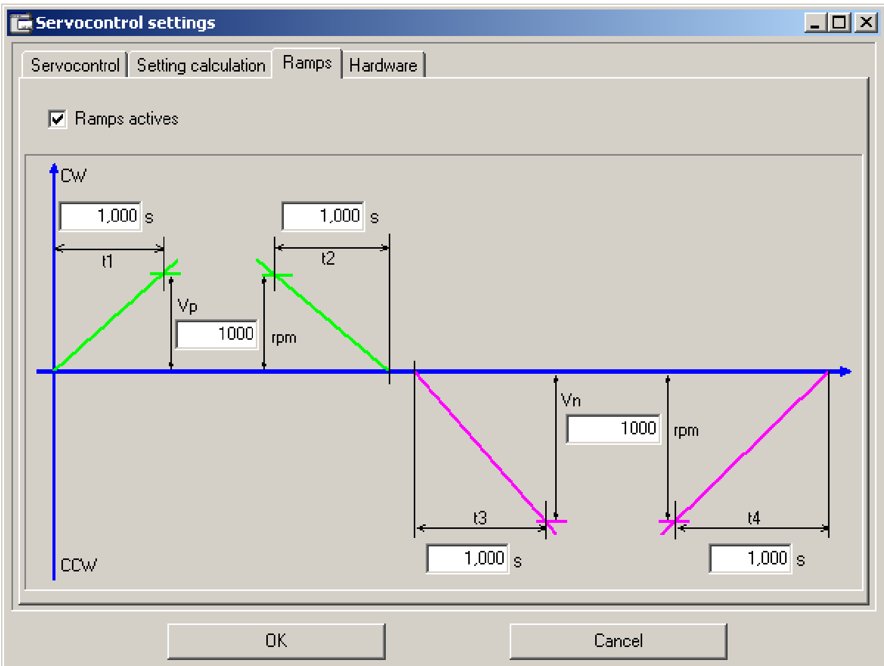
- - "disconnected" from the physical input.
- - forced using the software to 0 or 1.

1.3.3.4 Stimuli / oscilloscope functions

Certain functions integrated in the drive can be used to excite the speed set point: dc voltage, square (response to scale), sine.
These stimuli are activated using a PC. The result, stored in the drive memory, can be displayed on the PC screen by using the oscilloscope function (a maximum of 4 variables can be simultaneously displayed by using the DIGIVEX μ^{micro} Drive Module PME software).

1.3.3.5 Speed ramp function

A ramp function is integrated into the drive unit for versions of software above AP516V07, running with PME version 4.04 or above. This function is used to create time dependent linear speed ramps. Parameters can be set in “Servo-control settings” under the “ramp” tab:

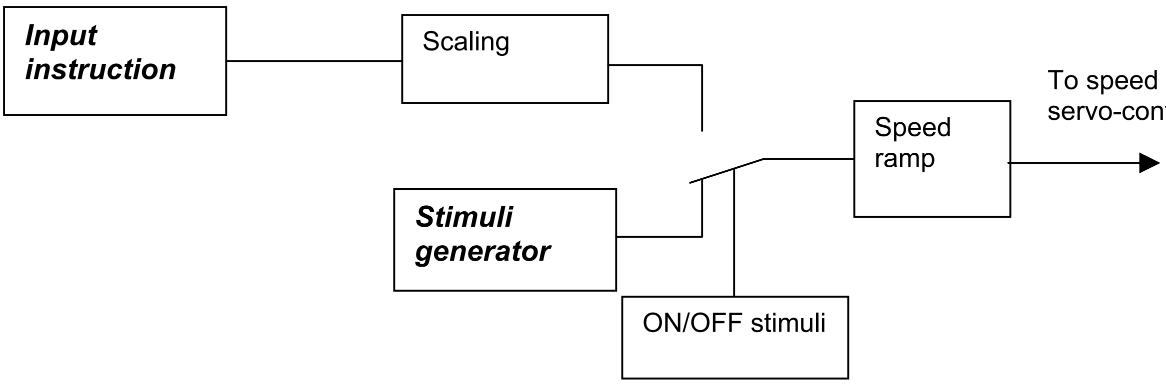


- Times t1, t2, t3, and t4 can be programmed from 0 to 1000s.
- Speeds Vp and Vn can be programmed from 0 to 50,000 rpm.

Comment:
Vp and Vn are points on the ramp; they can be defined outside of maximum motor speed. However, servo-controls will limit the motor speed to the maximum authorized speed.

How the ramp operates:

The ramp input can either be the analog input instruction or the stimuli generator as shown below:



In the event that the input is analog, scaling is carried out by the input instruction product (V) * speed range for 1V, the speed range for 1 volt can be found in the servo-control dialogue box.

Ramp activation is validated by the information "TORQUE=1" (enable torque activated). Therefore, the ramp operates as soon as the zero torque information is unlocked and an operating direction (CW or CCW) selected. When CW or CCW is deactivated, the motor decelerates **in accordance with the pre-set ramp** which means that CW or CCW cannot be selected as mechanical stops.

Important remarks:

- When "TORQUE" is successively deactivated and reactivated, the speed is reduced to zero prior to following the progression of the ramp.
- The ramp function must be deactivated when a DLD with digital control is used to carry out a check on the axis position.

1.3.3.6 Logic output

- Speed detection

OUT logic output status complies with the table below:

Criterion	OUT
Speed < Limit (OUT)	• **1**
Speed > Limit (OUT)	**0**

NB: 19 rpm ≤ limit (OUT) ≤ 100,000 rpm

1.3.3.7 Monitoring reasons for stoppage

This monitoring can result in a number of current-related faults such as a stoppage or a reduction in performance via strategy selection.

Variables monitored:

- Mean drive current.
- Output current (short circuit).
- Dissipater temperature.
- Ambient temperature.
- Overspeed.
- No resolver.
- Maximum and minimum dc bus voltages.

1.3.3.8 DIGIVEX μ^{micro} Drive general technical characteristics

Power reduction with altitude	Operating power falls by 1% per 100m above 1000m up to a maximum of 4000m
Operating temperature relative humidity	Normal use: 0 to +40°C Reduction in operating characteristics in accordance with the temperature measured in the vicinity of one of the power bridge components: 2% per °C from 75°C to 99°C Stoppage when this temperature is greater than or equal to 100°C. Drive stoppage when the ambient temperature measured on the electronic map is greater than or equal to 70°C. 85% (without condensation)
Storage temperature	-30°C to + 85°C
Chopping frequency	8 kHz
Current bandwidth	600Hz to -3dB
Speed bandwidth	Up to 200Hz
Minimum speed	0.05 rpm or 1/8000th of maximum speed
Vitesse maximale	Pilotable par le DIGIVEX : 100 000 tr/min
Static speed accuracy for zero load variation at rated current and for DIGIVEX μ^{micro} Drive rated voltage	With analog instruction: 1% regardless of speed
Electrical protection	Galvanic insulation of power bridge Mean current protection in line with drive rating Pulse current protection of drive and motor Rms current protection of motor Protection against short circuits at bridge output
Mechanical protection	IP20 in accordance with CEI 529
Degree of pollution	UL: 2 To be assembled in a shielded enclosure
Other monitoring devices	Drive temperature Resolver supply

1.4 Compliance with standards

The CE mark of this product is shown on the descriptive label affixed to the equipment.

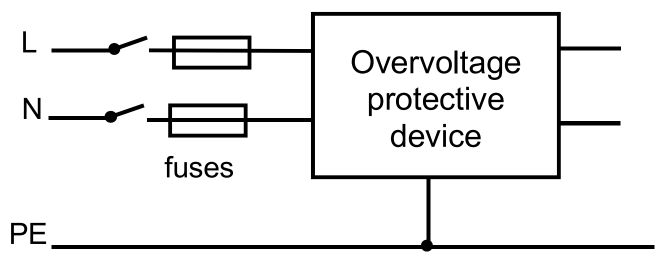
The DIGIVEX μ^{micro} Drive products have the CE marking under the European Directive 89/336/EEC as amended by Directive 93/68/EEC on electromagnetic compatibility as well as under the Electrical Safety Directive or Low Voltage Directive 73/23/EEC amended by Directive no.93/68/EEC.
The European Directive concerning electromagnetic compatibility refers to the harmonised generic standards EN 50081-2 of December 1993 (Electromagnetic Compatibility – Generic Standard for Emissions – Industrial Environments) and EN 50082-2 of June 1995 (Electromagnetic Compatibility – Generic Standard for Immunity – Industrial Environments). These two harmonised generic standards are based on the following standards:

- EN 55011 of July 1991: Radiated and conducted emissions.
- ENV 50140 of August 1993 and ENV 50204: Immunity to radiated electromagnetic fields.
- EN 61000-4-8 of February 1994: Mains frequency magnetic fields.
- EN 61000-4-2 of June 1995: Electrostatic discharge.
- ENV 50141 of August 1993: Interference induced in cables.
- EN 61000-4-4 of June 1995: Rapid transient.

The Low Voltage Directive groups all the electrical safety standards together including the EN 60204-1 Standard which covers electrical fittings on industrial machinery.

Compliance with the reference standards above implies observance of the wiring instructions and diagrams provided in this technical documentation which accompanies all equipment.

The DIGIVEX μ^{micro} Drive complies with the CEI 1800-3 product standard ("electric power drives with variable speed") with the addition of an overvoltage protection device between phase – neutral, phase – earth, neutral – earth on the power inputs in compliance with the CEI 1004-5 standard



Incorporation in a machine
The design of this equipment allows it to be used in a machine subject to Directive 98/37/CE of 22/06/98 (Machinery Directive), provided that its integration (or incorporation and/or assembly) is done in accordance with trade practices by the machine manufacturer and in accordance with the instructions in this booklet

2. ENERGY DISSIPATION

The energy a module has to dissipate is broken down into:

- Energy generated by braking.
- Energy from rectifier and power bridge losses

2.1 Braking energy dissipation

2.1.1 Calculating the power to be dissipated in the braking resistor

The permanent and pulse power levels given in the table below are limited by the characteristics of the "braking" resistors.
The mean power to be dissipated must be calculated for each axis when the application includes intensive cycles or long-duration decelerations.

$$\text{P in Watts} = \frac{J}{2}\left(\frac{N}{9.55}\right)^2 .f$$

J: Moment of inertia of the servomotor and the related load in kgm².
N: Angular speed of the motor shaft at the start of braking in rpm.
f: Repeat frequency of braking cycles in s^{-1}.

This formula is for the least favourable case. For a mechanism with substantial friction or with low reverse output, the power to be dissipated can be greatly reduced.

2.1.2 Braking energy dissipation

Braking energy is dissipated through a resistor fitted in the module.

2.1.3 Braking capacity and module losses.

Resistor value	Ω	100
Maximum current	A	3,8
Pulse power	KW	1,2
Permanent power (at 25°C)	W	10
Maximum duration	s	0,2
Repetition	%	1,6
Losses from modules (at maximum power)	W	10
Low level consumption	W	5

Definitions

Maximum current: maximum power drawn, resistance connecting is carried out at *365V*; hence, the power drawn has a maximum resistance value equal to *380*.

Pulse power: maximum power dissipated by the resistor, this power can only be drawn for a short time and in compliance with a certain cycle.

Permanent power (to 25°C): mean power that can be dissipated on a permanent basis by the resistor.

Maximum duration: maximum duration, in seconds, for which the pulse power can be required (starting from cold); the resistor must be allowed to cool down before braking again.

Module losses: losses specific to the module, the value shown in the table is that obtained when the module is used at maximum power.

Low-level consumption: consumption of the low-level power supplies in Watts.

2.2 DµD paralleling

The breaking capacity of applications requiring the use of several DµD, placed in the same electrical control cabinet, can be increased [(1) (2)]. It is only a question of linking the DC buses from all the DµD using the B4 connector provided for this purpose. The operation quite simply comprises of combining the braking capacities of all the appliances.

(1) If cycle simultaneity does not exist between the axes:
There is no synchronization between the braking axes
(2) It is possible to use the axes' synchronism according to the following cycles:
Braking of one axis whilst another axis is accelerating.
(the braking energy is used to accelerate the other axis).

Connections:

Connector	Contact	Function
B4	1	DC+
B4	2	DC-

Connections are carried out from DC+ to DC+, DC- to DC-.

Maximum number of parallel axes: 6.

Connecting copper cables section: 1 mm² minimum (cable reference: UL 1015 AWG16)

Maximum length of connection: 300mm of connecting cable (connection to be kept as short as possible).

Every axis must remain connected to the electric mains supply (it is absolutely forbidden to connect 1 axis to the mains and then use the DC bus link as a power supply for the axes connected via this connection).

Follow the electrical connection plans on pages 25 and 26, especially with regard to all axis and line fuses.

The axes linked together by the DC buses must be connected to the same electric mains supply.

A clear 10mm must be spaced between each axis.

Plan of dimensions: see page 19

Electrical connection plans: see pages 25 and 26.

2.3 Associating DµD with DLD

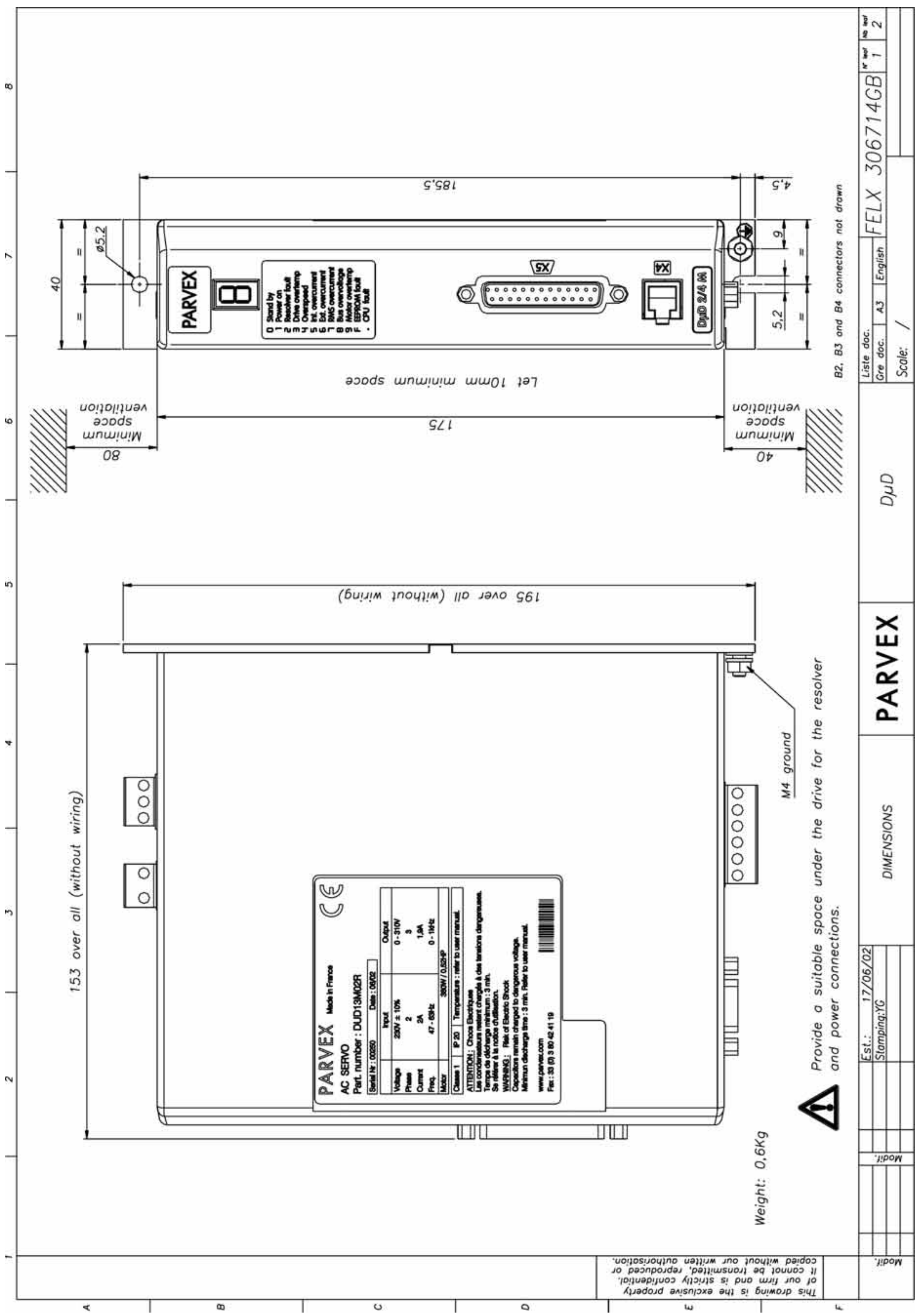
It is possible to parallel DµD axes with DLD axes. The constraints are the same as those described in section 2.2.

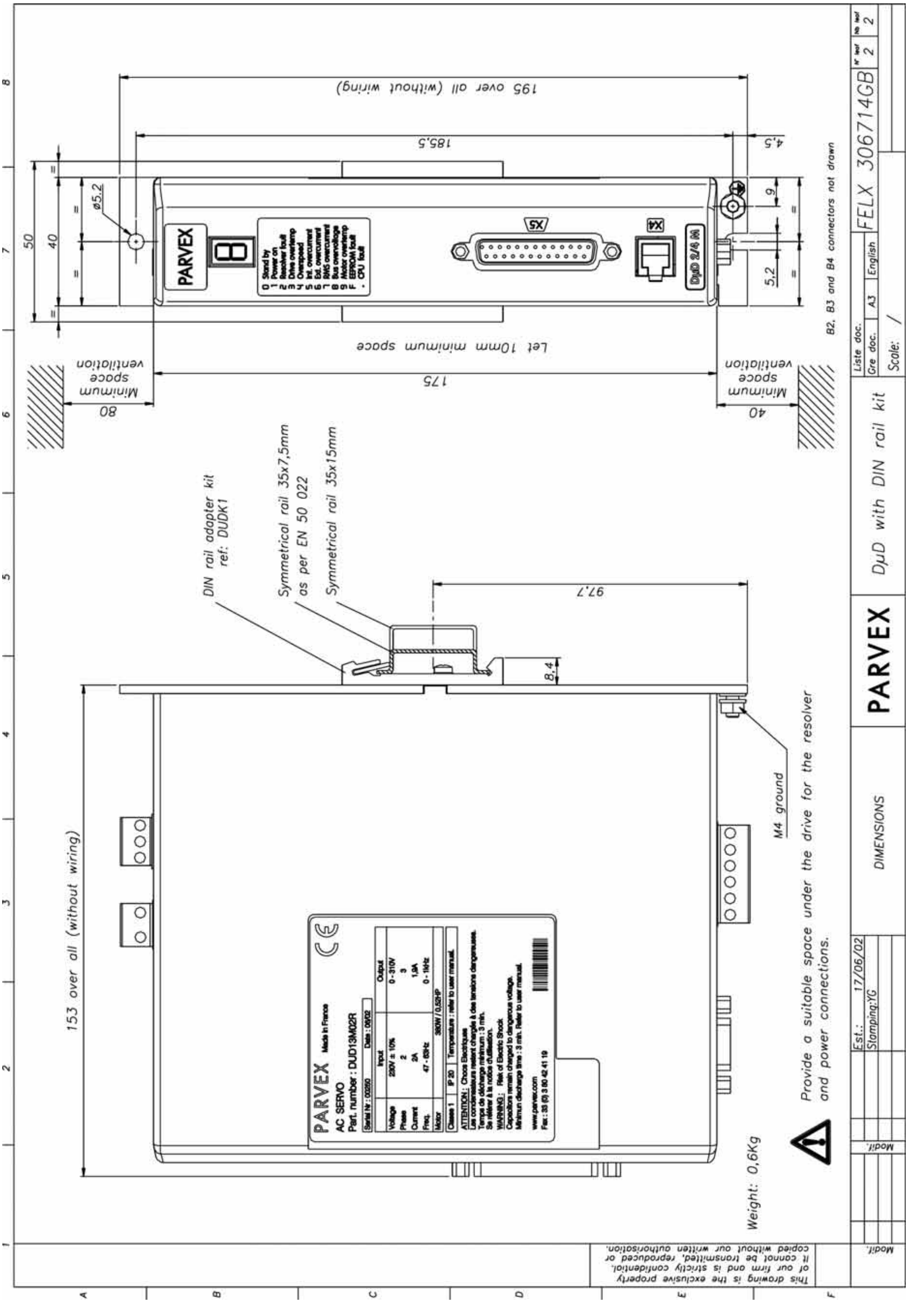
3. DIMENSIONS, ASSEMBLY, MASS, LABELLING, CODES

3.1 Dimensions, assembly and mass

See following pages, drawings

- FELX 306714GB


185,5
4,5
40
ø5,2
9
5,2
B2, B3 and B4 connectors not drawn
Let 10mm minimum space
175
80
40
Minimum space ventilation
Minimum space ventilation
195 over all (without wiring)
153 over all (without wiring)
M4 ground
Provide a suitable space under the drive for the resolver and power connections.
Weight: 0,6Kg
FELX 306714GB
DμD
PARVEX
DIMENSIONS


195 over all (without wiring)
185,5
4,5
ø5,2
50
40
9
5,2
X5
X4
PARVEX
Let 10mm minimum space
175
Minimum space ventilation
80
40
B2, B3 and B4 connectors not drawn
DIN rail adapter kit ref: DUDK1
Symmetrical rail 35x7,5mm as per EN 50 022
Symmetrical rail 35x15mm
97,7
8,4
153 over all (without wiring)
M4 ground
Provide a suitable space under the drive for the resolver and power connections.
Weight: 0,6Kg
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
Est.: 17/06/02
Stamping:YG
DIMENSIONS
PARVEX
DμD with DIN rail kit
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 306714GB
2
2
Modif.

3.2 Labelling, codes

Physical identification is made using labels:

- On the DµD :
  - ∗ A descriptive label is affixed to the equipment in accordance with the model below:

Meaning of label indications:

- AC SERVO: Alternating current converter
- DµD - - - - - DµD servoamplifier code
- Serial Nr: Servoamplifier serial number
- Date: Date of manufacture
- Input: Input current
- Output: Output current
- Voltage: Rms voltage
- Phase: Phase number
- Current: Current peak value
- Freq.: Frequency in Hz
- Motor: Motor power in W and HP
- Class: Service class under the NF standard EN 60146, 1= permanent
- IP20: Protection index in accordance with the NF standard EN 60529

Codes

CODE	FUNCTION
DUD13 M02R	DIGIVEX μ^{micro} Drive single-axis Ue 230 V 2/4A single-phase

4. ELECTRICAL CONNECTIONS

4.1 General Wiring Requirements

4.1.1 Appliance handling

Please refer to the safety instructions given at the beginning of this booklet. It is strongly recommended that personnel wait for the 7-segment display, situated on the front panel, to go off before undertaking any intervention of the servoamplifier or servomotor.

4.1.2 Electromagnetic compatibility

EARTHING

- Comply with all local safety regulations concerning earthing.
- Use a metal surface as an earth reference plane (e.g. control cabinet wall or assembly grid). This conducting surface is termed the TRP, potential reference plate. All the equipment of an electrical drive system is connected up to this TRP by a low impedance (or short distance) link. Ensure the connections provide good electrical conduction by scraping off any surface paint and using fan washers. The drive will therefore be earthed via a low impedance link between the TRP and the earth screw at the back of the DIGIVEX μ^{micro} Drive. If this link exceeds 30cm, a flat braid should be used instead of a conventional lead.

CONNECTIONS

- Do not run low-level cables (resolver, inputs - outputs, NC or PC links) alongside what are termed power cables (power supply or motor). Do not run the power supply cable and the motor cables alongside one another otherwise mains filter attenuation will be lost. These cables should be spaced at least 10cm apart and should never cross, or only at right-angles.
- Except for the resolver signals, all low-level signals will be shielded with the shielding connected at both ends. At the DIGIVEX μ^{micro} Drive end, the shielding is made continuous by the Sub-D plug mechanism.
- The motor cables are limited to the minimum functional length. The yellow and green motor cable must be connected to the box or front panel terminal block with the shortest possible link.
- This usually means shielded motor cable is not required. Chokes can also be inserted into the motor phase leads.

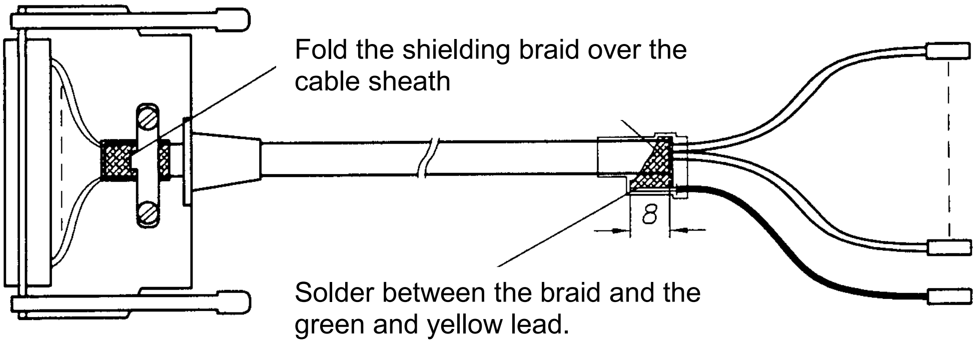
OTHER MEASURES

Self-inducting components must be protected against interference: brakes, contactor or relay coils, fans, electro-magnets etc.

4.1.3 DIGIVEX μ^{micro} Drive Sub-D plugs

It is essential, in order to ensure the system is free from interference, for the DµD to be properly connected to the earth plane of the electrical control cabinet and for the covers of the Sub-D plugs to be EMI/RFI shielded (metal with shielding braid connection). Make sure the Sub-D plugs and their covers are properly connected (lock screws fully tight).
The shielding is connected to the inside of the Sub-D covers in the following manner:

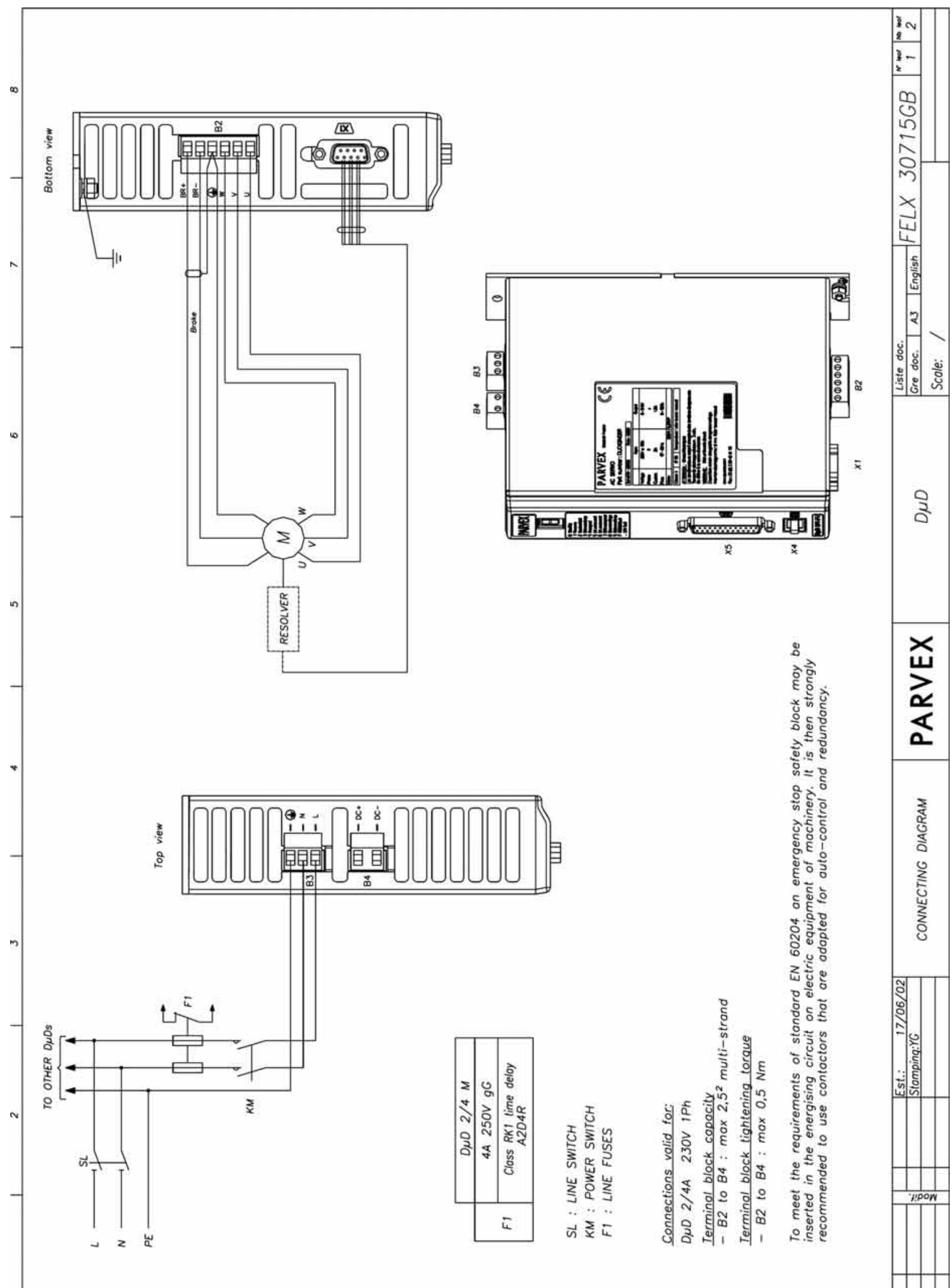
GROUND CONNECTION

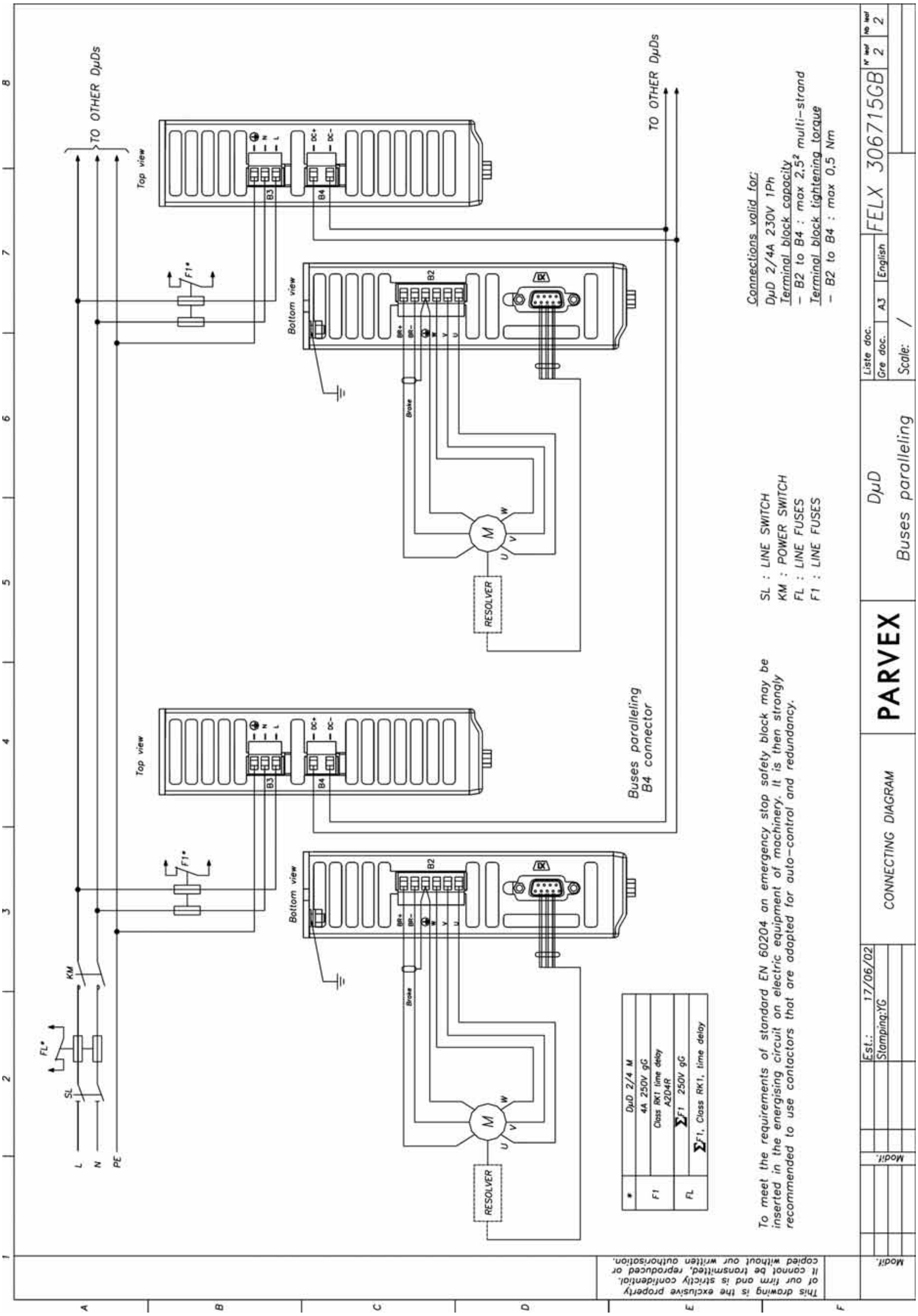


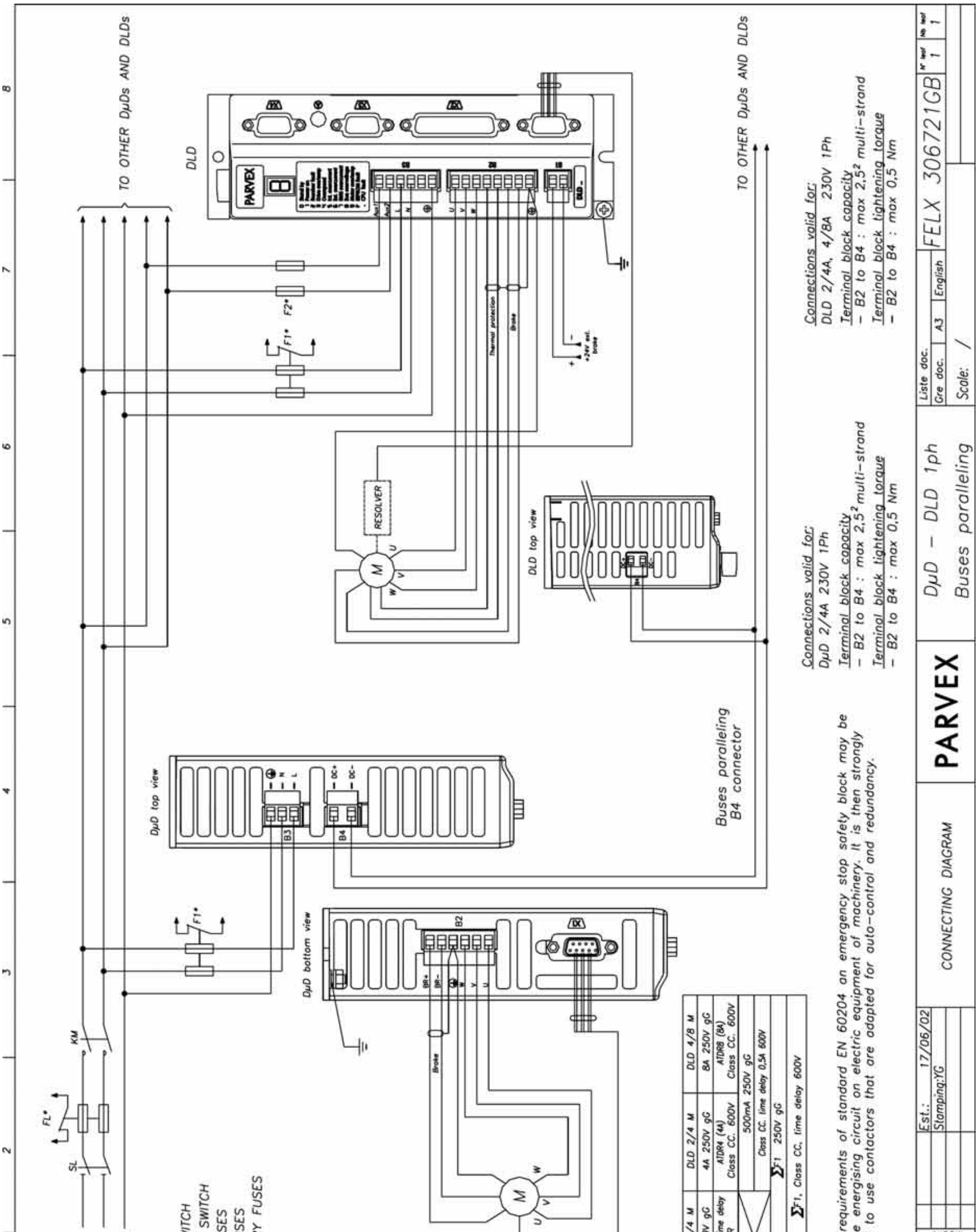
4.2 Standard connection diagram

See the following pages for drawings:

FELX 306715
FELX 306721


Bottom view
B2
BR+
BR-
W
V
U
Brake
M
U
V
W
RESOLVER
X1
X4
X5
B3
B4
Top view
N
L
DC+
DC-
TO OTHER DμDs
F1
KM
SL
L
N
PE
DμD 2/4 M
4A 250V gG
F1
Class RK1 time delay A2D4R
SL : LINE SWITCH
KM : POWER SWITCH
F1 : LINE FUSES
Connections valid for:
DμD 2/4A 230V 1Ph
Terminal block capacity
– B2 to B4 : max 2,5² multi-strand
Terminal block tightening torque
– B2 to B4 : max 0,5 Nm
To meet the requirements of standard EN 60204 an emergency stop safety block may be inserted in the energising circuit on electric equipment of machinery. It is then strongly recommended to use contactors that are adapted for auto-control and redundancy.
PARVEX
CONNECTING DIAGRAM
DμD
FELX 30715GB
Est.: 17/06/02
Stamping:YG
Liste doc.
Gre doc.
A3
English
Scale: /
Modif.
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.


TO OTHER DµDs
Top view
Bottom view
B2
B3
B4
Brake
RESOLVER
M
U V W
SL
KM
FL*
F1*
L
N
PE
Buses paralleling
B4 connector
DµD 2/4 M
4A 250V gG
Class RK1 time delay A2D4R
ΣF1 250V gG
ΣF1, Class RK1, time delay
To meet the requirements of standard EN 60204 an emergency stop safety block may be inserted in the energising circuit on electric equipment of machinery. It is then strongly recommended to use contactors that are adapted for auto-control and redundancy.
SL : LINE SWITCH
KM : POWER SWITCH
FL : LINE FUSES
F1 : LINE FUSES
Connections valid for:
DµD 2/4A 230V 1Ph
Terminal block capacity
– B2 to B4 : max 2,5² multi-strand
Terminal block tightening torque
– B2 to B4 : max 0,5 Nm
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
Est.: 17/06/02
Stamping:YG
CONNECTING DIAGRAM
PARVEX
DµD
Buses paralleling
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 306715GB
2
2
Modif.


TO OTHER DμDs AND DLDs
DLD
PARVEX
RESOLVER
DLD top view
DμD top view
Buses paralleling
B4 connector
DμD bottom view
TO OTHER DμDs AND DLDs
SL : LINE SWITCH
KM : POWER SWITCH
FL : LINE FUSES
F1 : LINE FUSES
F2 : AUXILIARY FUSES
To meet the requirements of standard EN 60204 an emergency stop safety block may be inserted in the energising circuit on electric equipment of machinery. It is then strongly recommended to use contactors that are adapted for auto-control and redundancy.
Connections valid for:
DμD 2/4A 230V 1Ph
Terminal block capacity
– B2 to B4 : max 2,5² multi-strand
Terminal block tightening torque
– B2 to B4 : max 0,5 Nm
Connections valid for:
DLD 2/4A, 4/8A 230V 1Ph
Terminal block capacity
– B2 to B4 : max 2,5² multi-strand
Terminal block tightening torque
– B2 to B4 : max 0,5 Nm
CONNECTING DIAGRAM
PARVEX
DμD – DLD 1ph
Buses paralleling
FELX 306721GB
Scale: /
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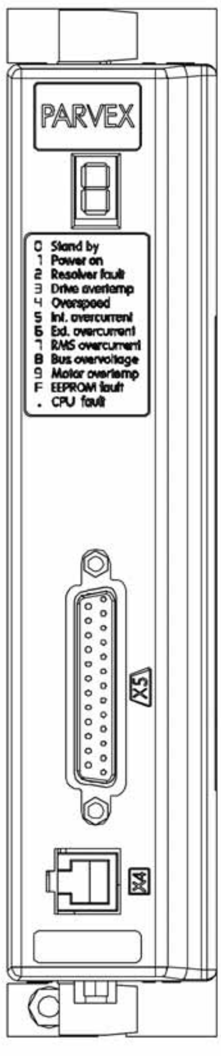
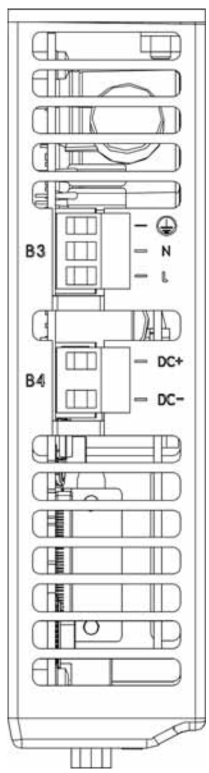
4.3 Description of terminal blocks and Sub-D plugs

All the Inputs/Outputs required for operating are arranged on the front panel; they include:

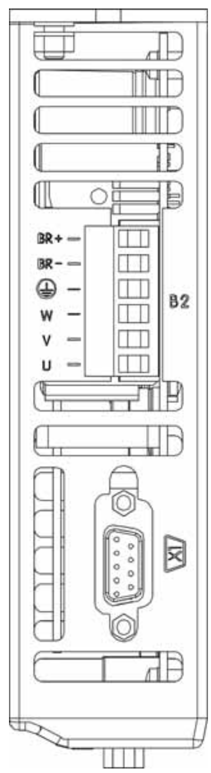
- B2 motor terminal.
- B3 power supply + auxiliary power terminal.
- B4 DC Bus terminal
- X1 RESOLVER connector.
- X5 INPUTS/OUTPUTS + encoder emulation connector
- X4 RS232 connector.



Viewed from above



Viewed from below



4.3.1 Terminal blocks B2, B3, B4

ITEM REF.	TERMINAL	Front Panel Marking	FUNCTION	TERMINAL BLOCK TYPE	TERMINAL CAPACITY
B2/1 B2/2 B2/3	U V W	B2	Motor connection	Unpluggable screw-type	Min 0.2 mm² Max 2.5 mm² flexible and rigid lead
B2/4	⏚	B2	Earth		
B2/5 B2/6	BR- BR+	B2	Connection terminals for cable with brake		
B3/1	⏚	B3	Earth	Unpluggable screw-type	Min 0.2 mm² Max 2.5 mm² flexible and rigid lead
B3/2 B3/3	N L	B3	Mains connection		
B4/1	DC+	B4	DC+ BUS	Unpluggable screw-type	Min 0.2 mm² Max 2.5 mm² flexible and rigid lead
B4/2	DC-	B4	DC- BUS		

4.3.2 Sub-D X1, X5 and RJ9-X4 plugs

4.3.2.1 Sub-D and RJ9 plug table

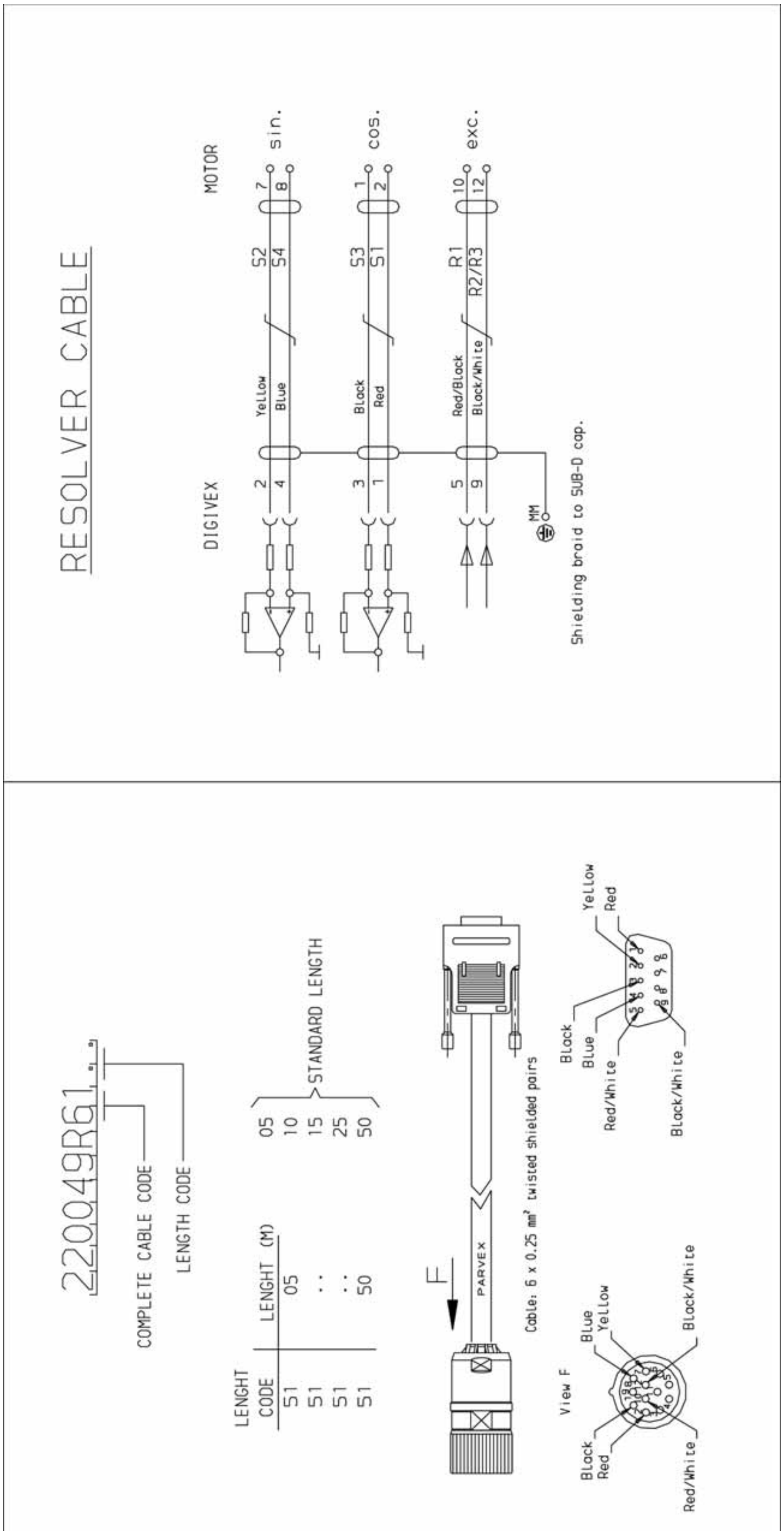
Plugs with metal-plated or metallic covers.

ITEM REF.	PLUG TYPE (cable end)	FUNCTION	MAX. CONDUCTOR CROSS-SECTION
X1 RESOLVER	9-pin plug for soldering	Resolver link	Max. 0.5 mm² on soldering barrel
X5 INPUTS/ OUTPUTS et ENCODER	25-pin plug for soldering	Logic and analog inputs/outputs Encoder emulation output	Max. 0.5 mm² on soldering barrel
X4 RS232	RJ9 8-pin plug	PC link	Max. 0.5 mm² on soldering barrel

4.3.2.2 Sub-D X1 plug: "Resolver"

DIGIVEX end connections, Sub-D 9-pin plug item ref. X1
Maximum conductor cross-section: 0.5 mm²

CONTACT	TYPE	FUNCTION
1	Input	Cosine S1
2	Input	Sine S2
3	Input	Cosine S3
4	Input	Sine S4
5	Output	Excitation R1
6		
7		
8		
9	Output	Excitation R2 / R3


RESOLVER CABLE
DIGIVEX
MOTOR
Yellow
Blue
Black
Red
Red/Black
Black/White
S2
S4
S3
S1
R1
R2/R3
sin.
cos.
exc.
MM
Shielding braid to SUB-D cap.
220049R61
COMPLETE CABLE CODE
LENGTH CODE
LENGHT CODE
LENGHT (M)
51
05
10
15
25
50
STANDARD LENGTH
F
PARVEX
Cable: 6 x 0.25 mm² twisted shielded pairs
View F
Red/White
Black/White

4.3.2.3 Sub-D X5 plug: INPUTS / OUTPUTS and encoder emulation

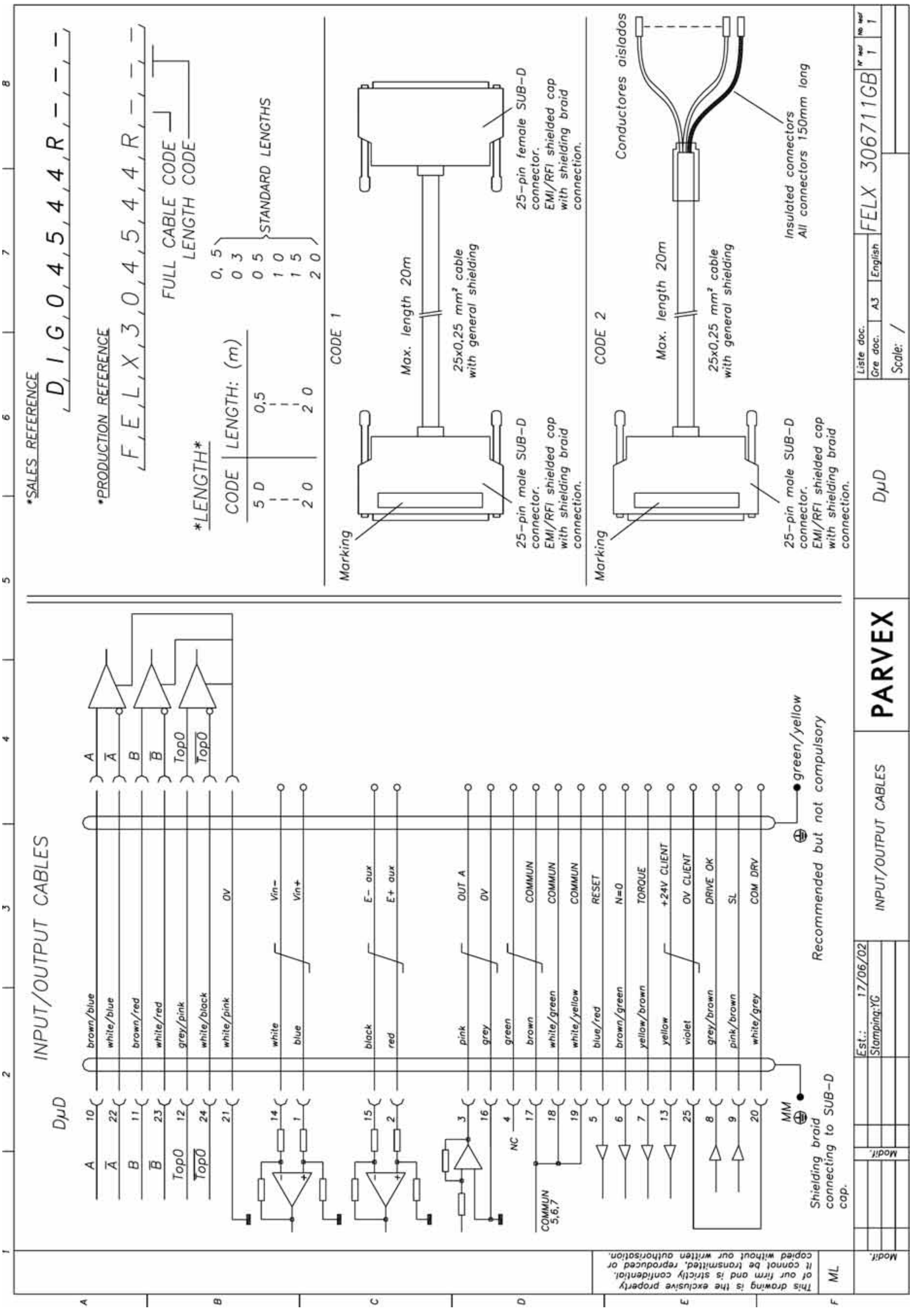
CONTACT	TYPE	FUNCTION	CHARACTERISTICS
1 14	EA1 + EA1 -	Speed or current set point ±10 V, **+** point Speed or current set point ±10 V, **-** point	Analog conversion: 13 bits + sign Differential input
2 15	EA2 + EA2 -	Analog input ±10 V, **+** point Analog input ±10 V, **-** point Input assigned to external current limitation. +/-10 V = max. current	Analog conversion: 9 bits + sign Differential input
3 16	SA1 0 V	Analog output ±5 V, **+** point ANA 0 V of analog output Output assigned to speed measurement 5 V = maximum speed	Analog conversion: Max. voltage = 5 V Max. current = 10 mA Protected against short circuits
6	EL1	N = 0: set to zero speed	These inputs must have a 24 V supply to have level 1
7	EL2	TORQUE: enables torque if input is at 1	Type 1, optocoupled 24 V logic input in accordance with standard CEI 1131-2
5	EL3	RESET: fault clearance	Type 1, optocoupled 24 V logic input in accordance with standard CEI 1131-2
17	Logic 0 V	Logic inputs 0 V For EL1+, EL2+, EL3	The logic inputs are common via the logic 0 V

EA = analog input, **EL =** logic input, **SA =** analog output, **SL =** logic output

Sub-D X5 plug: INPUTS / OUTPUTS and encoder emulation (cont.)

CONTACT	TYPE	FUNCTION	CHARACTERISTICS
8 18	SL2 Logic 0 V	DRV OK: drive status	Optocoupled PNP 24 V output Max. 50 mA
9 19	SL1 Logic 0 V	OUT speed detection	Optocoupled PNP 24 V output Max. 50 mA
20	Logic 0 V		
13 25	+24 V logic Logic 0 V	+24 V power supply input 0 V power supply input	Max. voltage : 35V Max. current = 160mA
24	SL	$\overline{\text{Top 0}}$	
22	SL	$\overline{A}$	Encoder emulation
23	SL	$\overline{B}$	
12	SL	Top 0	RS 422 output level
10	SL	A	
11	SL	B	Differential output
21	0 V	0 V	

EA = analog input, **EL =** logic input, **SA =** analog output, **SL =** logic output

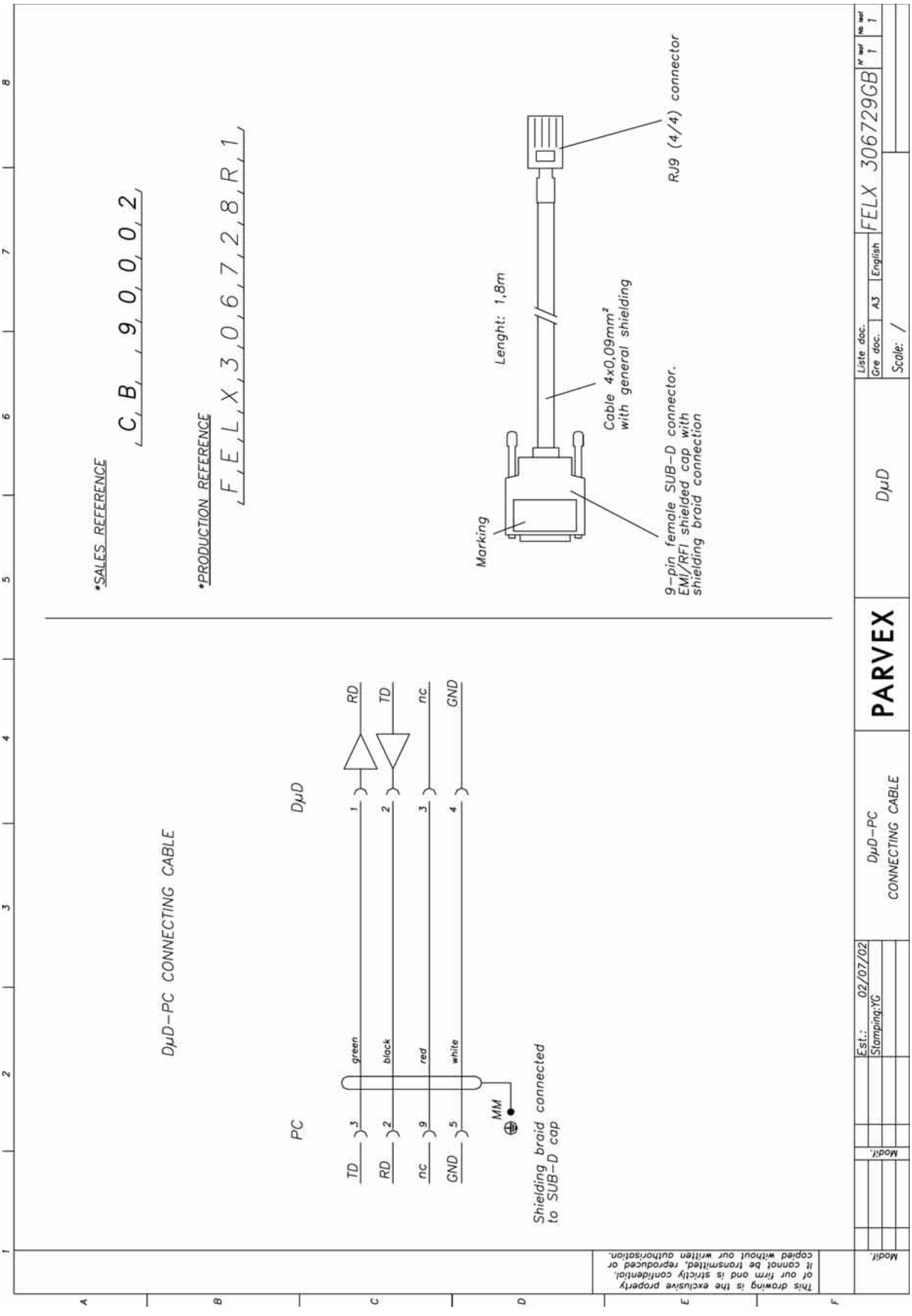

INPUT/OUTPUT CABLES
DμD
*SALES REFERENCE
D I G 0 4 5 4 4 R - - -
*PRODUCTION REFERENCE
F E L X 3 0 4 5 4 4 R - - -
FULL CABLE CODE
LENGTH CODE
LENGTH
CODE | LENGTH: (m)
5 D | 0,5
2 0 | 2 0
0, 5
0 3
0 5
1 0
1 5
2 0
STANDARD LENGTHS
CODE 1
Max. length 20m
25x0,25 mm² cable with general shielding
25-pin male SUB-D connector. EMI/RFI shielded cap with shielding braid connection.
25-pin female SUB-D connector. EMI/RFI shielded cap with shielding braid connection.
Marking
CODE 2
Conductores aislados
Insulated connectors All connectors 150mm long
Shielding braid connecting to SUB-D cap.
Recommended but not compulsory
green/yellow
MM
brown/blue
white/blue
brown/red
white/red
grey/pink
white/black
white/pink
white
blue
black
red
pink
grey
green
brown
white/green
white/yellow
blue/red
brown/green
yellow/brown
yellow
violet
grey/brown
pink/brown
white/grey
0V
Vin-
Vin+
E- aux
E+ aux
OUT A
COMMUN
RESET
N=0
TORQUE
+24V CLIENT
0V CLIENT
DRIVE OK
SL
COM DRV
A
B
Top0
NC
COMMUN 5,6,7
PARVEX
Est.: 17/06/02
Stamping:YG
Liste doc.
Gre doc. A3 English
Scale: /
FELX 306711GB
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
Modif.

4.3.2.4 RJ9 connector - X4: "RS232"

- Serial link configuration:
  - 9600 bauds
  - 8 data bits
  - 1 start bit, 1 stop bit
  - No parity
  - No galvanic insulation

DµD RJ9 connector		PC 9-pin Sub-D plug	
			1
2	TD (TXD)	RD (RXD)	2
1	RD (RXD)	TD (TXD)	3
			4
4	0 V	0 V	5
			6
			7
			8

This input is for linking with a computer (PC) for parameter loading and setting via the DIGIVEX μ^{micro} Drive Module PME software.


DμD-PC CONNECTING CABLE
PC
DμD
TD
RD
nc
GND
3
2
9
5
green
black
red
white
1
2
3
4
RD
TD
nc
GND
MM
Shielding braid connected to SUB-D cap
*SALES REFERENCE
C B 9 0 0 2
*PRODUCTION REFERENCE
F E L X 3 0 6 7 2 8 R 1
Marking
9-pin female SUB-D connector. EMI/RFI shielded cap with shielding braid connection
Cable 4x0,09mm² with general shielding
Lenght: 1,8m
RJ9 (4/4) connector
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
Modif.
Est.: 02/07/02
Stamping:YG
DμD-PC CONNECTING CABLE
PARVEX
DμD
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 306729GB
1
1

4.4 Connection Details

4.4.1 Mains supply characteristics

230 V single-phase modules

PARAMETER	*VALUE*
Frequency	47 - 63 Hz
Minimum voltage	150 V rms
Maximum voltage	253 V rms
Rated voltage	230 V rms *
Dc voltage achieved	140 - 357 V

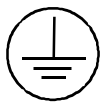
* To guarantee mechanical power
NB: power supplies required for regulation (±5 V, fans) are taken from the power bus internal dc voltage.

4.4.2 Power component dimensions

Applicable to the components ahead of the DµD (fuses, cables, contactors, etc.), the dimensions are based on:

- the permanent current $\hat{I}_0$ (sine curve peak) at the motor's slow speed, such as is given in the characteristics.
- Efficient mains power ≅ 1.1 eff. U $\hat{I}_0$
- Eff.I power source = $\frac{eff.mainsP}{eff.U\sqrt{3}} \times \frac{1}{0.65}$ in single-phase
- Eff.I power source = $\frac{eff.mainsP}{eff.U\sqrt{3}} \times \frac{1}{0.65}$ in single-phase
-

4.4.3 R Earth connection to the chassis



Chassis earth:

The cable cross-section must usually be identical to that of the mains connection in order to comply with standards in force.

4.4.4 Short circuit capacity

The DµD is suitable for use with power supply circuits capable of delivering not more than 5000 rms symmetrical amperes.
(UL 508 C)

4.4.5 Connection terminals for cable with brake

Two terminals, B2/B5 and B2/6, are accessible on the motor phase connection terminal in order to simplify the cabling. These terminals are used for connecting:

- on the one hand, a +24 V DC power supply, holding brake power supply.
- on the other hand, the connection leads for the holding brake for the motor cable fitted with these two leads.

Data conveyed to terminals B2/5 and B2/6 is not used for monitoring or for DµD protection.

The brake cable shielding must be connected at both ends:

- motor connector end
- terminal B2/4 drive connector end

4.5 Servomotor connection

4.5.1 Power cable definition

Caution!!! Only use copper core cables

The power/drive connector cables must have as a minimum requirement:

- 3 x insulated conductors connected to U, V, W phases. Cross-sections as in the table below.
- 1 x earth conductor (green/yellow).
- 2 x shielded twisted pairs for connection of the holding brake (if fitted). Cross-section of about 1mm².

Power cable cross-section
Cable cross-sections shown in the table below make allowance for:

- rated drive current.
- Motor - drive distance, loss in operating voltage = RI.
- ambient temperature, cable loss of Joules = RI².
- standardized increase of cable cross-sections.

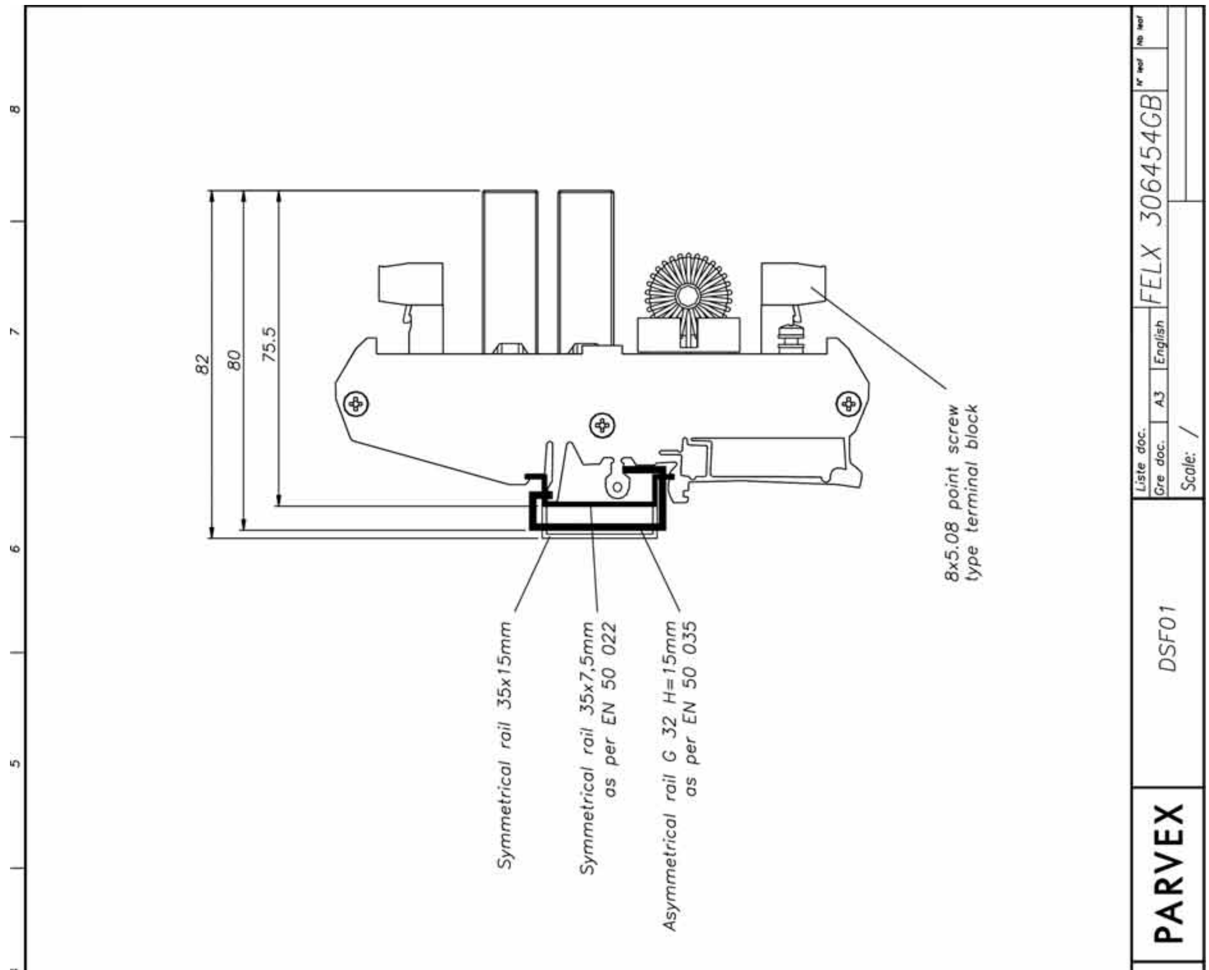
The cable cross-section to be used is shown in the table below:

Distance ➔	0m 50m
DIGIVEX rating	Cable cross-section in mm²
2/4	0.5

Guidelines for long cables

Copper cable length	Standard	L ≤ 20 m	20 < L ≤ 50 m
	Shielded	L ≤ 15 m	15 < L ≤ 50 m
2/4		-	DSF01

- DSF01: box of three resistor controlled coils to be fitted on DIN rail placed between the DµD and the motor.
- Keep the default value (8kHz + PWM mode 1) in the window Servo-control settings / PME Hardware
- Please contact us for information on cables longer than 50 m.


82
80
75.5
Symmetrical rail 35x15mm
Symmetrical rail 35x7,5mm as per EN 50 022
Asymmetrical rail G 32 H=15mm as per EN 50 035
8x5.08 point screw type terminal block
88.5
125.5
DSF01
DRIVE
MOTOR
PARVEX
DIMENSIONS
FELX 306454GB
Liste doc.
Gre doc.
A3
English
Scale: /
Est.: 13/04/01
Stamping:YG
Modif.
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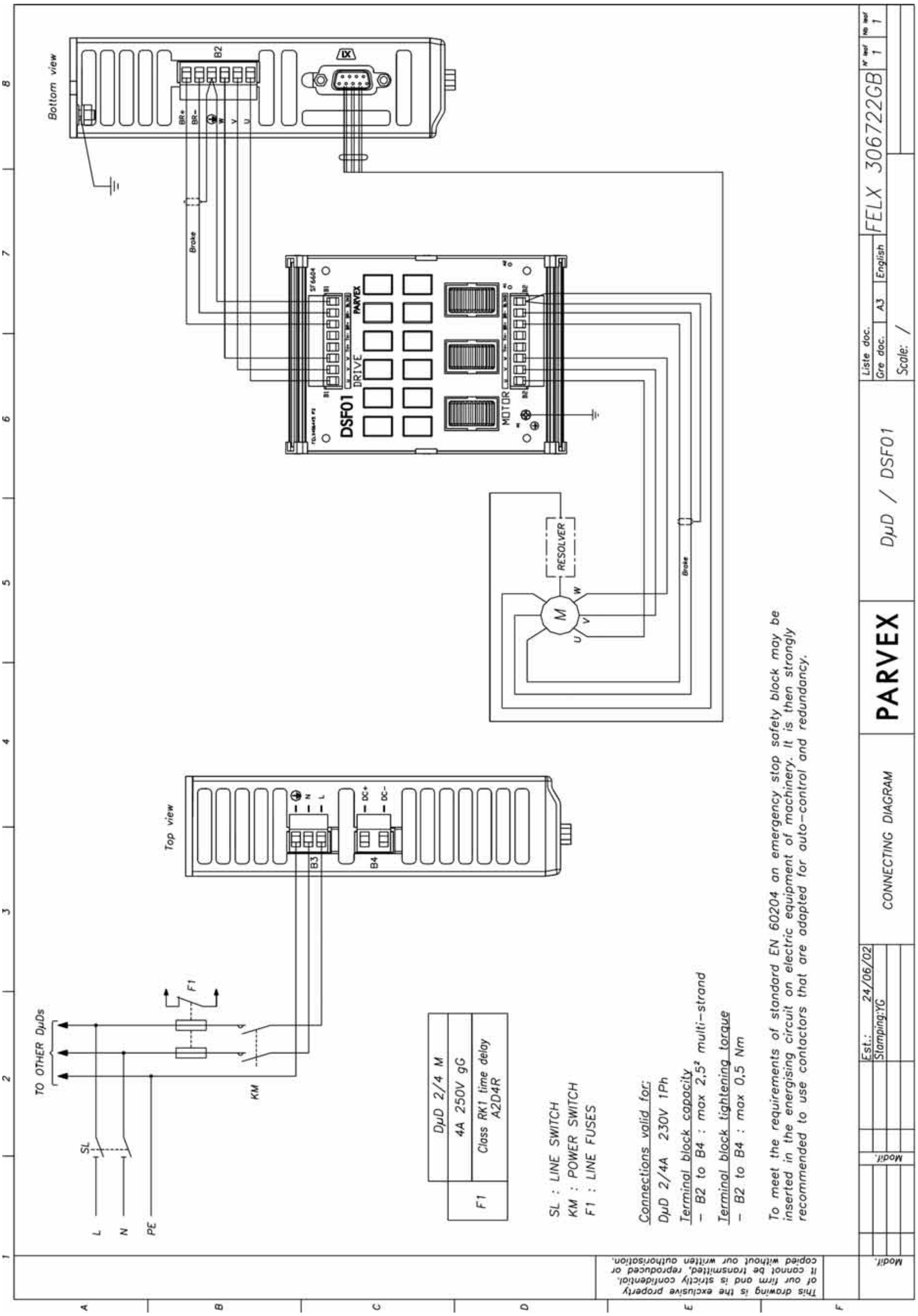
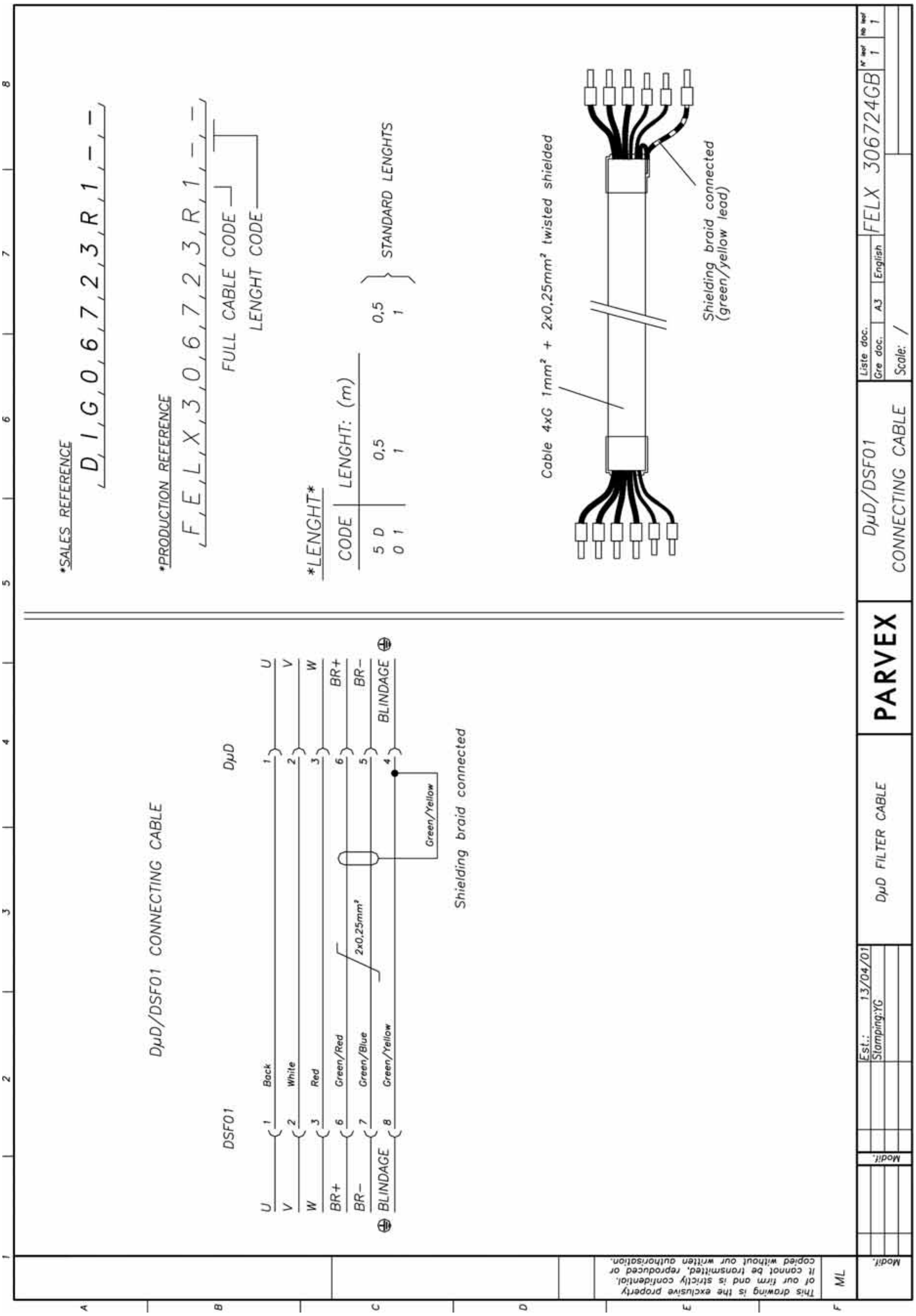

Bottom view
B2
BR+
BR-
W
V
U
Broke
DSF01
DRIVE
MOTOR
PARVEX
RESOLVER
M
U
V
W
Brake
Top view
B3
B4
N
L
DC+
DC-
TO OTHER DµDs
SL
KM
F1
L
N
PE
DµD 2/4 M
4A 250V gG
Class RK1 time delay A2D4R
F1
SL : LINE SWITCH
KM : POWER SWITCH
F1 : LINE FUSES
Connections valid for:
DµD 2/4A 230V 1Ph
Terminal block capacity
- B2 to B4 : max 2,5² multi-strand
Terminal block tightening torque
- B2 to B4 : max 0,5 Nm
To meet the requirements of standard EN 60204 an emergency stop safety block may be inserted in the energising circuit on electric equipment of machinery. It is then strongly recommended to use contactors that are adapted for auto-control and redundancy.
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
Est.: 24/06/02
Stamping:YG
CONNECTING DIAGRAM
PARVEX
DµD / DSF01
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 306722GB
Modif.


DμD/DSF01 CONNECTING CABLE
DSF01
DμD
U
V
W
BR+
BR−
BLINDAGE
Back
White
Red
Green/Red
Green/Blue
Green/Yellow
2x0,25mm²
Green/Yellow
Shielding braid connected
*SALES REFERENCE
D I G 0 6 7 2 3 R 1 - -
*PRODUCTION REFERENCE
F E L X 3 0 6 7 2 3 R 1 - -
FULL CABLE CODE
LENGHT CODE
LENGHT
CODE
LENGHT: (m)
5 D
0 1
0,5
1
STANDARD LENGHTS
Cable 4xG 1mm² + 2x0,25mm² twisted shielded
Shielding braid connected
(green/yellow lead)
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
ML
Modif.
Est.: 13/04/01
Stamping:YG
DμD FILTER CABLE
PARVEX
DμD/DSF01
CONNECTING CABLE
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 306724GB
1
1

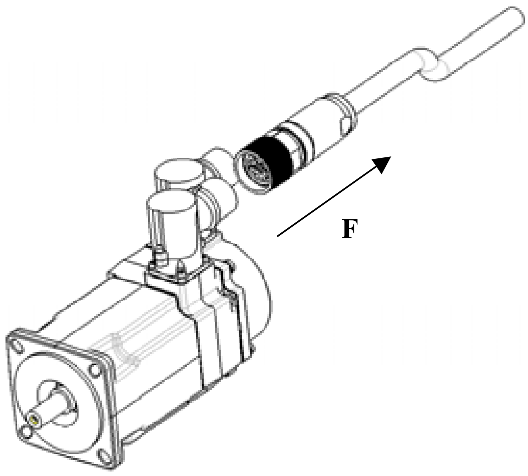
4.5.2 Motor end connection

Power connection

Connection possibilities available:

- Heavy-duty socket or output cable power connector (IP 67) for NX1, NX2 and NX3 servomotors.
- MOLEX power connector (IP 40) for NX1 and NX2 servomotors.
-

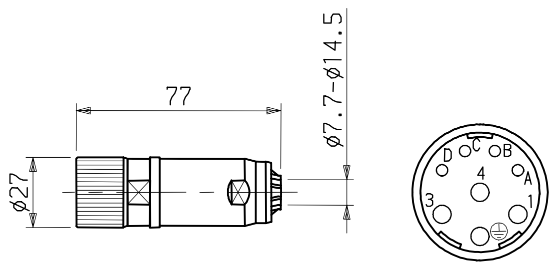
4.5.2.1 Heavy-duty socket power connector (IP 67) for NX3



Cable and plug references

REFERENCE	DESIGNATION
220065R1610	Heavy-duty power plug
6537P0019	Polyurethane cable by the metre
220049R49xx	Plug fitted cable by the metre (xx: length in metres)

View of plug 220065R1610



F View

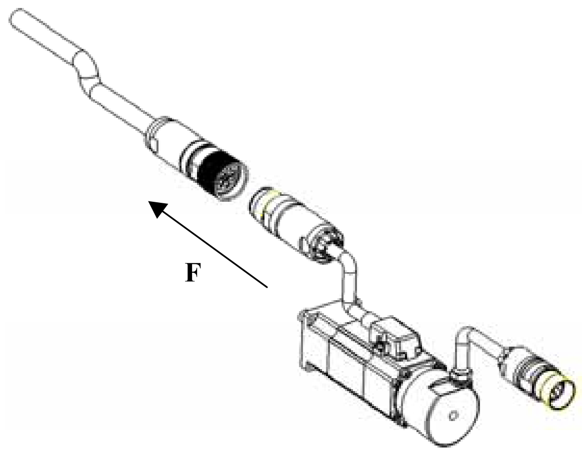
Permissible cable cross-section for plugs

Plug 220065R1610: Power & earth: 0.14 - 1.5 mm². Brake and thermal sensor: 0.14 - 1 mm²

FUNCTION	PLUG PINS Ref.: 220065R1610	CABLE COLOUR
BRAKE + BRAKE **-**	A B	Green-red Green-blue
THERMAL PROTECTION THERMAL PROTECTION	C D	Orange Yellow
EARTH	2	Yellow-green
U**2** V**2** W**2**	1 4 3	Black White Red

Do not link the "Brake and "Thermal protection" pair shielding to the motor end. It should be linked to the earth terminal at the drive end.

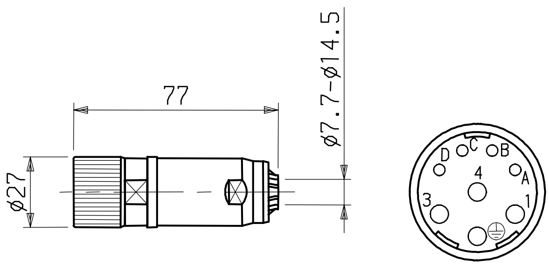
4.5.2.2 Heavy-duty output cable power connector (IP 67) for NX1 and NX2



Cable and plug references

REFERENCE	DESIGNATION
220065R1610	Heavy-duty power plug
6537P0023	Polyurethane cable by the metre
220154R32xx	Plug fitted cable by the metre (xx: length in metres)

View of plug 220065R1610



F View

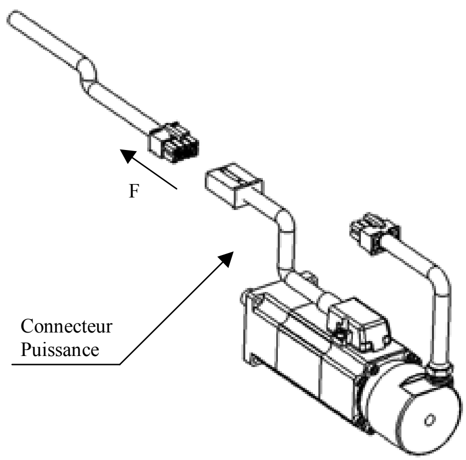
Permissible cable cross-section for plugs

Plug 220065R1610: Power and earth: 0.14 - 1.5 mm². Brake & thermal sensor: 0.14 - 1 mm²

FUNCTION	PLUG PINS Ref.: 220065R1610	CABLE COLOUR
BRAKE + BRAKE -	A B	Green-red Green-blue
THERMAL PROTECTION THERMAL PROTECTION	C D	Orange Yellow
EARTH	2	Yellow-green
U2 V2 W2	1 4 3	Black White Red

Link the "Brake" and "Thermal protection" pair shielding to the metal cover of the connector at the motor end. It should be linked to the earth terminal at the drive end.

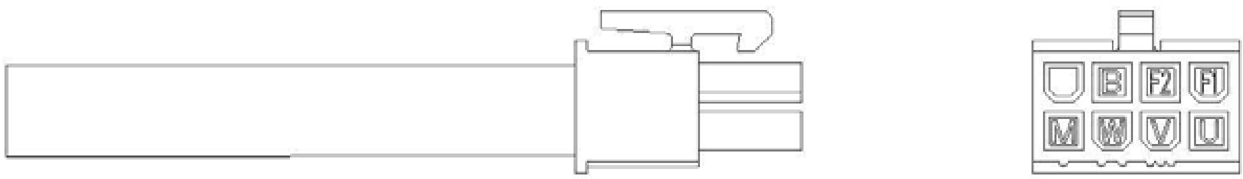
4.5.2.3 MOLEX power connector (IP 40) for NX1 and NX2



Cable and connector references

REFERENCE	DESIGNATION
220004R1000	MOLEX connector set (power and resolver)
220004R2000	MOLEX connector set with cover (power and resolver)
6537P0023	Polyurethane power cable by the metre
220154R12xx	MOLEX connector fitted cable by the metre (xx: length in metres)

View of MOLEX connector



F View

Function	Pins	Cable colour
Phase U	U	Black
Phase V	V	White
Phase W	W	Red
Earth	M	Yellow-Green
Brake +	F1	Green-Brown
Brake -	F2	Green-Blue
Shielding	B	Twisted braid

4.5.2.4 Holding brake connection

Brushless motors can be fitted with a specially sized brake to hold the axis immobilized. If 24V+/-10% dc voltage is applied across the brake terminals, the brake disc is released and the motor can rotate.

The 24V dc supply used for brake control must be regulated and filtered.

4.5.2.5 Thermal protection connection

The two thermal sensor terminals are not used in the DIGIVEX μ^{micro} Drive.

4.5.2.6 Direction of motor rotation

If the wiring instructions have been followed correctly, a positive speed set point applied to the drive will result in clockwise rotation when viewed from the power shaft end.

4.5.3 Resolver connection

The resolver is a high-precision sensor, and, therefore must be wired carefully:

- separate power cable routing.
- cable made up of three pairs; each pair twisted and shielded individually (no general shielding). The shielding must be linked to the metal Sub-D plug cover.

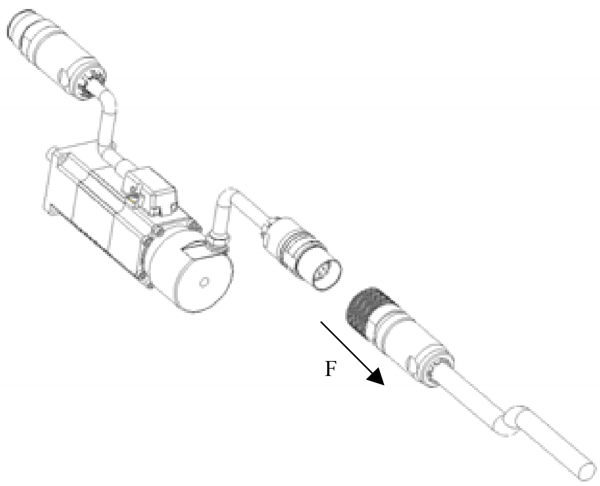
PARVEX can supply this cable in one of two ways:

- Cable fitted with a Sub-D plug at the drive end and a connector at the motor end:
- Heavy-duty resolver connector (IP 67)
- MOLEX resolver connector (IP 40)
- We **strongly recommend** this ready-to-use cable.
-
- Separate cable; in this case please follow the cabling instructions in the drawings below.
-

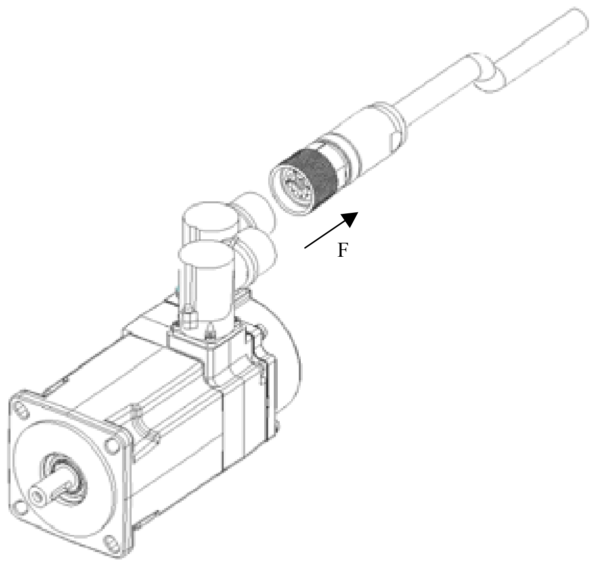
Maximum distance between resolver and DIGIVEX μ^{micro} Drive: 50m. (Please contact us for information on longer cables).

Maximum cross-sections for Sub-D plugs: 0.5 mm².

4.5.3.1 Heavy-duty resolver connector (IP 67)



NX1, NX2

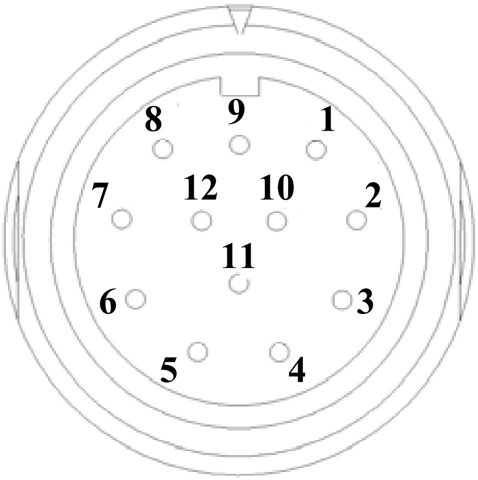


NX3, NX4, NX6

Cable and plug references

REFERENCE	DESIGNATION
220065R4621	Heavy duty resolver plug (solder-fit contacts)
6537P0001	Polyurethane resolver cable by the metre
220049R61xx	Polyurethane resolver cable with heavy-duty plug fitted at the motor end and a 9-pin Sub-D plug at the drive end

View of resolver connector removable plug (ref.: 220065R4621)



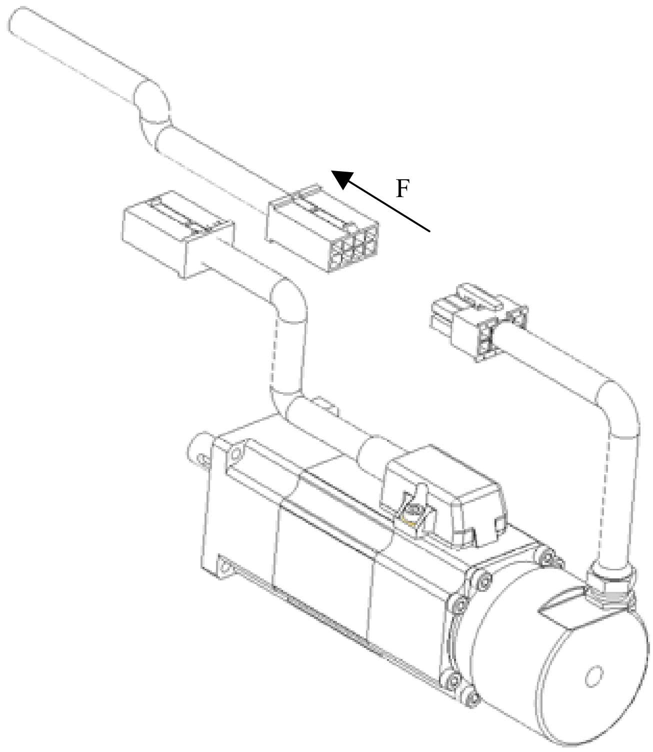
F View

Function	Connector pins	Cable colour	Sub-D pins
Sine (S2)	7	Yellow	2
Sine (S4)	8	Blue	4
Cosine (S3)	1	Black	3
Cosine (S1)	2	Red	1
Excitation (R1)	10	Red/White	5
Excitation (R2)	12	Black/White	9
Shielding (B)	11	Twisted braid	Metal cover

Maximum permissible cross-sections for connector removable plug: 0.14 - 1 mm² (solder-fit contacts).

The shielding must not be linked to the motor end.

4.5.3.2 MOLEX resolver connector (IP 40) for NX1 and NX2



Cable and connector references

REFERENCE	DESIGNATION
220004R1000	MOLEX connector set (resolver and power)
220004R2000	MOLEX connector set with cover (resolver and power)
6537P0001	Polyurethane resolver cable by the metre
220154R21xx	Polyurethane resolver cable with a MOLEX plug fitted at the motor end and a 9-pin Sub-D plug at the drive end (xx: length in metres)

View of MOLEX connector

F View

Function	Connector pins	Cable colour	Sub-D pins
Cosine (S1)	S1	Red	1
Sine (S2)	S2	Yellow	2
Cosine (S3)	S3	Black	3
Sine (S4)	S4	Blue	4
Excitation (R1)	R1	Red/White	5
Excitation (R2)	R2	Black/White	9
Shielding (B)	B	Twisted braid	Metal cover

Maximum permissible cross-sections for connector removable plug: **0.35** mm² (solder-fit or crimp-fit contacts) for all wires and **1.34** mm² for the shielding (B)

Link the shielding to the MOLEX connector B terminal.

4.5.4 Input/Output cable

REFERENCE	DESIGNATION
CB08304	Input/output cable by the metre
DIG04544R2xx	Input/output cable fitted with a 25-pin Sub-D plug (xx: length in metres)
DIG04544R1xx	Input/output cable fitted with two 25-pin Sub-D plugs (xx: length in metres)

Please refer to section 4.3 for the functions and characteristics and the FELX 306711 drawing

4.5.5 RS232 serial link cable (PC – Drive)

REFERENCE	DESIGNATION
CB90002	RS232 cable – 9-pin Sub-D plug at the PC end, and an RJ9 connector at the drive end. Length: 1.80m

Please refer to section 4.4 for the functions and characteristics and the FELX 306729 drawing

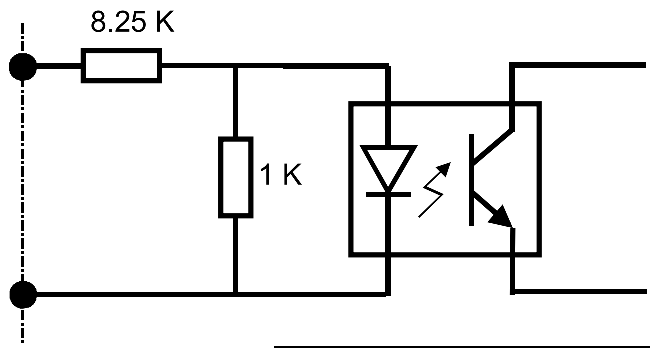
5. AUTOMATIC CONTROL INPUT / OUTPUT FUNCTIONS AND CHARACTERISTICS

5.1 Input / Output Characteristics

5.1.1 Logic inputs

- 24 V dc optocoupled inputs (100 V isolation voltage)
- type 1 inputs under European standard CEI 1131-2
- these inputs can be connected directly to PNP type outputs (no external load resistor required)
-
-

LOGIC INPUTS



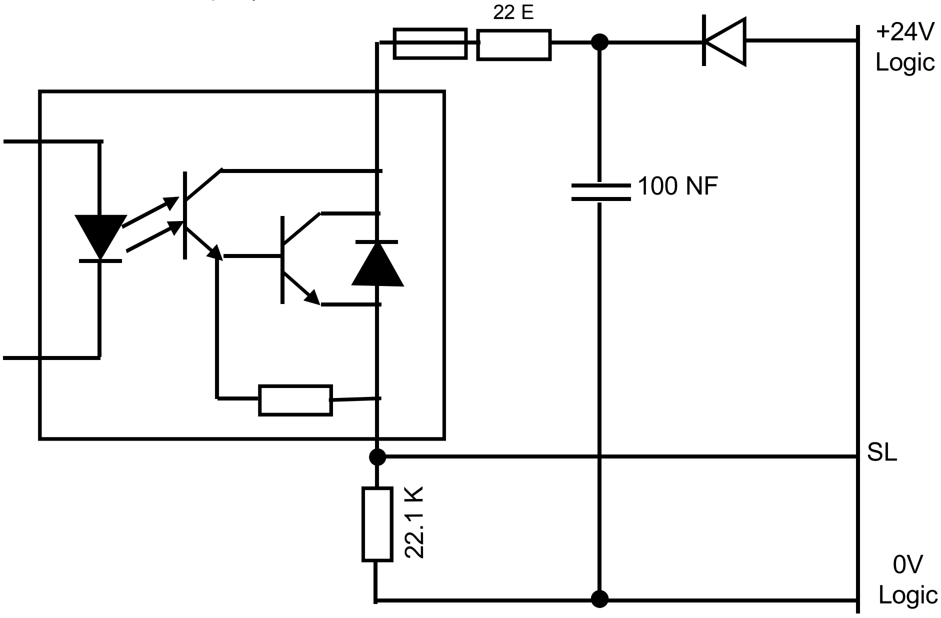
	MIN.	TYPICAL	MAX.
Level 0 input voltage	-	0 V	5 V
Level 1 input voltage	15 V	24 V	30 V
Level 0 input current	-	0mA	0.5mA
Level 1 input current	1.7mA	2.8mA	3.6mA
Ton response time (0 to 1)	-	1 ms	-
Toff response time (1 to 0)	-	1 ms	-

5.1.2 Logic outputs

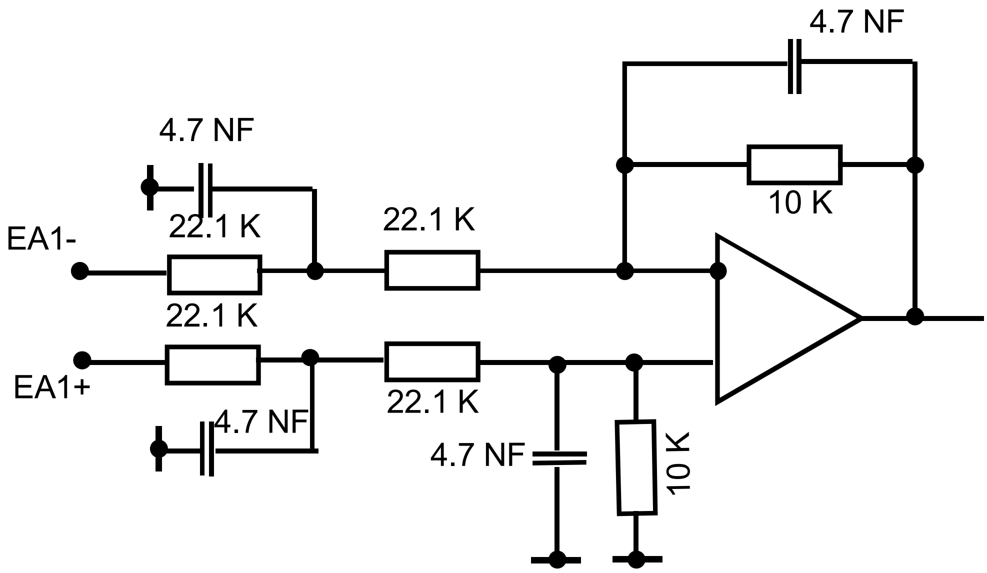
The outputs are fed by an external 24 V (24 V terminal 13 and 0 V terminal 25). The two 0 V outputs are linked to terminal 25.

- Maximum authorized output current (level 1) : 50 mA
- Residual current (level 0) : Negligible
- Response time : 1 ms
- Voltage drop : 2 V
-

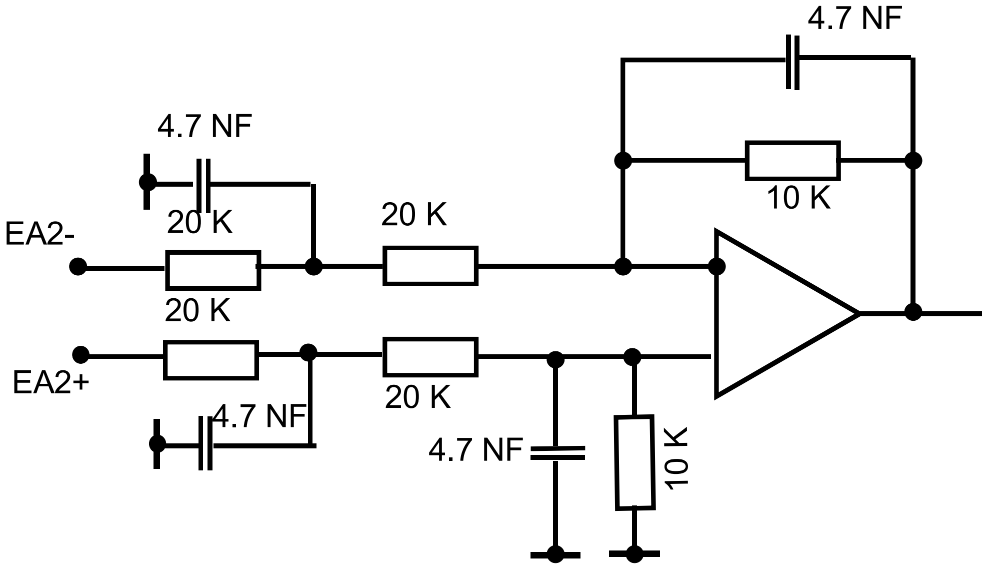
Opto-isolated output, the load being for connection to the 0 V logic (i.e.: between the two contacts allocated to this output).



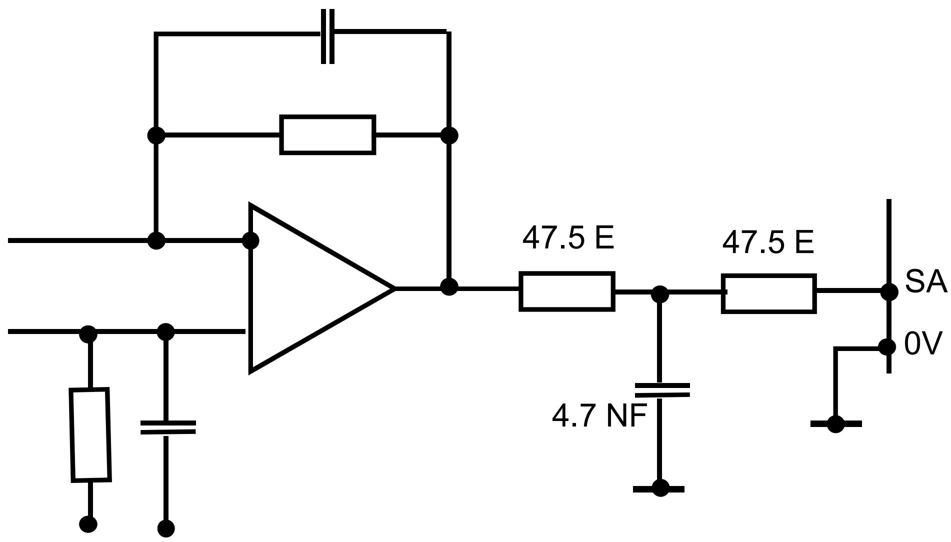
5.1.3 Speed set point input



5.1.4 Current limitation input



5.1.5 Analog output



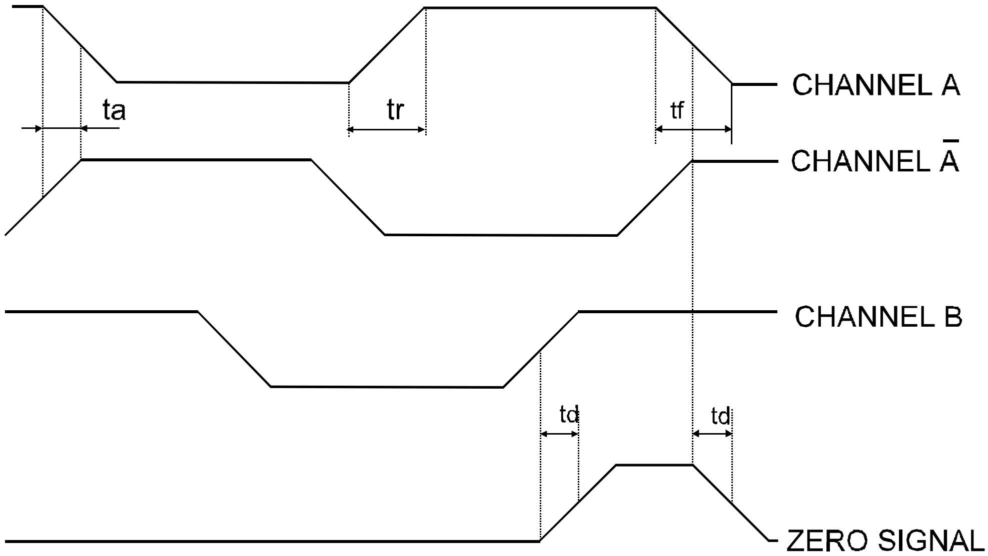
CAUTION!!!
± 5 V maximum output voltage

5.1.6 Encoder emulation

Electrical characteristics
The electrical output interface meets standard RS 422 for differential serial links. The circuit used is an MC26C31 "LINE DRIVER". The electrical characteristics are, therefore, closely related to the use of this component.

Short-circuit capability
A single output can be short-circuited at 0 V at any given time

Signal form
Signal levels:

- U high ≥ 2.5 V for I high ≥ -20mA
- U low ≤ 0.5 V for I low ≤ 20mA
- 

Switching time:

Rise or fall time defined from 10% to 90% of the magnitude in question, without cable and without load.

tr = tf = 4ns (typical value)

Time delay between direct and complemented channels

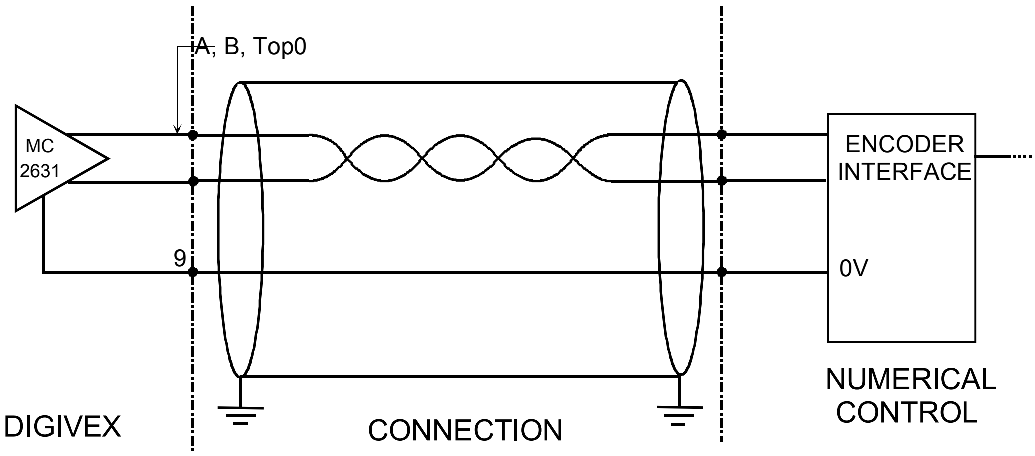
Time delay defined at 50% of magnitudes in question without cable and without load.

-6ns ≤ ta ≤ 6ns (maximum)

Time delay between channels A, B and the zero mark 0

Time delay defined at 50% of magnitudes in question without cable and without load.

-6ns ≤ td ≤ 6ns (maximum)



Encoder emulation

The resolver is above all a position sensor. It is used to measure the position of the rotor relative to the stator.

This function allows the transformation of the signal from the resolver into a series of pulses identical to those from an incremental encoder: A, B, 0 and their complement.

Programming resolution and the zero mark position

This is done using PME software.

Resolution

Adjustable between 16 and 16384, either by +/- keys, or by entering the number directly (off-line only).

Zero mark setting

Setting by teaching with the PC working "on-line".

When the operator judges the position is suitable, he/she confirms by acknowledging the zero mark.

5.2 RESET and DRV OK output

- X5/5	**Reset +**
- X5/17	**Reset -**

A 24 V status applied to X5/5 relative to X5/17 induces the reset after a drive fault.
It is worth noting that the reset can also be carried out by turning the power supply to the drive off completely.
This control has no effect during normal operating conditions. The system must be "reset" after any active fault.

- X5/8	**DRV OK+**
- X5/18	**DRV OK-**

- This logic output is at 1 when the drive is operating correctly (motor operational).
- This logic output is at 0 when the drive shows an operating fault or when the drive power supply voltage is below the minimum operating voltage (140 V dc).
- This logic output shifts from 1 to 0 in the following cases:
  - on drive fault
  - on normal stoppage, obtained by turning the power supply to the drive off.
- This logic output shifts from 0 to 1 in the following cases:
  - when the drive is powered-up
  - when the reset control is used, if the cause of the drive fault is no longer present.

5.3 Initialization Sequence

After the power supply has built up:

To	⇐ Mains supply present
To + 1s	⇒ Motor operational

5.4 Stop sequence

5.4.1 Normal stoppage

Normal stoppage is achieved by deliberately opening the main contactor.

To	⇐ contactor opened
To + delay	⇒ The "DRV OK" output of the X5 plug shifts to 0 for minimum Bus voltage. This off-load time depends on the activity of the drive during this phase. The motor continues to be driven until this output is switched over.

5.4.2 Stoppage due to a fault

To	⇐ Fault detection, the DRV OK output shifts to 0
To + 20ms	⇒ Fault type displayed. The motor can no longer be driven.

6. SERVOCONTROL PARAMETER FUNCTION AND SETTING

6.1 Servocontrol Parameter Functions

6.1.1 List of parameters

Regulation selection:

- Speed Proportional: P
  - ⇒ Proportional and integral: PI
  - ⇒ Proportional and double integral: PI²
- Current regulation

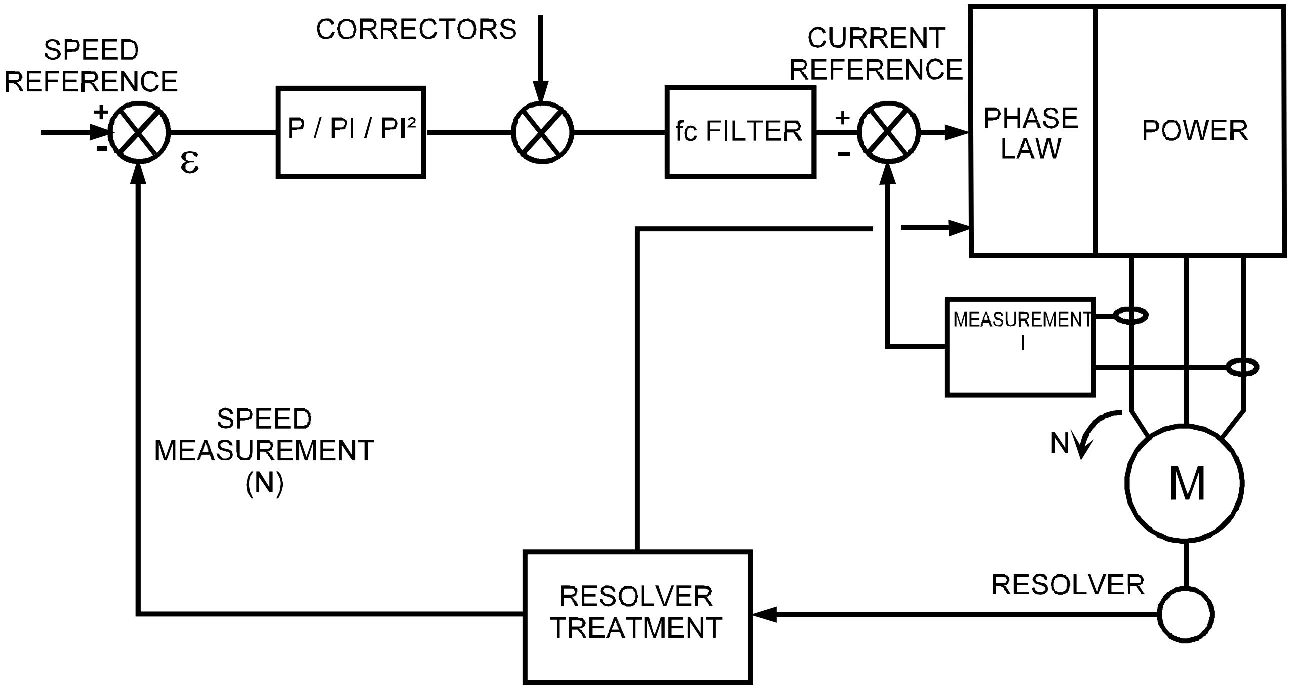
In all cases:	**Minimum value**	**Maximum value**
• Filtering frequency	20 Hz	800 Hz
• Offset	- 3.4% V max.	+ 3.4% V max.
• Current limitation	0 A	I pulse - drive
For speed regulation (P, PI, PI²)		
• Maximum speed	100 rpm	100,000 rpm
• Speed for 1V	10 rpm	14,150 rpm
• Proportional gain	I pulse - drive/156	I pulse - drive x 210
• Integration stop	0.1 Hz	100 Hz
•		

6.1.2 Regulation selection: current, proportional, PI, PI²

Current regulation

Selecting "current" means current can be controlled directly (therefore, the motor torque through the torque coefficient Kt). This then gives 10 V = pulse peak current of the drive selected beforehand.
In this mode, the PI/PI² settings and predictors are neutralized. The only functions operative are:

- Current limitation (often reduced below the permanent drive current, so as not to trip in mean or rms values.
- The second order low pass filter (filtering frequency) for reducing the effect of any resonance.
-



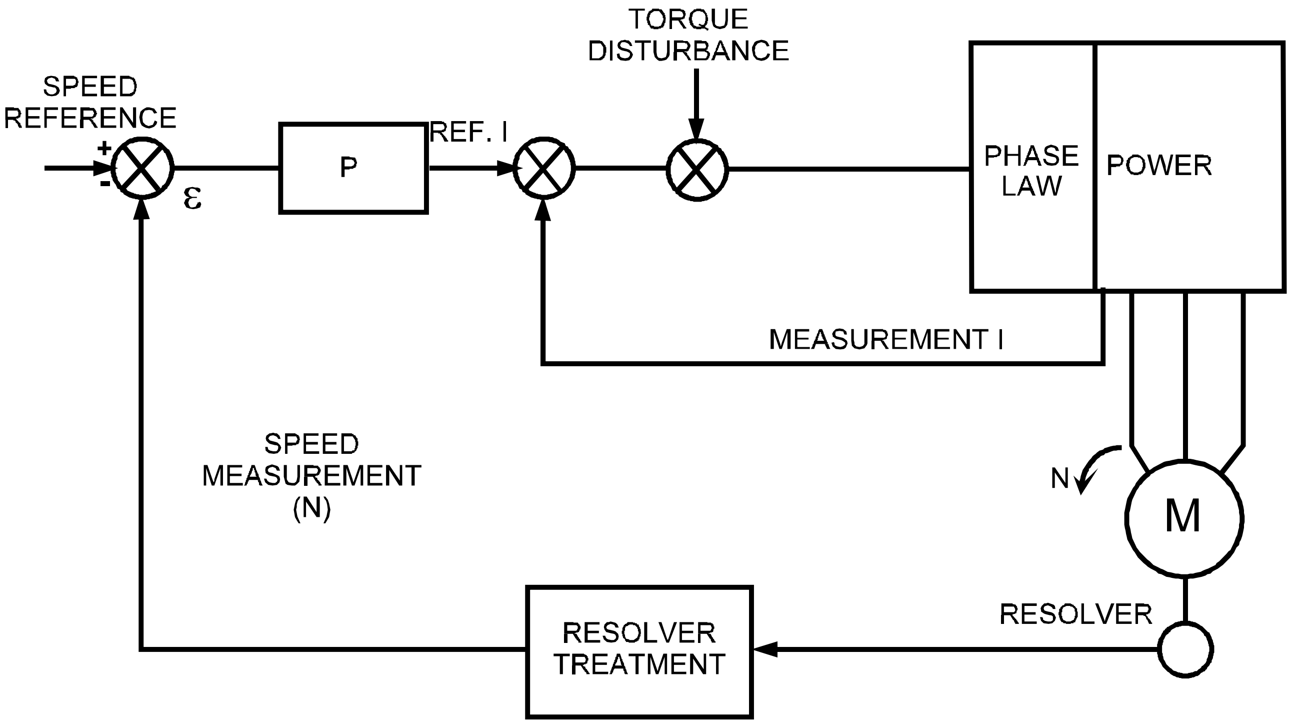
Selecting P

The drive is used in a speed loop with purely proportional gain. This gain is the ratio between the output current and the speed error. It is expressed in mA / rpm.

For the same current I, if the gain increases, the error ε is reduced, the rapidity of the system increases as does its bandwidth.

An increase in gain can lead to instability because of the other components in the loop (resonances, second order filter).

The use of proportional action P alone has the drawback of giving zero rigidity because there is no integration ahead of the current section.



Selecting PI (proportional and integral action)

Compared with P action alone, PI provides the following two modifications:

- The gain (open loop) at zero frequency is infinite. If there is a torque surge, there will be an angular discrepancy of the motor shaft in relation to idle status. This angle will be proportional to the applied torque and there will not be any permanent speed drift. The system can be said to be "rigid". This rigidity is strictly proportional to the integration stop frequency.

- The proportional gain P sets the bandwidth f_o (system rapidity). The integral action entails a -90° phase shift which creates instability. This phase shift is not troublesome at low frequencies, but it can make the system unstable at higher frequencies. It is therefore best to adjust the "integral stop frequency" correctly (0.2 - 0.3 times the bandwidth f_0).

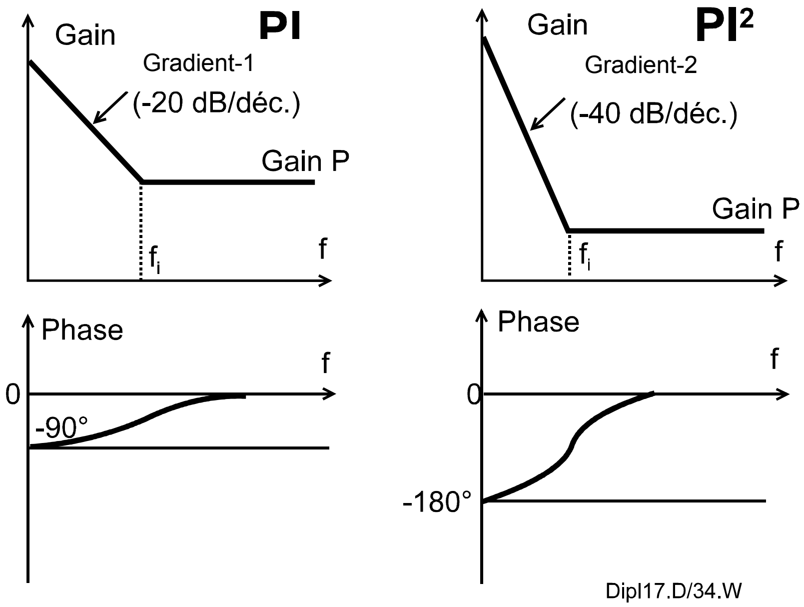
Selecting PI² action (proportional and double integration action)

Compared with P action alone, PI² provides the following two modifications:

- Rigidity when stopped is infinite. When motor torque surges, and after a transient period, the motor shaft returns to the position it was in for idle status (there is no longer any permanent position discrepancy).
- The double integral action entails a -180° phase shift at low frequencies. Poor adjustment of the integral stop frequency can entail instability in the system. Settings should be restricted to 0.1 or 0.2 times the bandwidth f_0.
-

6.1.3 Integration stoppage

Please refer to the previous paragraph for the function of this parameter. Its definition according to the Bode graphs (gain/frequency and phase/frequency) is given below



6.1.4 Speed scaling

The motor - drive unit selection determines the maximum possible speed.
The "Maximum" speed parameter can be used to reduce this maximum speed for the application. This parameter is external to the speed loop, and modifying it does not modify gain.
The "Speed for 1 volt" parameter determines the speed "gradient" (e.g. maximum speed can be obtained for 10 V, 9 V or 7 V, depending on the position control).

6.1.5 Filtering frequency

Resonance phenomenon

Many systems have one or more resonance frequencies related most of the time to mechanical phenomena: inertia or mass, associated with the rigidity of the mechanical components (belts, screws, reducing gear, frames, etc.).

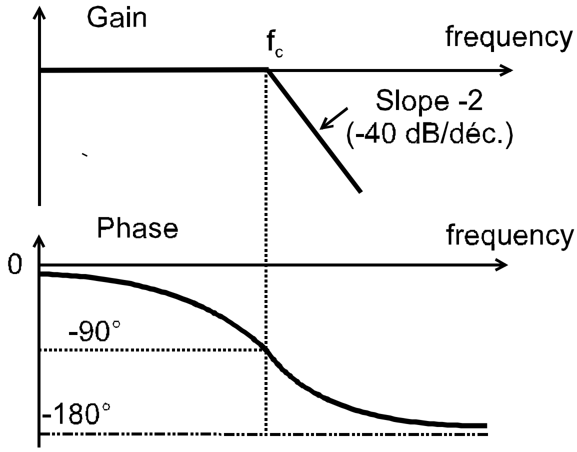
In a zone of reduced frequency around the resonance frequency there occurs:

- Marked variations in loop gain.
- Marked variations in the closed loop phase.

This leads to instabilities or "squeaking", with more or less violent oscillation.

Second order filter

This phenomenon cannot be dealt with by P/PI/PI² adjustment. If the resonance cannot be dealt with mechanically, the frequencies concerned must be eliminated. This is the function of the second order low pass filter.



6.1.6 Predictors

Purpose of predictors

Four physical phenomena:

- Vertical mass.
- Dry friction
- Friction proportional to speed.
- Acceleration.

are direct and calculable causes of modification of motor torque.
The purpose of predictors is, by calculation, to act directly on the current set point, without recourse to the speed loop and without waiting for the speed error produced by these phenomena (see block diagram).

The principle of predictor setting and work is to minimize the current set point part from the P, PI, PI² branch and therefore to reduce the speed error.

These predictors do not affect stability as they are outside the speed loop which must be adjusted first. They provide an appreciable improvement on response time.

The acceleration predictor improves stability and allows gain to be increased in any position loop superimposed on the speed loop.

However, it should be noticed that many speed servocontrols do not require the use of these predictors.

General characteristics of each predictor

- Mass or gravity compensation (vertical axis)

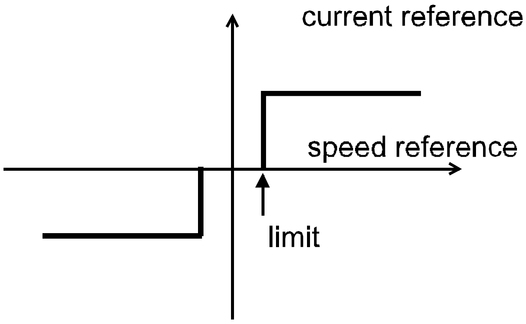
The current value, in amps, required by the motor to move the mass at constant speed (average between the up and the down) is introduced directly into the parameter.

- Dry or "static" friction

The friction force is fixed, whatever the speed. Its direction is opposed to motion; the sign therefore depends on the speed set point sign.

In this case too, the values are entered directly in amps, for the required motor current to overcome friction.

The "threshold" expressed in rpm defines a speed "band" within which this compensation is zero.



The threshold is of the order of 1/1000th of maximum speed. This zone allows torque oscillation to be reduced during rapid and repeated changes of the speed sign. This is the case, in particular, at stoppage when there is a position loop.

- "Dynamic" friction compensation

Friction proportional to speed, encountered on some mechanical components using fluids.

Value to enter: coefficient in amps / rpm

- Acceleration prediction

Depending on the total inertia (load and motor rotor) and on the desired acceleration, the torque necessary is equal to: $C = \Sigma J \cdot d\omega / dt$.

The set point is monitored therefore in order to send a set point that is proportional to inertia (fixed) and to acceleration to the current control. This is one of the limits of the system; there is no point in having a variation in the speed set point that is greater than the maximum possible acceleration of the motor, given by $d\omega / dt$ = peak torque / Σ J. Acceleration prediction is only useful if there is a ramp on the speed reference.

The parameter used is t_{pr}, prediction time, in milliseconds; t_{pr} can vary between:

- 0 ms (no prediction).
- t = td, start-up time from 0 to maximum speed with full drive current. There is then 100% correction.
-

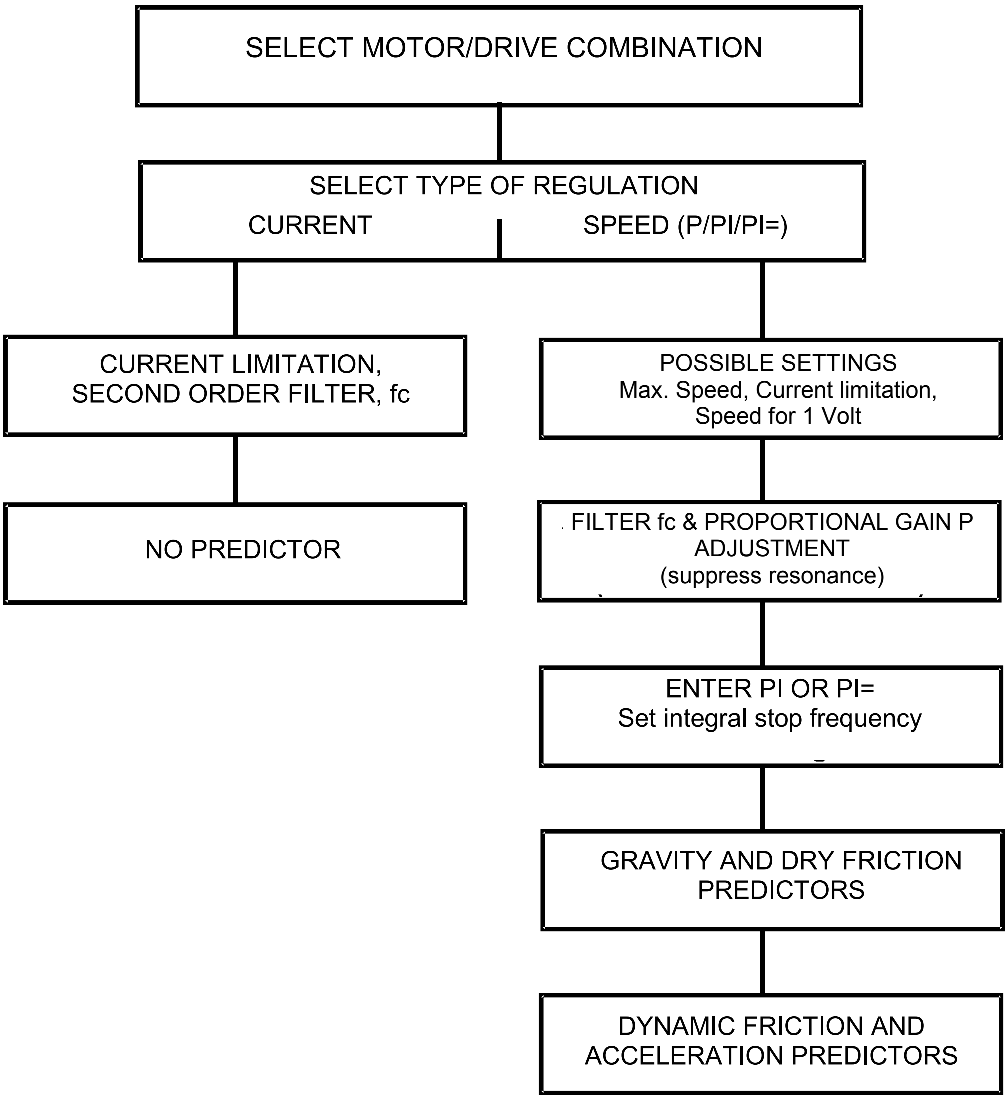
6.2 Entering parameters

Customization parameters for the motor - drive unit are entered on start-up using a PC with the PME software under WINDOWS.

Transfer of this customization to a drive with a different rating leads to the generation of a fault. The parameters contained in the EEPROM are saved.

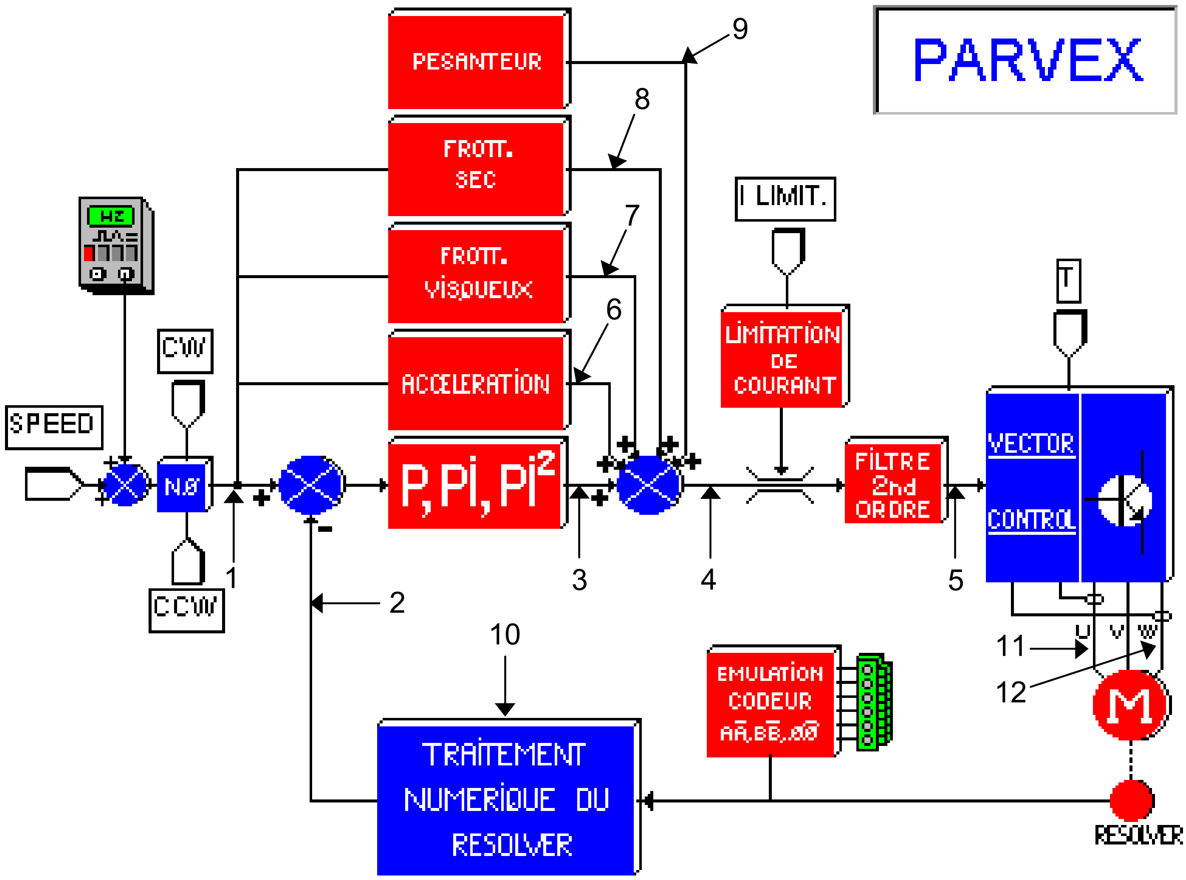
6.3 Parameter setting via DIGIVEX μ^{micro} Drive Module PME software

6.3.1 Outline



6.3.2 Internal variables

Internal variables accessible via DIGIVEX μ^micro Drive Module PME software
The following internal variables can be selected:



Reference

- 1 Input set point in rpm: speed-input
- 2 Speed measurement in rpm: speed-measure
- 3 P, PI, PI² output in amps: current-corrector-output
- 4 Sum in amps: current-output
- 5 Current set point in amps: current-filtered-output
- 6 Acceleration in amps: current-acceleration-output
- 7 Viscous friction in amps: current-dynamic-output
- 8 Dry friction in amps: current-static-output
- 9 Position in degrees: position-measure
- 10 Position in degrees
- 11 Phase current U in amps: iu-measure
- 12 Phase current W in amps: iw-measure

- Access via the name of the variable, this is valid for the 11 above plus the following variables:

- Temperature in °C: heatsink-temperature-measure
- Bus voltage in Volts: ubus-measure
- Active I in amps: id-output
- Reactive I in amps: iq-output
- Id current in amps: id-measure
- Iq current in amps: iq-measure
- Ud voltage in volts: ud-command
- Uq voltage in volts: uq_command
- Auxiliary input in volts: auxiliary-input
- Position – filtered in degrees: position-filtered-measure
- Speed – filtered: speed-filtered-measure
- Drive thermal load in %: thermic-drive-load
- Motor thermal load in %: thermic-motor-load
- Recovery thermal load in %: thermic-break-load

It should be noted that these variables can be assigned to the analog output which means that a separate oscilloscope can be used.
The "ibus-measure", "ibus-filtered-measure" and "power-bus-measure" variables cannot be accessed using the DμD drive.

6.3.3 Entering parameters via DIGIVEX μ^{micro} Drive Module PME software

Please refer to the DIGIVEX μ^{micro} Drive Module PME software instructions:

- Selecting rating
- Selecting motor (standard or special)
- Selecting resolver
- Entering servocontrol parameters (global transfer)
- Assigning inputs/outputs and variables
- Using the oscilloscope function
- Using the stimuli function

6.3.4 Setting loop parameters for speed regulation

This can be done by using the "Setting Assistant" menu or directly with the stimuli and oscilloscope.

Speed for 1 V and maximum speed
The maximum possible speed is set when the motor - drive selection is made. Here, it can only be reduced.

To control the result:

- Select a "dc" stimulus of say 1 volt.
- Check the value obtained for the "measure speed in rpm" variable using the variable watcher or oscilloscope functions.

Proportional gain adjustment

Initial status

- Switch to proportional gain P alone.
- Filtering frequency fc to maximum (800 Hz) and low gain.
- System ready to run, no predictor.

Proportional gain and filter frequency are adjusted simultaneously. If, by increasing proportional gain, the system starts to resonate, the resonance must be eliminated by reducing the filter frequency, then increasing P etc. until a compromise is found.

Maximum recommended for P

There is a maximum recommended proportional gain, depending on the drive rating, and corresponding to maximum current oscillation.

RATING	P in mA/rpm
2/4	35

NB: This gain can be exceeded under certain circumstances. Please ask for details.

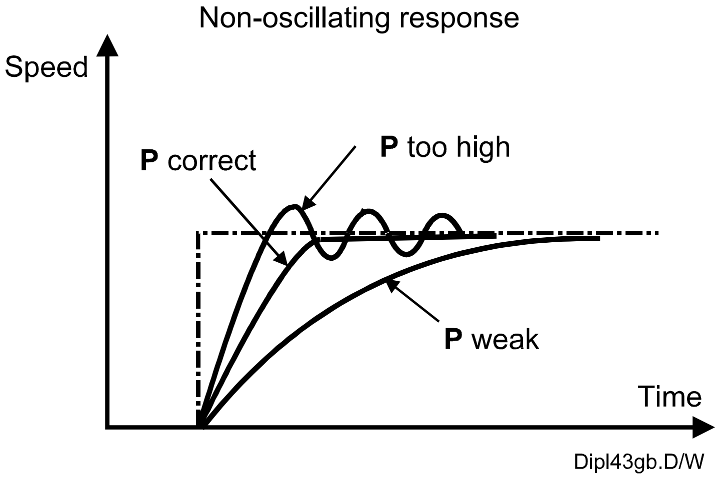
Generate a speed set point scale (0.5 to 1V).

Use the oscilloscope function to display
- Channel 1 ⇒ the input set point.
- Channel 2 ⇒ the speed measurement.
- Trigger on channel 1 at 5 or 10% of N max, leading edge.

Increase proportional gain

The stimulus is excited on-line. The response is collected at one scale of speed set point.

There are three possibilities:



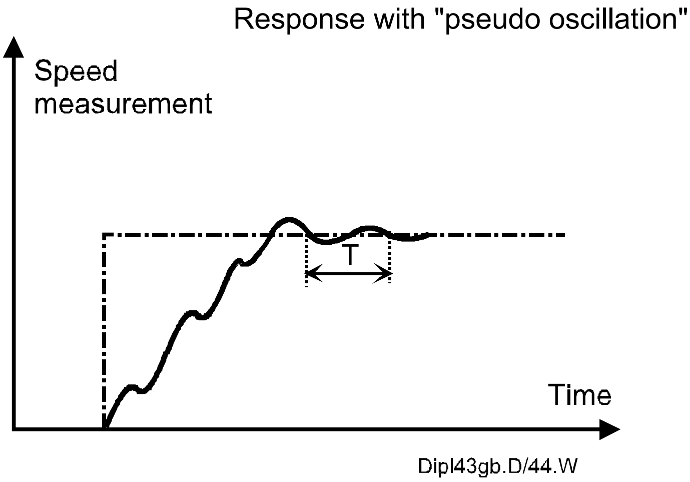
A response must be obtained without overshooting and oscillation. For example, increase gain until oscillations gradually appear; then, reduce it by 20 to 30%.

If the maximum value shown in the table is reached with proportional gain, without reducing the filtering frequency, then:

- Stop increasing P
- Reduce the filtering frequency until the limit of oscillation

Filtering frequency setting

Oscillations can appear on the response obtained above (even when speed is increasing).



This gives a frequency resonance (probably of mechanical origin) of fr = 1 /T, greater than 100Hz.

Then reduce the filtering frequency until the oscillation disappears almost completely. If that cannot be done, the maximum gain is reached.

If it is possible, gain can be increased again until a response is obtained without oscillation. Oscillation can reappear, in which case, reduce the filtering frequency a little more.

Notice that it is essentially P and the filtering frequency that determine the bandwidth.

If the resonance frequency is too low, adjust the filter frequency to a high value.

PI / PI² - integral stop frequency setting

Initial status

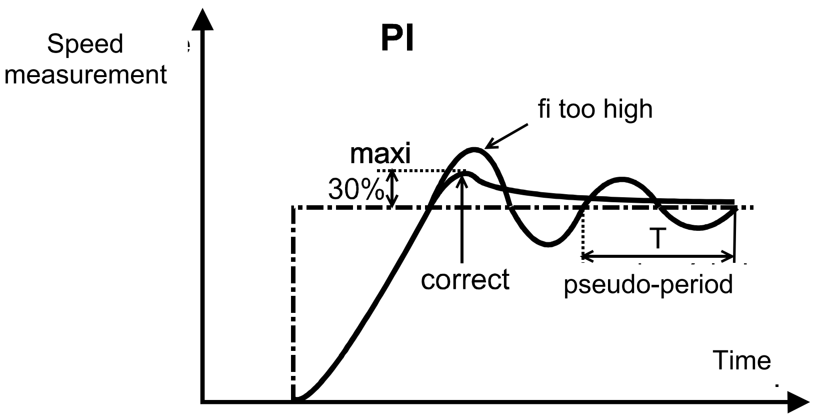
- P gain alone. P and filtering frequency setting completed.
- Integration stop frequency = 0.
- Still no integration.
- System ready to run.

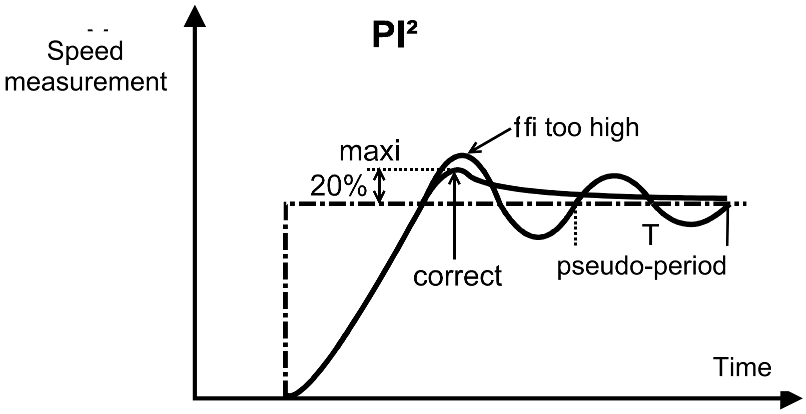
  - ♦ Select PI or PI².
  - ♦ Use the same stimuli as before (index analysis).
  - ♦ "On-line", increase the integration stop frequency until overshoot is obtained in the order of:

    VTNU25 - 30% in PI
    VTNU15 - 20% in PI²

Without oscillation.

If the frequency is too high, fairly low frequency oscillations occur (< 50Hz). Frequency must then be reduced (never readjust the proportional gain).





Do not change PI to PI² without setting the integral frequency to 0.

6.3.5 Setting predictors

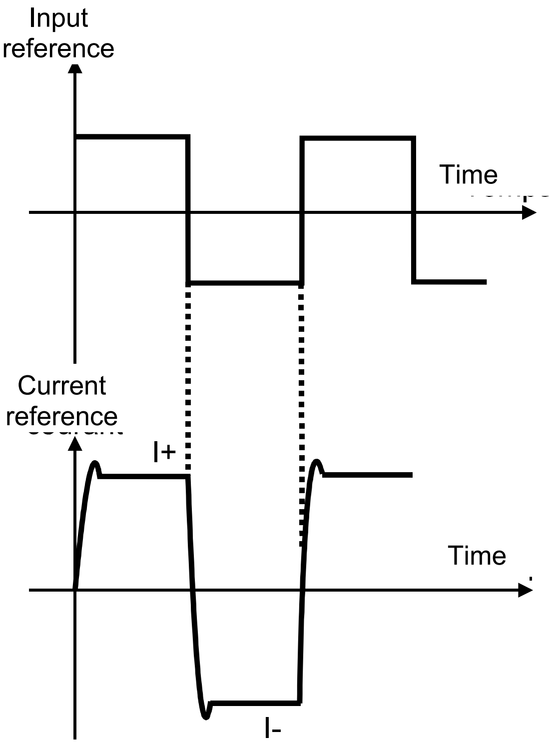
Initial conditions

- All loop parameters (P, integral and filtering frequency, maximum speed, current limitation) are set (without predictors).
- The system is ready to run.

Setting the Gravity and Static Friction predictors

Notice that the gravity factor is zero for a horizontal axis.

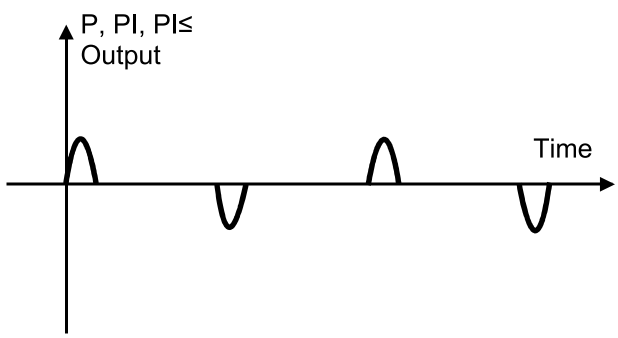
- Take a square stimulus, offset = 0, peak-to-peak value = 3 to 5% of maximum speed in rpm, frequency 0.2 to 1Hz.
- Using the oscilloscope function, display:
    - ♦ The input set point
    - ♦ The current set point



NB: I+ and I- are to be taken with their sign. In general, I- is negative.

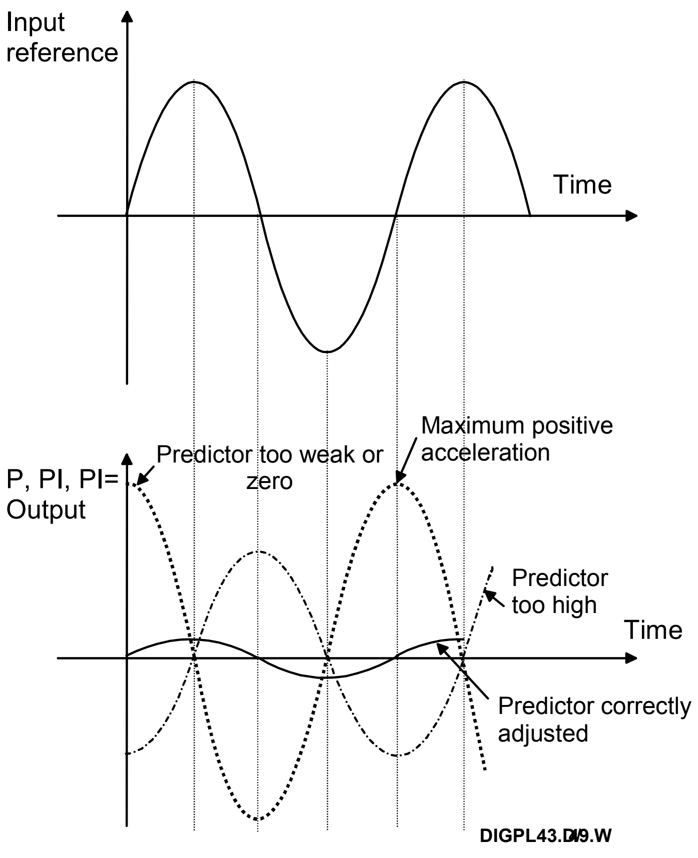
In principle:

- Gravity = $\frac{I_+ + I_-}{2}$ in amps (horizontal motion, gravity = 0).
- Static friction = $\frac{I_+ - I_-}{2}$ in amps.
- Enter these values into the parameters.
- Enter the threshold value (e.g. threshold = maximum speed / 1000).
- After introducing the values, the result obtained can be checked with the same stimuli.
- Check the input set point on one channel and the P, PI, PI² output on the other channel. This should give a result close to:
-



Setting the dynamic friction and acceleration predictors. (It is assumed that the dry friction and gravity predictors have been set).

- Use a sine stimulus, offset 0 peak-to-peak value 10 to 20% of the maximum speed, frequency 0.2 to 1Hz.
- Using the oscilloscope function, display:
    - ♦ The input set point on one channel.
    - ♦ P, PI, PI² output on the other channel.
- Acceleration predictor setting. Increase the predictor until the P, PI, PI² output is minimized. Too high a value increases P, PI, PI² with a phase change.
-



Très forte différence entre réglage optimum et pas de prédicteur.

Very marked difference between optimum setting and no predictor.

The correct setting corresponds to minimum amplitude P, PI, PI² output. The predictor must allow the P, PI, PI² output to be reduced in a ratio of at least 5 to 10.

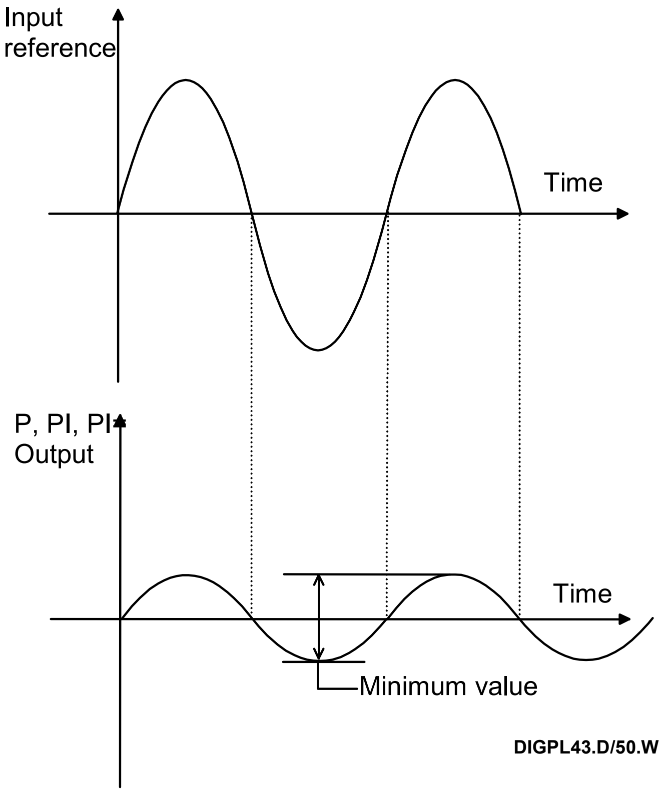
Remember that the value of t_{pr} (prediction time in ms) is close to td (start-up time), with:

$$td = \frac{(\text{Load inertia} + \text{Motor inertia}) \,.\, \omega \ \max}{\text{Maximum torque}}$$

td is the acceleration time from 0 to maximum speed with maximum torque
td in seconds, inertia in kgm², maximum ω in rd/s, torque in Nm,

- Setting the dynamic friction predictor. Once all the other predictors have been adjusted, increase the dynamic predictor to minimize the P, PI, PI² output signal.

When the setting is correct, this output should be minimum and in phase with the input set point.



6.3.6 Setting current regulation parameters

If the "current" option has been selected, the only adjustments needed are:

- Current limitation; take care in this type of application that it does not trip with mean or rms current monitoring. Current limitation is often equal to permanent current.
- Second order filter frequency. This can only be done with the "superior" regulation loop giving the current set point.

6.3.7 Other characterization parameters

Logic and analog inputs / outputs

Access via:
I/O, servocontrol parameter adjustment function.

This means that it is possible to:

- assign one of the internal variables to the 5 V analog output.
- assign a constant value (between -5 V and +5 V) to the analog output
- force the logic inputs to 0 or 1.

The logic inputs / outputs are assigned permanently.

Encoder emulation

- Selection of the number of marks between 16 and 16384 per revolution *(*off-line*)*.
- Validation by teaching of zero mark position (on-line).

Miscellaneous choices

- Selection of processing strategy for mean or rms current monitoring: current reduction or switching to "DRV OK".

7. COMMISSIONING - SERVOCONTROL PARAMETER SETTING - DETECTING REASONS FOR STOPPAGE

7.1 Commissioning sequence

7.1.1 Preliminary checks

Wiring check

- Power connections.
- Reset wiring to terminal X5
- Check the resolver connections.
    - ♦ Motor end
    - ♦ DμD end
- Check the power and brake connections.
    - ♦ Motor end
    - ♦ DμD end

Power supply type check

- Power: 50/60Hz, 230 V single-phase.

Caution: Make sure that the power bus is at 0 V before doing any work on the system. After total stoppage of the motors, wait for at least three minutes before starting work. **Wait for the 7-segment display to go off.**

7.1.2 Commissioning with the DIGIVEX μ^{micro} Drive Module PME software

- Connect the PC via the RS232 serial link
- Energize the DμD
- Go "on-line" via the PC, with the PC in interactive mode. Connect with the parameter setting functions. If this connection is not carried out:
    - ♦ Check the compatibility of the serial link configuration (PORT, BAUD RATE, etc.)
    - ♦ Check the serial link cable.
    - ♦ Check that you are using the correct interface (PC, DμD).

Once "on-line", all the parameters in the DIGIVEX μ^{micro} Drive can be read.

- Check the TORQUE input status. N = 0
- Then configure the drive. This can be done "off-line" in a file and then transferred or modified "on-line".
    - ♦ Motor selection.
    - ♦ Servocontrol parameter selection (without the power part, their validity cannot be checked).
    - ♦ Ancillary selections: analog output, safety strategy, etc.
- Use the software to force the drive to zero torque.

- Remove "zero torque" locking using the software or via hardware contact (set "TORQUE" input to 24 V)
- Carry out system adjustment using the stimuli function.
    - ♦ "dc" stimuli (square with peak-to-peak = 0). Check maximum N.
    - ♦ "Square" stimuli or setting procedure for adjusting servocontrol parameters.
    - ♦ DIGIVEX μ^{micro} Drive Module PME software for setting the predictors if necessary.

Check the driven mechanism can operate freely.

7.2 Detecting reasons for stoppage

7.2.1 Fault display - Drive function

Incidents with the drive operation can be displayed in two ways.

- On the 7-segment display situated **on the front panel of the drive**
- Via the PME software which indicates in uncoded language the nature of the problem and gives advice on corrective action.

7.2.1.1 Handling operational malfunctions

There are two types of malfunction:

- Malfunctions requiring a stoppage of the system

  As a result of these malfunctions:
  - ♦ the drive shifts to zero torque.
  - ♦ the fault is displayed on the 7-segment display.
  - ♦ the DRV OK output shifts to 0.
  - ♦ the fault is stored in the axis.

- Malfunctions leading to a reduction in the system's dynamic characteristics such as:
-
  - ♦ an excessive DµD dissipater temperature.
  - ♦ an excessive mean current drive or excessive rms motor current, if the drive parameter setting allows the operation to continue. The selection of continuing the operation with reduced current or stopping is made by selecting the "current protection strategy in the "servocontrol" window of the parameter setting software.

  As a result of these malfunctions:

  - ♦ the motor current is reduced
  - ♦ the front panel displays the data (7-segment display flashes).

7.2.1.2 Current monitoring

RMS motor current

The drive monitors the rms current [$I^2 = f(t)$] to monitor the thermal status of the motor.

The rms current is compared to the permanent permissible current at slow rotation by the motor $\hat{I}_0$ (after first order filtering following motor thermal time constant). This data which is characteristic of the motor is known to the drive when the motor - drive selection is made.

As before there is a choice between two strategies:

- ♦ Strategy 1: Stoppage due to the "DRV OK" output shifting to logic 0.
- ♦ Strategy 2: Reduction of the drive pulse current to 0.9 $\hat{I}_0$ motor. The 7-segment display flashes.

Mean current drive

A monitoring of the mean current, filtered by a time constant of 2.4s, [I = f(t)] is carried out.
The fault is detected when the mean current is equal to or greater than the drive permanent permissible current.
Depending on the strategy adopted, this fault can:

- ♦ Lead the 0 V Drive OK output to shift to 0
- ♦ Reduce the drive current to 90% of the drive permissible current.

The parameters for the strategy selection are to be found in the "Servocontrol settings" window.

Drive output current

- ♦ Excessive output current (I maximum): the drive determines whether or not the measured current exceeds the pulse current by 30%.

There is stoppage due to the "DRV OK" output shifting to logic 0.

7.2.1.3 Temperature monitoring

Temperature measured in the vicinity of the DµD power bridge components

- ♦ If the temperature is less than 75°C at the dissipater, nothing happens.
- ♦ Between 75 and 99°C, there is a reduction in the pulse current which can release the drive (the "7-segment" display flashes at low frequency).
- ♦ At 100°C, the drive stops

Ambient temperature

This is measured between the electronic boards and operations are stopped when it exceeds 70°C.

7.2.1.4 Monitoring the DC Bus voltage

Recovery fault:

Drive electrical breaking capacity needs updating, cycle too restricting.

Bus overvoltage

Drive breaking capacity much too low with regard to the application.

7.2.1.5 Other monitoring

No resolver

Resolver fault or wiring fault.

Overspeed

Speed > 1.15 times the maximum motor - drive setting.

These two cases entail a fault with:

- Data displayed on the 7-segment display

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7.2.1.6 7-segment display

Function: to provide information on DμD status discriminating between faults.
Description:

Display	Description
0	Drive live, power supply voltage < 100 VAC (140 VDC)
1	Drive OK, power present
2	Resolver fault
3	Excessive ambient or dissipater temperature
3 Flashing	Excessive dissipater temperature / current reduction
4	Excessive speed
6	Maximum drive current reached
7	Excessive mean current or excessive rms current
7 Flashing	Excessive mean current or excessive rms current: Reduction
8	Bus overvoltage
. (dot)	CPU fault
F	Back-up error
r	Recovery fault

PC SOFTWARE FAULT-FINDING	COMMENTS
Maximum drive current reached	Output short-circuit or electrical grounding
Excessive mean current	Too much current asked of drive
Excessive rms current	Too much current asked of drive. Cycle too restricting
Excessive dissipater temperature	Fan cooling stopped or excessive electrical control cabinet temperature
Excessive ambient temperature	
Resolver fault	Problem with resolver or wiring
Excessive speed	Speed reference > 10 V +15% Or speed parameter setting error
CPU fault	
Bus overvoltage	Regenerative braking impossible. Disconnection from mains supply
Motor not connected	Motor is wrongly connected
Link impossible	No power supply
Excessive mean current OR Excessive rms current	Too much mean current asked of drive. Current reduction mean current > drive rating
	Too much rms current asked of drive. Cycle too restricting. Current reduction Drive rms current > Îo motor
Excessive dissipater temperature	Too much rms current asked of drive. Cycle too restricting. Current reduction Drive rms current > Îo motor

7.2.1.7 Corrective actions

The following incidents can arise from wiring errors or mishandling:

- Resolver fault
    - ♦ Check the resolver connection.
- Drive overcurrent
    - ♦ Poor motor connection (motor phase missing).
    - ♦ Programmed motor does not correspond with the connected motor.
- Overspeed
    - ♦ Nmax. incorrectly set.
    - ♦ Accidental transition to torque regulation.
- Motor fails to run and remains without torque
    - ♦ System is set to zero torque (hardware or software input TORQUE = 0). In particular, the torque has been forced to zero during a global transfer. Reset system torque (see software manual).
    - ♦ Motor is not connected.
- Motor fails to run but torque present
    - ♦ N=0 input is set to zero (hardware or software). Check with software.

7.3 Fault description

FAULT	TYPE	ACTION
2	Resolver fault	Detection of S1, S2, S3 and S4 signal absence. Loss of resolver excitation: Veff rated value = 7 V, Frequency = 8012 Hz on R1, R2/R3. Loss of sine (S2 S4) or cosine (S1 S3) signals or too low resolver transformation ratio. Bad contact (check connectors).
3	Excessive ambient or dissipater temperature	Ambient: this is measured between the electronic boards and operations are stopped when the temperature exceeds 70°C Dissipater: temperature measured in the vicinity of the power bridge components If the temperature is less than 75°C: nothing happens 75°C < T< 99°C: there is a progressive reduction of current authorized by the drive. 100°C < T: operations stop. Can be linked to large braking cycles. Check: • Electrical control cabinet ventilation • Good circulation around the drive
4	Excessive speed	Rotation speed measured at more than 15% above the maximum application speed Check: • Drive customization inappropriate to the motor and/or the application • Speed set point more than 15% above the maximum authorized value. • Driving load
6	Maximum drive current reached	The measured current exceeds the drive's pulse current by 30%. Check: • Long length of cable • Use of shielded cable with large capacity per unit length • The motor programmed in the drive does not correspond to the connected motor

FAULT	TYPE	ACTION
7	Excessive mean or rms current	Mean current: measurement of the mean current supplied by the drive Rms current: calculation of the rms current supplied by the drive Causes: • Oversized operating cycle • Mechanical binding spot
8	Bus overvoltage	Braking recovery impossible Causes: • Oversized operating cycle • Drive braking capacity much too low with regard to the application
r	Recovery fault	Causes: • Cycle too restricting • Axis recovery capacity exceeded.