SSD Parvex SAS
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F-21007 Dijon Cedex
www.SSDdrives.com

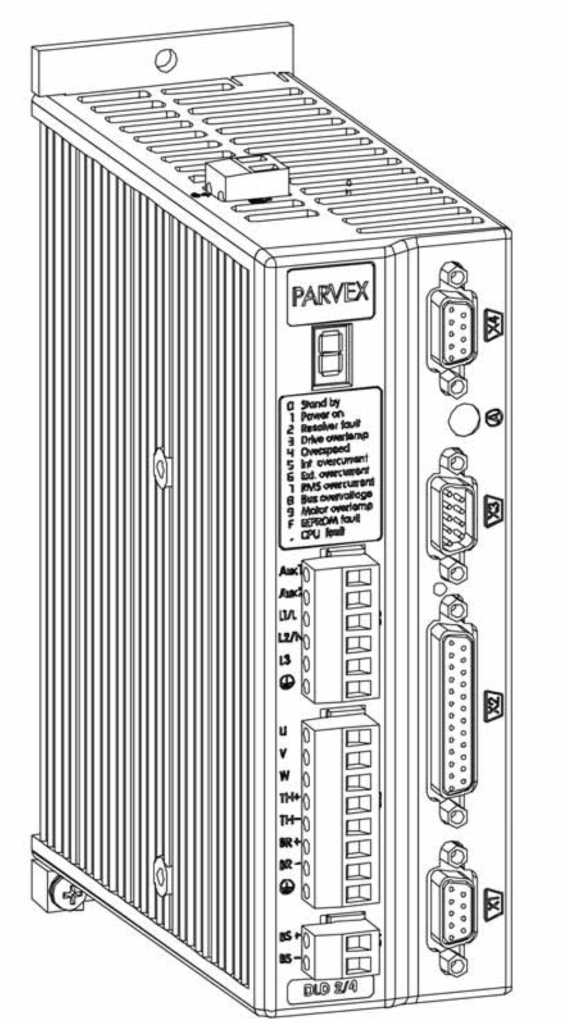
PARVEX

DIGIVEX Little Drive

DIGITAL SERVOAMPLIFIER

User and commissioning manual

PVD 3530 GB – 01/2005



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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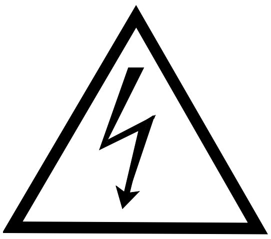
SAFETY

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

All of the drives comprise:
Brushless servomotors with permanent magnets, sine-wave e.m.f. and resolver-based position measurement (NX, LX, LS, LD range servomotors)
A box-type electronic control system including:
A power supply function for (depending on the model):

- *230 V single-phase mains supply or 230 V three-phase mains supply*

A control function corresponding to the servomotor (power and resolver) for spindle drive motor control.
This module also controls energy discharge via internal.

Two connection options are available for these servomotors:
Terminal box + resolver connector.
Power connector + resolver connector.

1.2 General Characteristics

Input voltage rating: 230V (see § 4.4.1)

TYPE	MAINS SUPPLY	CONTROLLABLE POWER	SINE PEAK PERMANENT CURRENT	PEAK MAXIMUM CURRENT	REF. PARVEX
DLD 2/4	230 V – single-phase *50/60 Hz*	*375 W*	*2 A*	*4 A*	*DLD13M02R*
DLD 4/8	230 V – single-phase *50/60 Hz*	*750 W*	*4 A*	*8 A*	*DLD13M04R*
DLD 2/4	*230 V –* three-phase *50/60 Hz*	*375W*	*2 A*	*4 A*	*DLD13002R*
DLD 4/8	*230 V –* three-phase *50/60 Hz*	*750W*	*4 A*	*8 A*	*DLD13004R*
DLD 7.5/15	*230 V –* three-phase *50/60 Hz*	*1,5kW*	*7.5 A*	*15 A*	*DLD13007R*

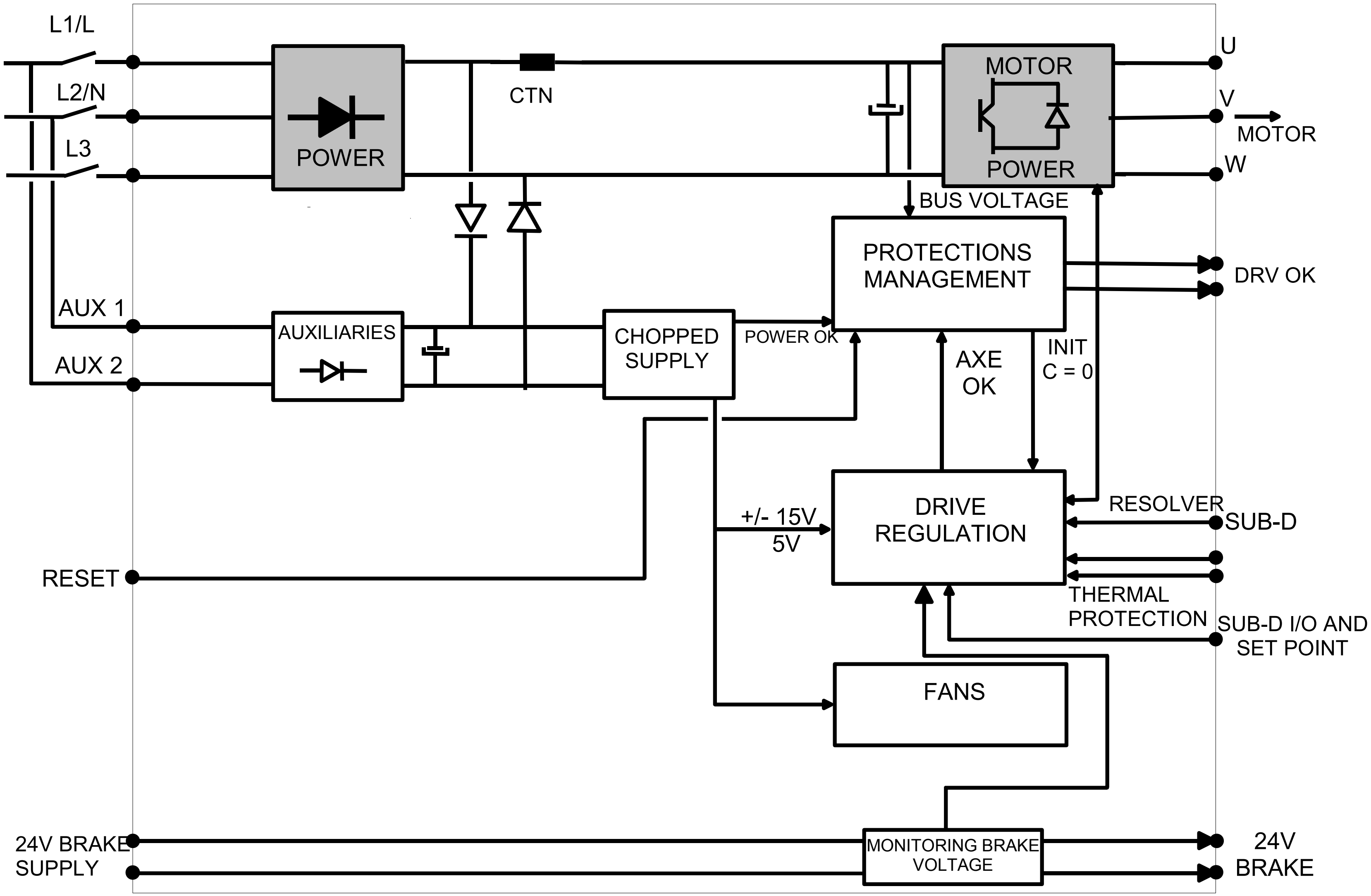
1.3 Operating Principle

1.3.1 Block diagram

The block diagram shows two parts:

A power supply section providing dc voltage to the power bridge and auxiliary power supplies (regulation, fans).

one part for axis control and monitoring control.


L1/L
L2/N
L3
POWER
CTN
MOTOR
POWER
U
V
W
MOTOR
BUS VOLTAGE
PROTECTIONS MANAGEMENT
DRV OK
AUX 1
AUX 2
AUXILIARIES
CHOPPED SUPPLY
POWER OK
AXE OK
INIT C = 0
DRIVE REGULATION
RESOLVER
SUB-D
+/- 15V 5V
RESET
THERMAL PROTECTION
SUB-D I/O AND SET POINT
FANS
24V BRAKE SUPPLY
MONITORING BRAKE VOLTAGE
24V BRAKE

1.3.2 Power supply functions

Receives the 230 V mains supply through terminal block B3 and converts it into a 325V dc voltage.
Receives the 230V monophase mains supply through the same B3 terminal block for powering the auxiliary power supplies (+/-15V, 5V) required by safety regulations.
May receive a 24 V supply via terminal block B1 for powering the motor brake.

1.3.3 Servomotor control functions

1.3.3.1 Presentation

The DIGIVEX Little Drive (DLD) servo-amplifier is a 4-quadrant, transistor control module for controlling (brushless) synchronous motors with resolvers.

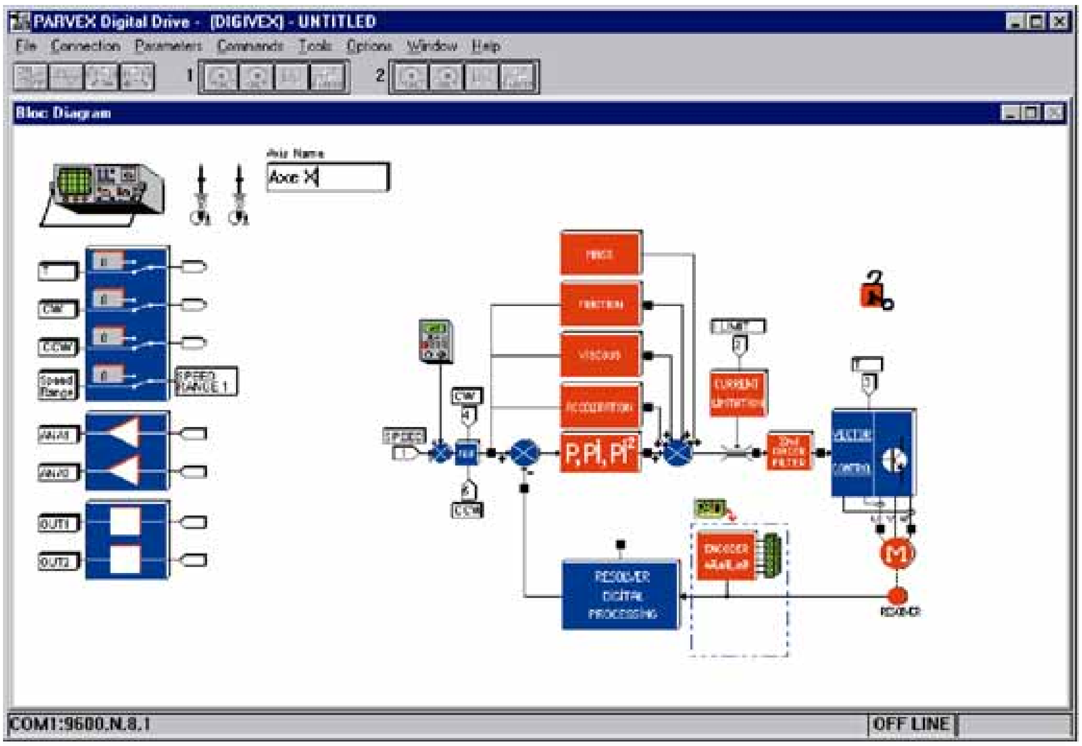
NX, LX, LS, LD spindle drive motors. See separate documentation (PVD3407 and PVD3535).

The customization of the motor - resolver unit and the setting of the servocontrol parameters are carried out using a PC with DIGIVEX software (PME software, DIGIVEX module), under Windows.

These parameters are stored in an EEPROM permanent memory.

1.3.3.2 Functions and block diagram

See next page. The diagram shows the main drive functions and the setting parameters.



On the right of the diagram, the motor - resolver - power section.
Parameters can be set for:

⇒ the choice of motor, which dictates the drive rating.
⇒ the general characteristics of the resolver.

The choice of the motor - drive combination determines a number of parameters: current limitation, $I^2 = f(t)$ protection, standard servo-control parameters.

Ahead of current control.

- Second order filter for reducing the effect of high-frequency resonance
- External reduction of current limitation

Resolver numerical processing (non parametric) and the encoder emulation function (number of lines adjustable from 1 to 16384).
Choice of type of regulation: torque or speed.
In speed loop. Parameters can be set for :

⇒ maximum speed for the application (limited by the maximum motor speed).
⇒ scaling (1 V = N rpm).
⇒ choice of corrector type: proportional, proportional and integral, proportional and double integration.

Predictive actions associated with speed control.

These actions, acting outside the speed loop, directly affect torque. As they are external they have little effect on loop stability. However, they allow anticipated actions, without waiting for the speed loop reaction.

The predictive actions (or predictors) are:

Gravity: compensation for vertical masses.

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

Viscous friction: compensation for friction forces that are proportional to speed (hydraulic or electrical system drive).

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

The analog input speed reference (13 bits + sign), non parametric.

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

The parameter setting software is used:

for allocating some of these Inputs / Outputs.

for forcing them to a logic status. The inputs are then disconnected from the outside.

1.3.3.3 Forcing logic inputs

The software allows the logic input to be forced to a value. Consequently, via the software, the SPEED RANGE, CW, CCW, TORQUE inputs are able to:
"disconnect" them from the physical input.
force them by software to 0 or 1.

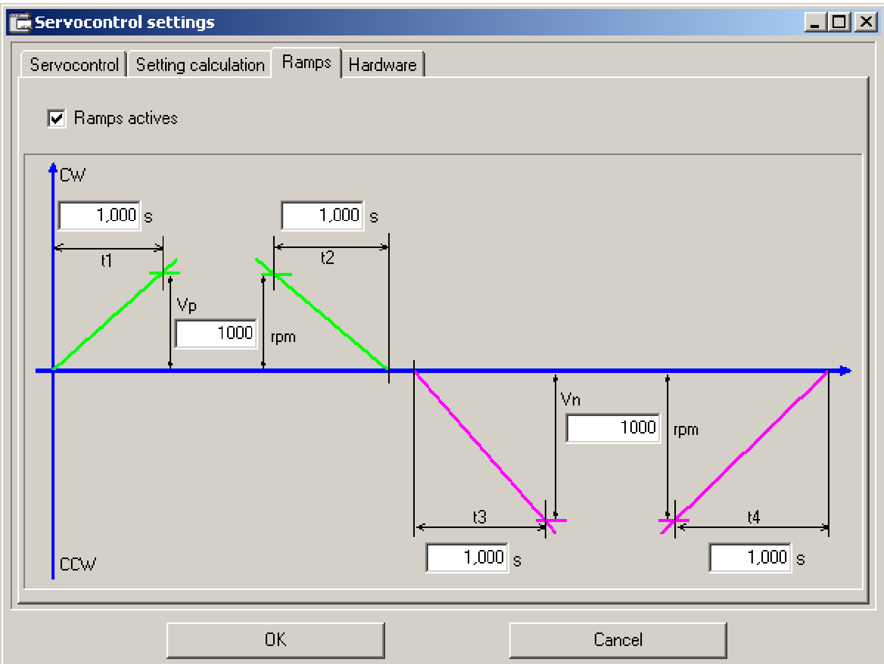
1.3.3.4 Stimuli / oscilloscope functions

Certain functions integrated in the drive allow the speed set point to be excited: dc voltage, square (response at one scale), sine.

These stimuli are activated by a PC. Their result, stored in the amplifier, can be seen on the PC screen by using the oscilloscope function (a maximum of 4 variables can be displayed simultaneously via the PME DIGIVEX 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:

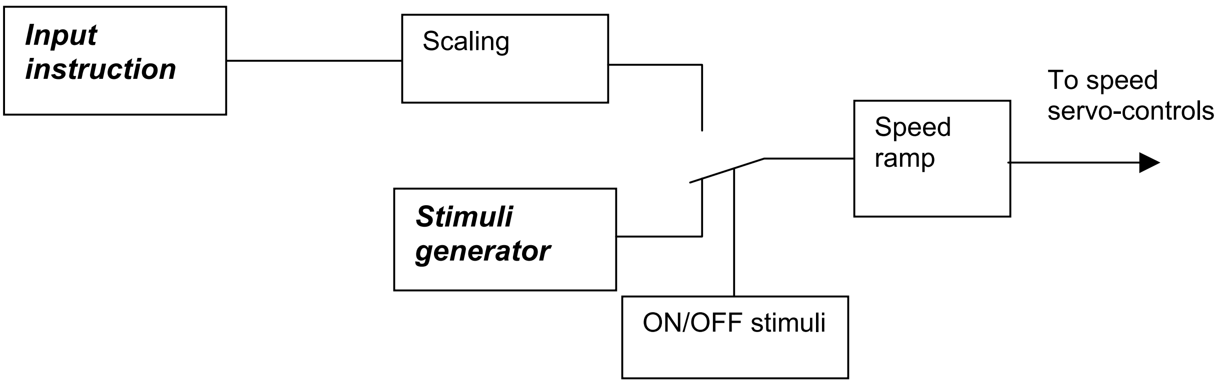


- Times t1, t2, t3, and t4 can be programmed from 0 to 1000s.
- Speeds Vp and Vn can be programmed from 0 to 50,000 rpm.

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 outputs

Speed detection

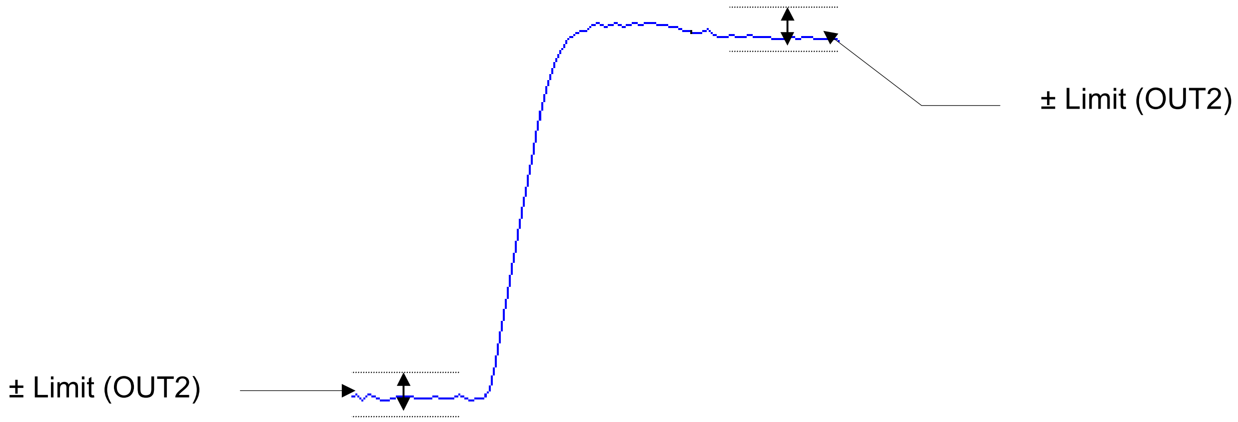
The **OUT1** output status acts in the following manner:

Criterion	OUT1
Speed < Threshold (OUT1)	**1**
Speed > Threshold (OUT1)	**0**

NB: 19 rpm ≤ threshold (OUT1) ≤ 100,000 rpm

Speed reached

OUT2 output changes to **1** status when the motor speed is within the range given by + or - the Threshold (OUT2) value:



(input instruction – threshold (OUT2) < actual speed < input instruction + threshold (OUT2)

NB: 48 rpm ≤ threshold (OUT2) ≤ 5252 rpm

1.3.3.7 Brake action

The drive can be declared in the parameters with a brake function.

The 24 V brake supply (terminal block B1) is monitored by the drive.
24 V present: Axis under torque. Removal of limitation of 90% of rated motor current.
24 V absent: Axis at reduced torque with 90% of rated motor current.

The brake engage or release order is in no event given by the drive but by the external control. The control can monitor the drive outputs indicating zero speed to decide whether or not to apply the brake.

1.3.3.8 Monitoring reasons for stoppage

This monitoring may, through strategic choice, entail either stoppage or reduced performance for certain faults related to current.

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

1.3.3.9 General characteristics of the DIGIVEX Little Drive

Power reduction with altitude	Above 1000 m, service power falls by 1% for every 100 m up to a maximum altitude of 4000 m
Operating temperature relative humidity	Normal use: 0 - 40°C Above 40°C, service power falls by 20% for every 10°C up to a maximum temperature of 60°C. The variable speed drive stops when the ambient temperature exceeds 60°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	Minimum speed 0.05 rpm or 1/8000th of maximum speed
Maximum speed	Driven by DIGIVEX : 100 000 rpm
Speed static precision for load variation from 0 to In and for rated voltage of DIGIVEX Little Drive	With analog set point: 1% whatever the speed
Electrical protection	Electrical isolation of power bridge Mean current protection depending on drive rating Pulse current protection of drive and motor rms current protection of motor Protection against short circuits at bridge output
Mechanical protection	IP20 under IEC 529
Pollution degree	UL : 2 To rise in a surrounding wall
Other monitoring	Motor temperature Drive temperature Resolver power supply Brake supply

1.4 Compliance with Standards

DIGIVEX Little Drive

CE Marking

DIGIVEX Little 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 Directive concerning electromagnetic compatibility invokes the harmonized generic standards EN 50081-2 of December 1993 (Electromagnetic Compatibility – Emission Generic Standard – Industrial Environment) and EN 50082-2 of June 1995 (Electromagnetic Compatibility – Immunity Generic Standard – Industrial Environment). These two harmonized generic standards are based on the following reference standards:

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

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.

Incorporation in a machine
The design of this equipment allows it to be used in a machine subject to Directive 98/37/EC 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.

UL Certification
DIGIVEX Little Drive products are covered by UL and cUL certificate (see section 8).

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 "breaking" resistors.
When the application includes intensive cycles or long-duration decelerations, the mean power to be dissipated by each axis must be calculated.

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

J : Moment of inertia of the servomotor and the related load in kgm².
N : Angular speed of motor shaft at 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 may be greatly reduced.
.

The power to be dissipated by the axis must not exceed the permanent power admissible by the resistor. Duration and repetition must not exceed the ratings in table § 2.1.3.

2.1.2 Braking energy dissipation

Dissipation of breaking energy is carried out through a resistor (or 2 resistors depending on the calibre) situated in the module.

2.1.3 Braking capacity and module losses.

230 V single-phase or three-phase modules.

		MODULE RATING		
		2/4	4/8	7.5/15
Resistor value	Ω	100	100	50
Maximum current	A	3.8	3.8	7.6
Pulse power	kW	1.2	1.2	2.4
Permanent power	W	20	30	40
Maximum non repetitive duration	s	0,2	0,2	0,2
Repetition	%	1,6	2,5	1,6
Losses from modules (at maximum power)	W	15	25	50
Low level consumption	W	10	10	10

Definitions

Maximum power: Maximum power drawn, resistance connecting is carried out at *360V*, hence, the power drawn has a maximum resistance value equal to *360*.

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 DLD paralleling

The braking capacity of applications requiring the use of several DLD, 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 DLD 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 cover cables section: 1mm² 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.

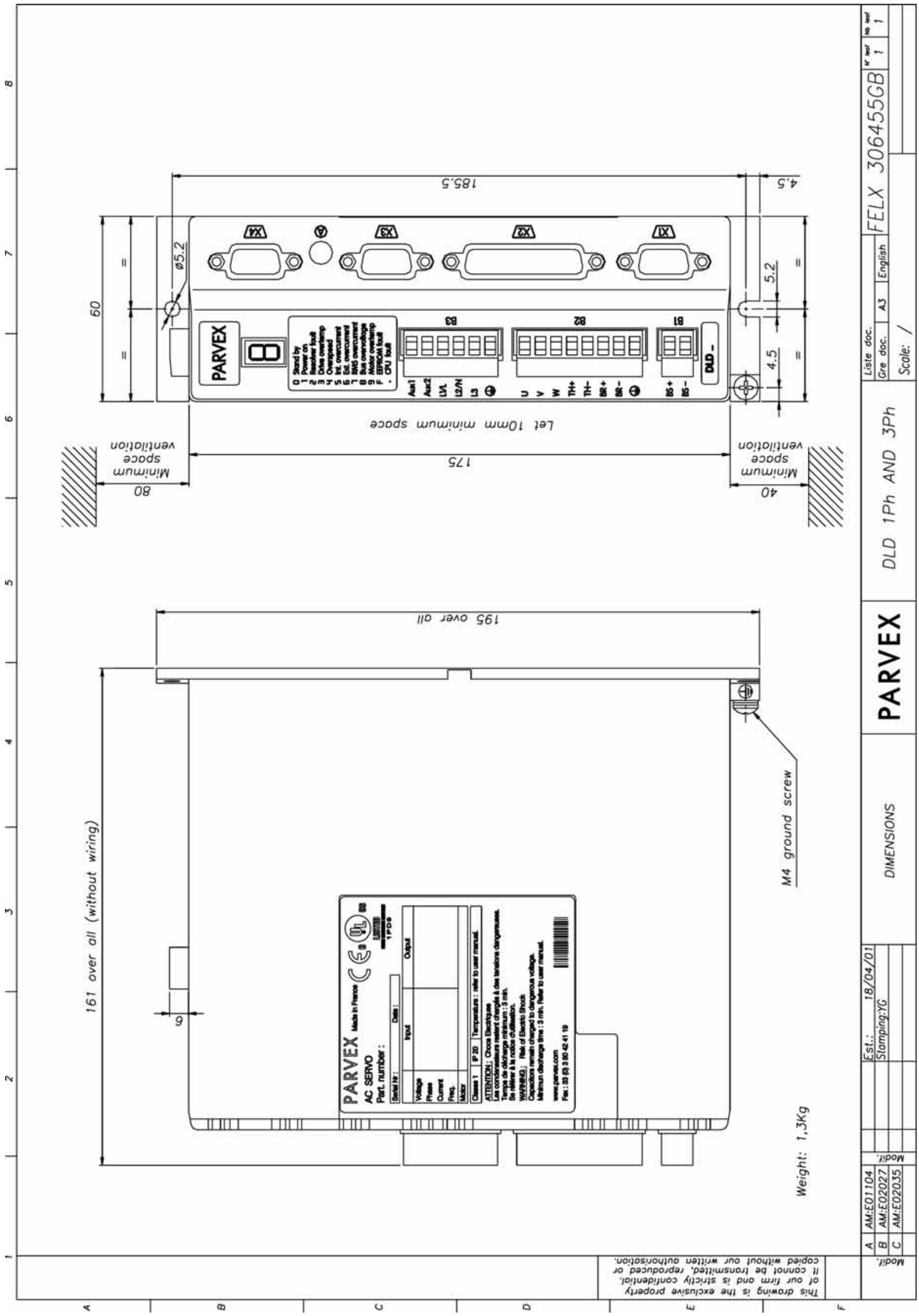
Plan of dimensions: see page 19

Electrical connection plans: see pages 25 and 26.

3. DIMENSIONS, ASSEMBLY, MASS, LABELLING, CODING

3.1 Dimensions, Assembly and Mass

See the following pages, drawing numbers - FELX 306455


185.5
4.5
60
ø5.2
5.2
4.5
Let 10mm minimum space
175
80
Minimum space ventilation
40
Minimum space ventilation
195 over all
161 over all (without wiring)
9
M4 ground screw
Weight: 1,3Kg
PARVEX
DIMENSIONS
DLD 1Ph AND 3Ph
FELX 306455GB
Scale: /
18/04/01
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.

3.2 Labelling and Coding

Physical identification by labels:

On DLD :

∗ One label plate fixed to the appliance as in the model below:

Meaning of label indications:

- AC SERVO : Alternating current converter
- DLD - - - - - : DLD servo-amplifier code
- Serial Nr : servoamplifier serial number
- Date : date of manufacture
- Input : Input current
- Output : Output current
- Voltage : Voltage mean value
- Phase : Phase number
- Current : Current peak value
- Freq.: Frequency in Hz
- Motor : Motor power in W and in HP
- Class : Service class under NF standard EN60146, 1= permanent
- IP20 Protection indice acording to NF EN 60529 standard

The customization of the resolver is stored in a EEPROM memory. The parameters can be read by the software

Codification

CODE	FUNCTION
DLD13M02R	DIGIVEX Little Drive monoaxe Ue 230V 2/4A single-phase
DLD13M04R	DIGIVEX Little Drive monoaxe Ue 230V 4/8A single-phase
DLD13002R	DIGIVEX Little Drive monoaxe Ue 230V 2/4A three-phase
DLD13004R	DIGIVEX Little Drive monoaxe Ue 230V 4/8A three-phase
DLD13007R	DIGIVEX Little Drive monoaxe Ue 230V 7,5/15A three-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.
Utilize a metal surface as an earth reference plane (e.g. cabinet wall or assembly grid). This conducting surface is termed the potential reference plate. All the equipment of an electrical drive system is connected up to this potential reference plate 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 then be earthed via a low impedance link between the potential reference plate and the earth screw at the back of the DIGIVEX Little Drive. If this link exceeds 30 cm, 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 10 cm 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 Little Drive end, the shielding is made continuous by the Sub-D connector mechanism.
The motor cables are limited to the minimum functional length. The yellow and green motor cable lead 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 may also be inserted into the motor phase leads.

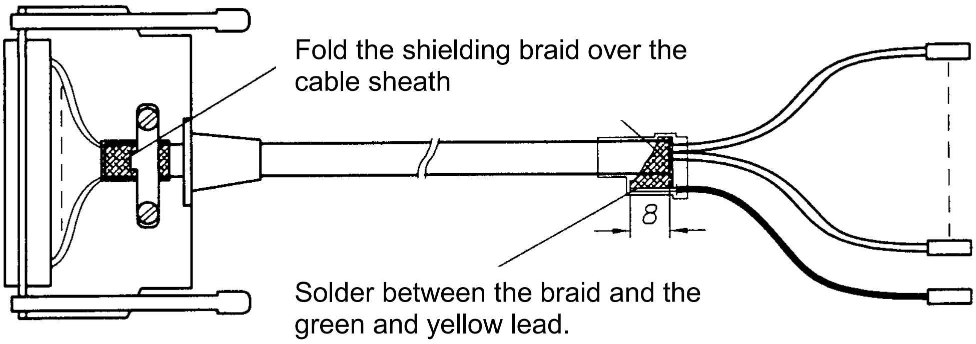
OTHER MEASURES

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

4.1.3 DIGIVEX Little Drive Sub-D connectors

In order to ensure the system is free from disturbances, it is essential for the rack to be properly connected to the earth plane of the electrical cabinet and for the covers of the Sub-D connectors to be EMI/RFI shielded (metal with shielding braid connection).
Make sure the Sub-D connectors and their covers are properly connected (lock screws fully tight).

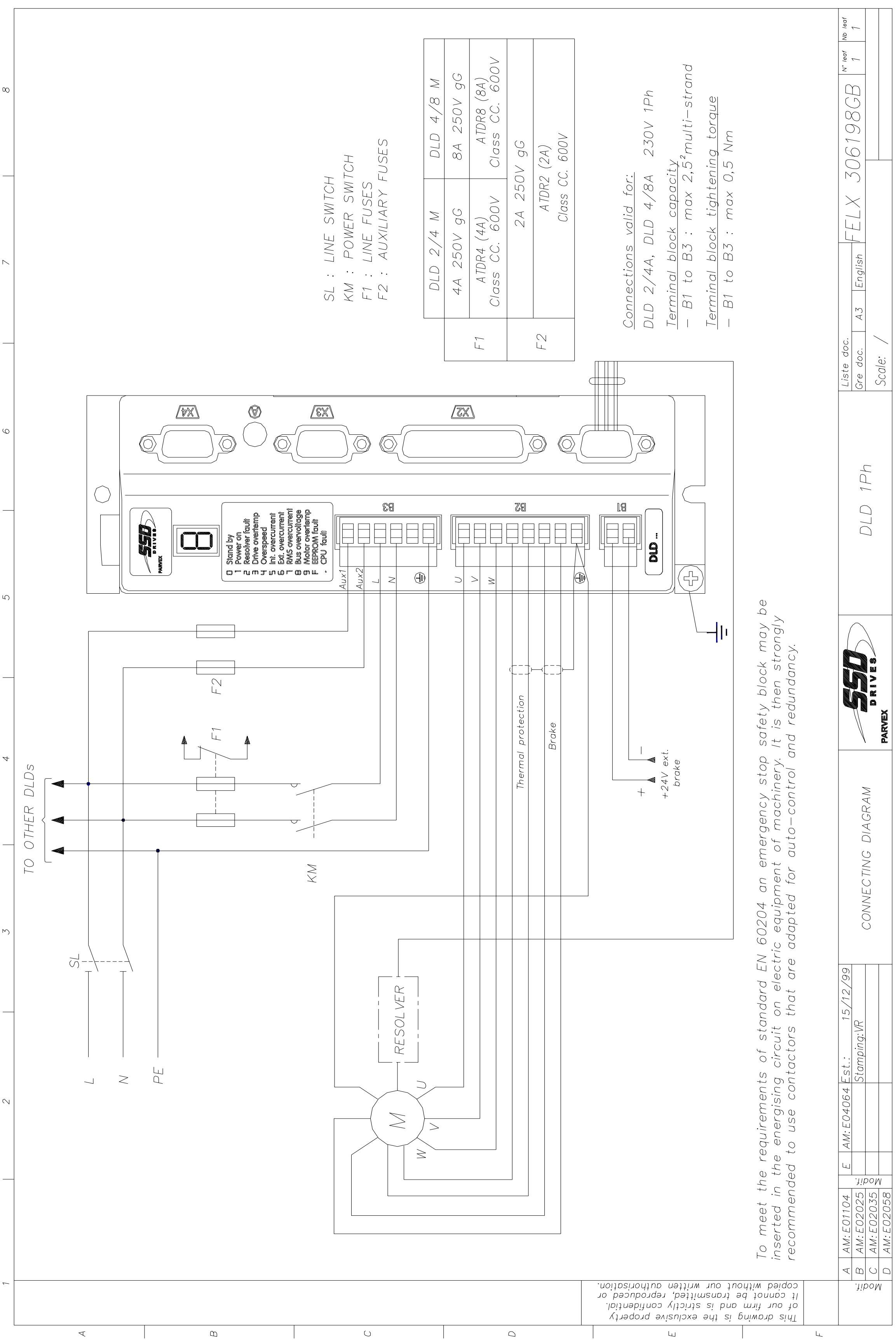
GROUND CONNECTION

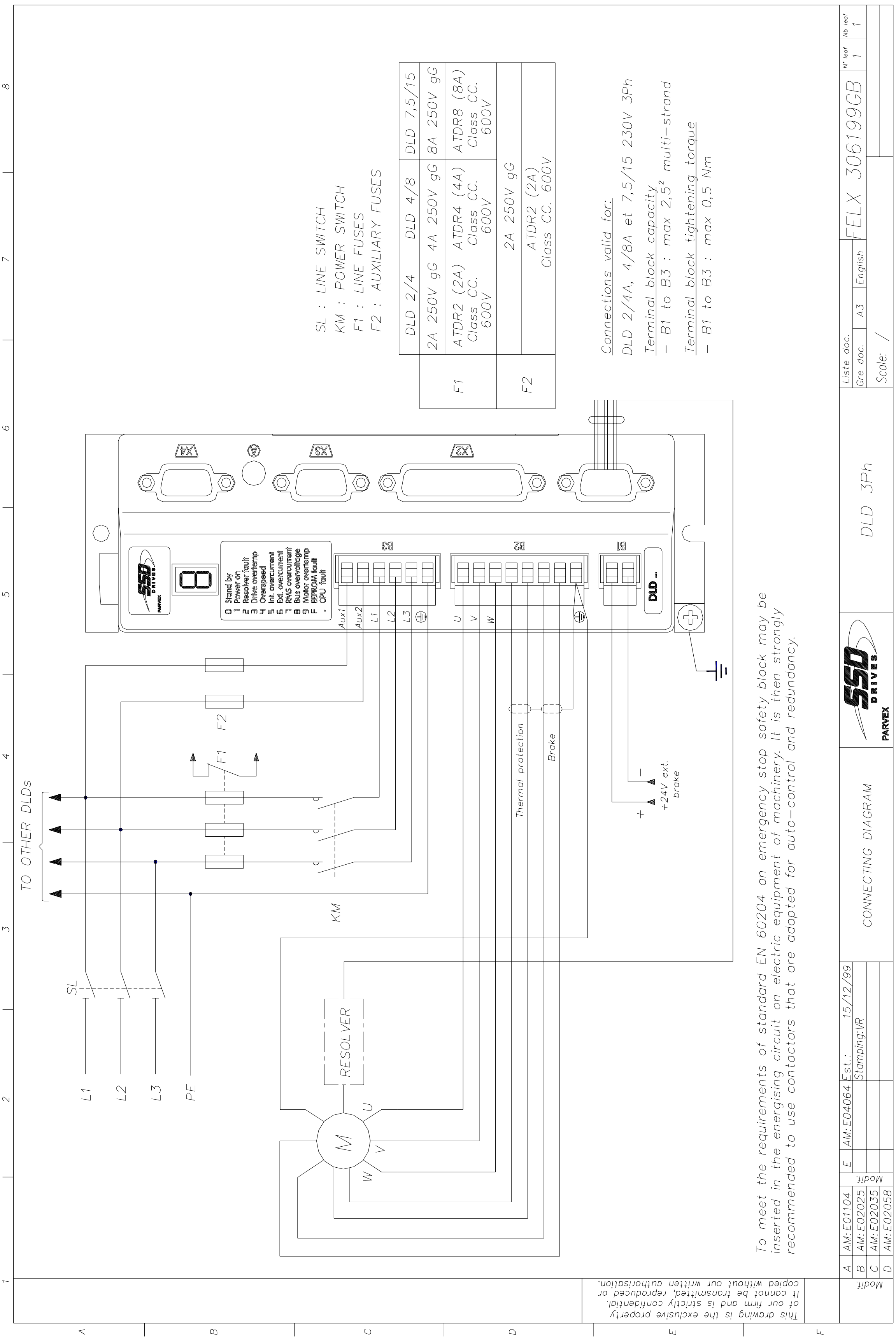


4.2 Standard Connection Diagram

See the drawings on the following pages

- FELX 306198
- FELX 306199
- FELX 306460
- FELX 306461


SL : LINE SWITCH
KM : POWER SWITCH
F1 : LINE FUSES
F2 : AUXILIARY FUSES
DLD 2/4 M
DLD 4/8 M
F1
4A 250V gG
8A 250V gG
ATDR4 (4A) Class CC. 600V
ATDR8 (8A) Class CC. 600V
F2
2A 250V gG
ATDR2 (2A) Class CC. 600V
Connections valid for:
DLD 2/4A, DLD 4/8A 230V 1Ph
Terminal block capacity
- B1 to B3 : max 2,5²multi-strand
Terminal block tightening torque
- B1 to B3 : max 0,5 Nm
TO OTHER DLDs
L
N
PE
SL
KM
F1
F2
RESOLVER
M
U
V
W
Thermal protection
Brake
+24V ext. brake
X4
X3
X2
B3
B2
B1
Aux1
Aux2
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 authorization.
CONNECTING DIAGRAM
DLD 1Ph
FELX 306198GB
English
A3
Scale: /
Stamping:VR
15/12/99


SL : LINE SWITCH
KM : POWER SWITCH
F1 : LINE FUSES
F2 : AUXILIARY FUSES
DLD 2/4
DLD 4/8
DLD 7,5/15
F1
2A 250V gG
4A 250V gG
8A 250V gG
ATDR2 (2A) Class CC. 600V
ATDR4 (4A) Class CC. 600V
ATDR8 (8A) Class CC. 600V
F2
2A 250V gG
ATDR2 (2A) Class CC. 600V
Connections valid for:
DLD 2/4A, 4/8A et 7,5/15 230V 3Ph
Terminal block capacity
- B1 to B3 : max 2,5² multi-strand
Terminal block tightening torque
- B1 to B3 : 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.
TO OTHER DLDs
L1
L2
L3
PE
SL
F1
F2
KM
RESOLVER
M
U
V
W
Thermal protection
Brake
+24V ext. brake
+
-
X4
X3
X2
B3
B2
B1
Aux1
Aux2
DLD ...
0 Stand by
1 Power on
2 Resolver fault
3 Drive overtemp
4 Overspeed
5 Int. overcurrent
6 Ext. overcurrent
7 RMS overcurrent
8 Bus overvoltage
9 Motor overtemp
F EEPROM fault
. CPU fault
CONNECTING DIAGRAM
DLD 3Ph
FELX 306199GB
English
A3
Scale: /
Est.: 15/12/99
Stamping:VR
AM:E01104
AM:E02025
AM:E02035
AM:E02058
AM:E04064
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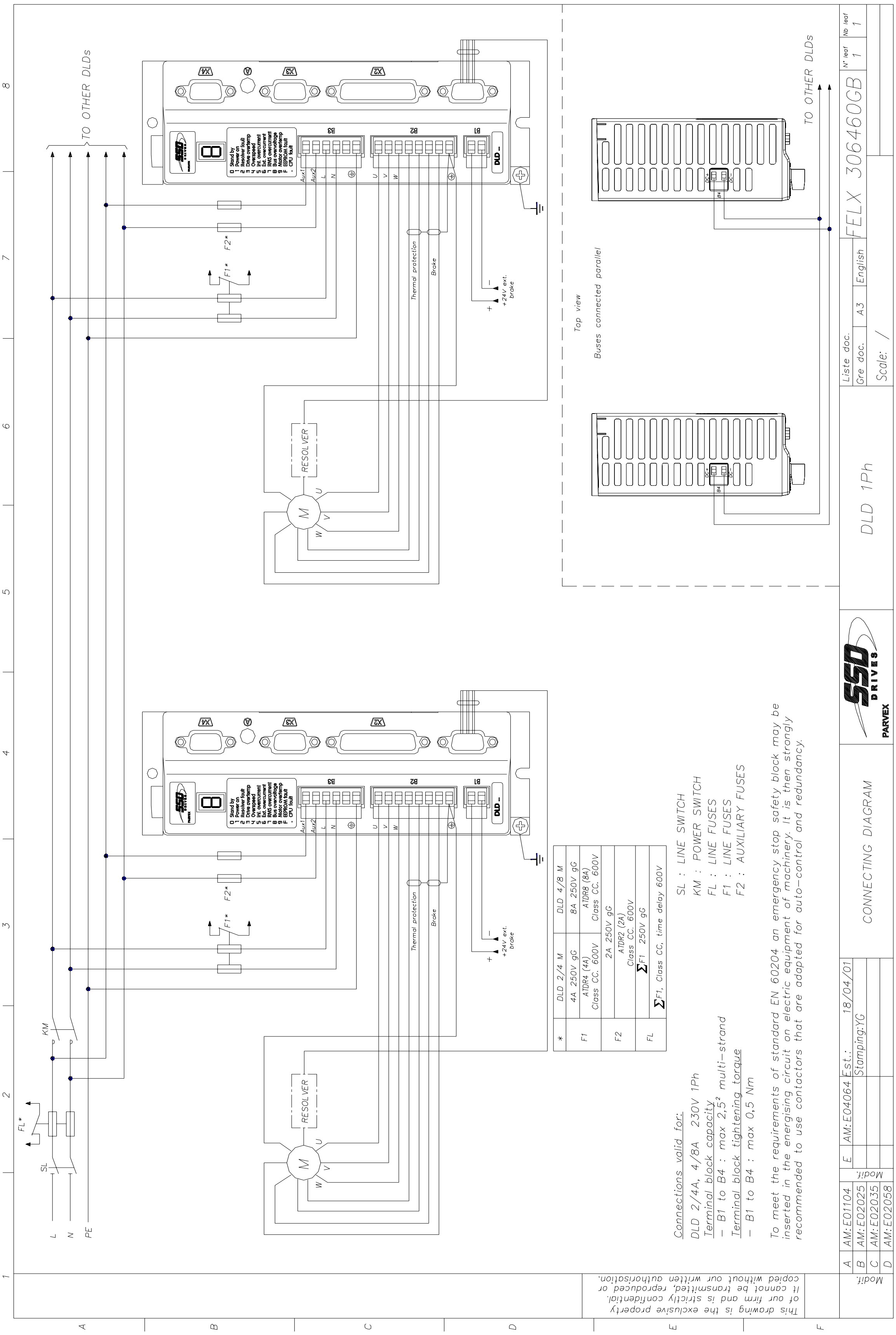
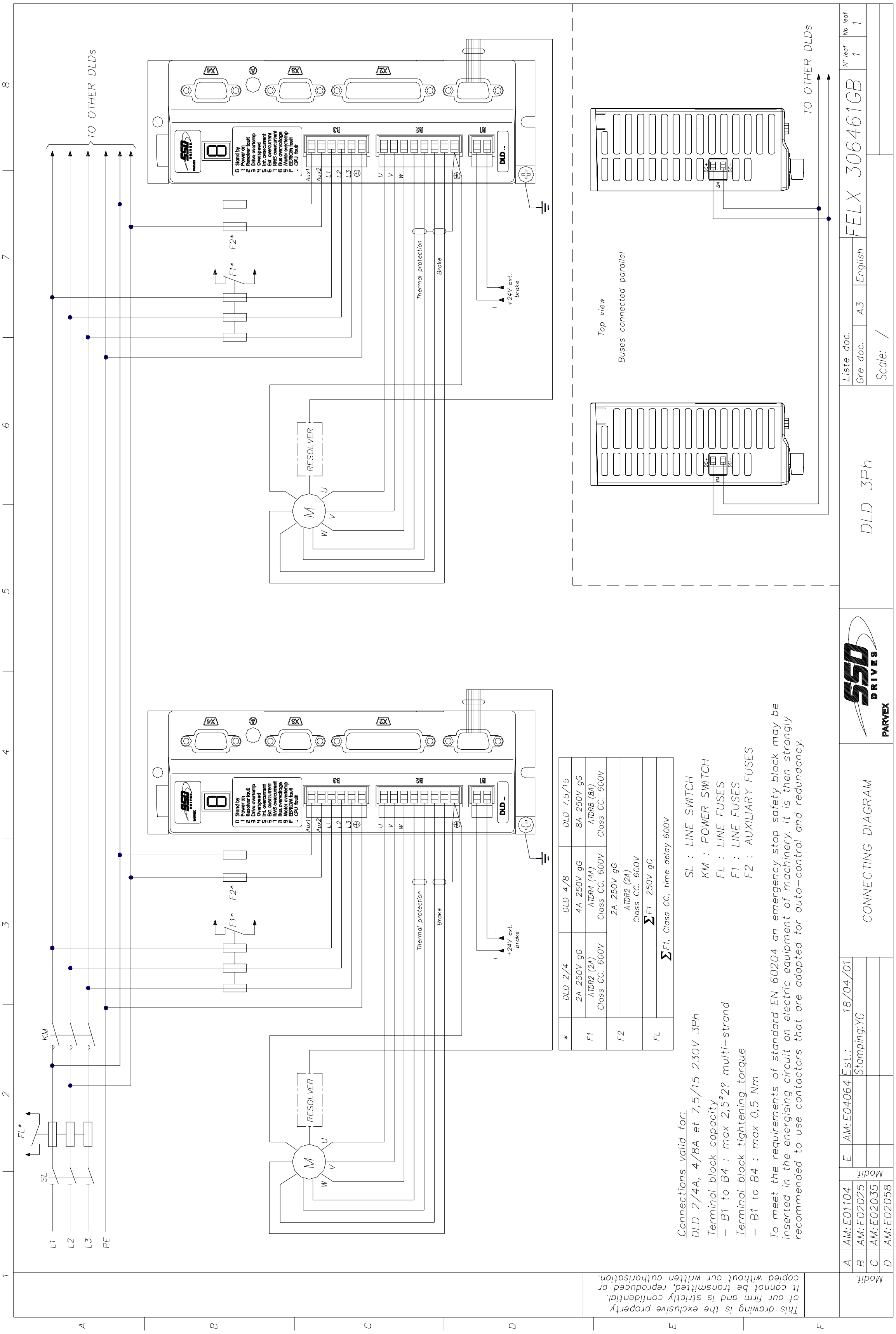

TO OTHER DLDs
RESOLVER
Thermal protection
Brake
+24V ext. brake
Top view
Buses connected parallel
TO OTHER DLDs
Connections valid for:
DLD 2/4A, 4/8A 230V 1Ph
Terminal block capacity
- B1 to B4 : max 2,5² multi-strand
Terminal block tightening torque
- B1 to B4 : max 0,5 Nm
SL : LINE SWITCH
KM : POWER SWITCH
FL : LINE FUSES
F1 : LINE FUSES
F2 : AUXILIARY FUSES
DLD 2/4 M
DLD 4/8 M
4A 250V gG
8A 250V gG
ATDR4 (4A)
ATDR8 (8A)
Class CC. 600V
2A 250V gG
ATDR2 (2A)
Class CC. 600V
ΣF1 250V gG
ΣF1, Class CC, time delay 600V
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 adopted 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.
CONNECTING DIAGRAM
DLD 1Ph
FELX 306460GB
English
A3
Stamping:YG
18/04/01


TO OTHER DLDs
Thermal protection
Brake
+24V ext. brake
RESOLVER
Top view
Buses connected parallel
TO OTHER DLDs
L1
L2
L3
PE
SL
FL*
KM
F1*
F2*
DLD 2/4
2A 250V gG
ATDR2 (2A) Class CC, 600V
DLD 4/8
4A 250V gG
ATDR4 (4A) Class CC, 600V
2A 250V gG
ATDR2 (2A) Class CC, 600V
DLD 7,5/15
8A 250V gG
ATDR8 (8A) Class CC, 600V
ΣF1 250V gG
ΣF1, Class CC, time delay 600V
Connections valid for:
DLD 2/4A, 4/8A et 7,5/15 230V 3Ph
Terminal block capacity
- B1 to B4 : max 2,5²2? multi-strand
Terminal block tightening torque
- B1 to B4 : max 0,5 Nm
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.
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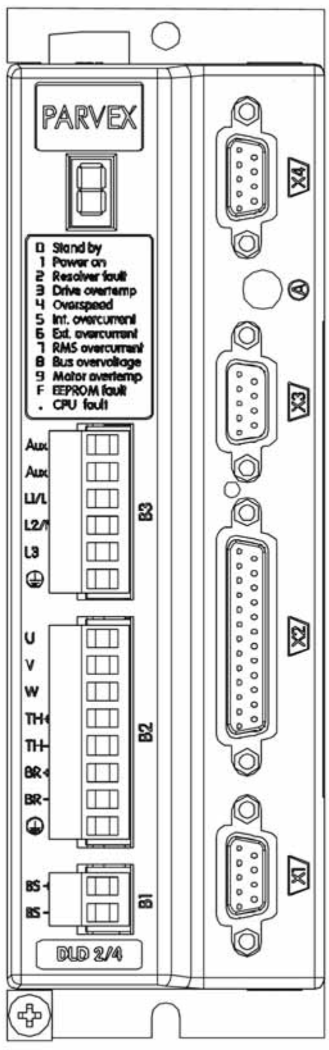
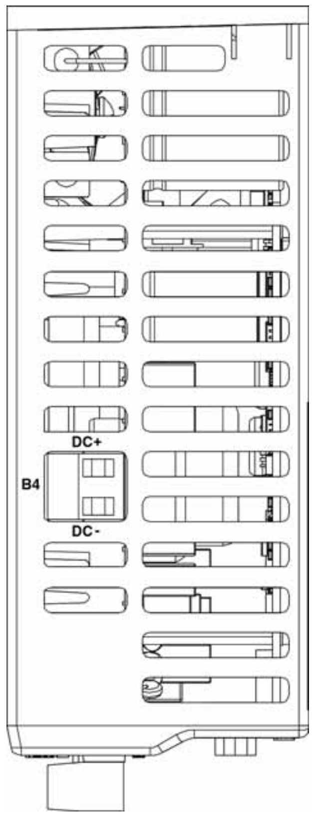
CONNECTING DIAGRAM
DLD 3Ph
FELX 306461GB
SSD DRIVES
PARVEX
English
A3
Scale: /
AM:E01104
AM:E02025
AM:E02035
AM:E02058
AM:E04064
Est.: 18/04/01
Stamping:YG

4.3 Description of Terminal Blocks and Sub-D Connector

All the input/outputs required for operation are arranged on the front panel in the form of:

- B1 brake power supply terminal.
- B2 motor terminal.
- B3 power supply and auxiliary power terminal.
- B4 DC Bus
- X1 RESOLVER connector.
- X2 INPUTS / OUTPUTS connector.
- X3 ENCODER connector
- X4 RS232 connector.





4.3.1 Terminal blocks B1, B2, B3, B4

ITEM REF.	TERMINAL	Front Panel Marking	FUNCTION	TERMINAL BLOCK TYPE	TERMINAL CAPACITY
B1/1 B1/2	BS+ BS-	B1	24V input for brake supply	Unpluggable screw-type	Min 0,2 mm² Max 2,5 mm² flexible and rigid lead
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 B2/5	TH+ TH-	B2	Motor thermal protection		
B2/6 B2/7	BR+ BR-	B2	Motor brake		
B2/8	⏚	B2	EARTH		
B3/1 B3/2	Aux1 Aux1	B3	Low-level supply	Unpluggable screw-type	Min 2,5 mm² flexible and rigid lead
B3/3 B3/4 B3/5	L1/L L2/N L3	B3	Mains connection *For single-phase mains only B3/3 and B3/4 are to be connected*	Unpluggable screw-type	Min 0,2 mm² Max 2,5 mm² flexible and rigid lead
B3/6	⏚	B3	EARTH		
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 connectors X1, X2, X3, X4

4.3.2.1 Sub-D connector table

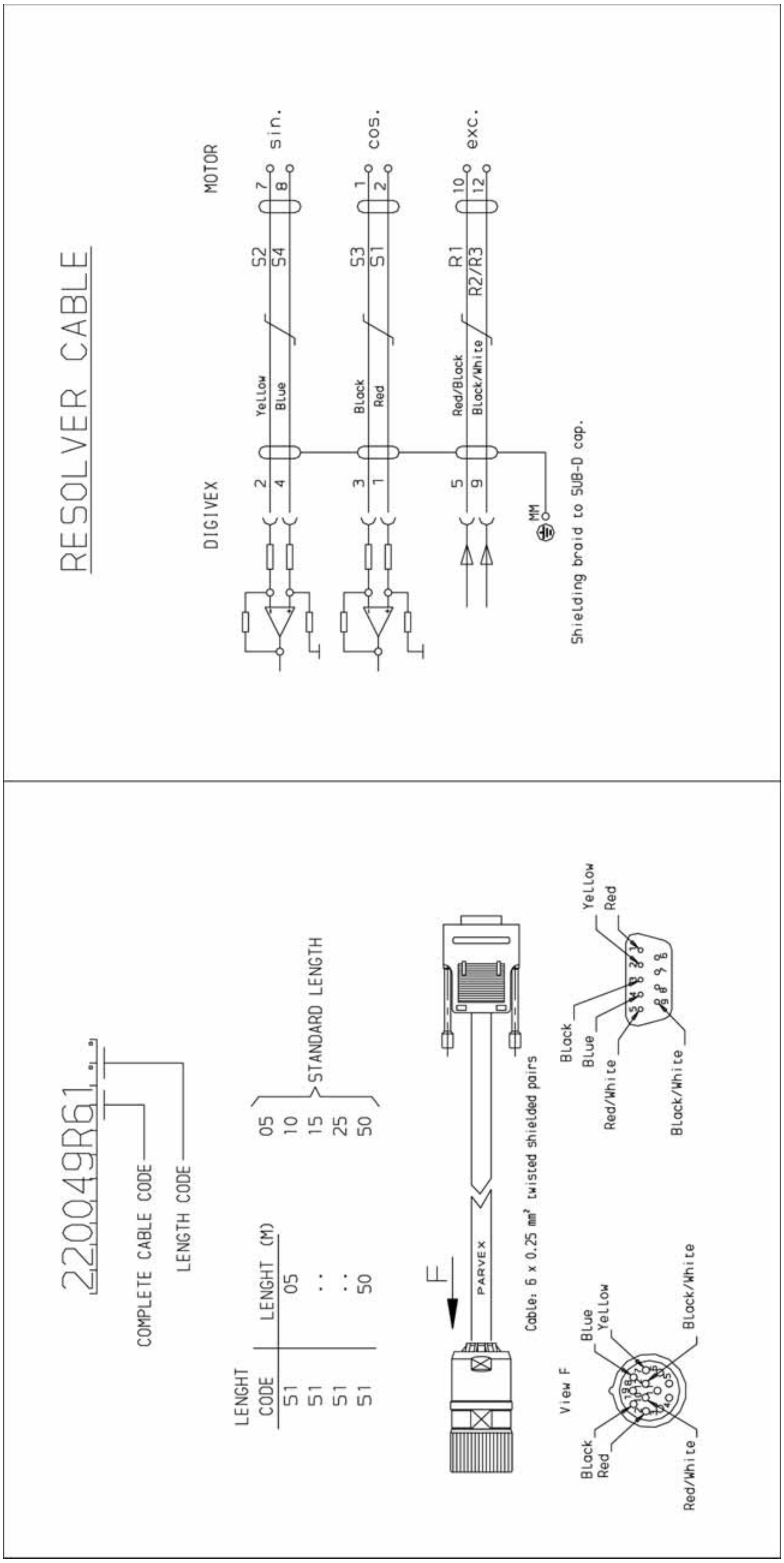
Connectors with metal-plated or metallic covers.

ITEM REF.	CONNECTOR TYPE (cable end)	FUNCTION	MAX. CONDUCTOR CROSS-SECTION
X1 RESOLVER	9-pin plug for soldering	Resolver link	max. 0.5 mm² on soldering barrel
X2 INPUTS/ OUTPUTS	25-pin plug for soldering	Logic and analog inputs / output	max. 0.5 mm² on soldering barrel
X3 ENCODER	9-pin socket for soldering	Encoder emulation output	max. 0.5 mm² on soldering barrel
X4 RS232	9-pin plug for soldering	PC link	max. 0.5 mm² on soldering barrel

4.3.2.2 Sub-D connector X1:"Resolver"

DIGIVEX end connections, Sub-D 9 pin connector 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	Excite R2/R3


RESOLVER CABLE
DIGIVEX
MOTOR
Yellow
Blue
Black
Red
Red/Black
Black/White
S2
S4
S3
S1
R1
R2/R3
sin.
cos.
exc.
Shielding braid to SUB-D cap.
220049R61
COMPLETE CABLE CODE
LENGTH CODE
LENGHT CODE
LENGHT (M)
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 connector X2: Inputs / Outputs

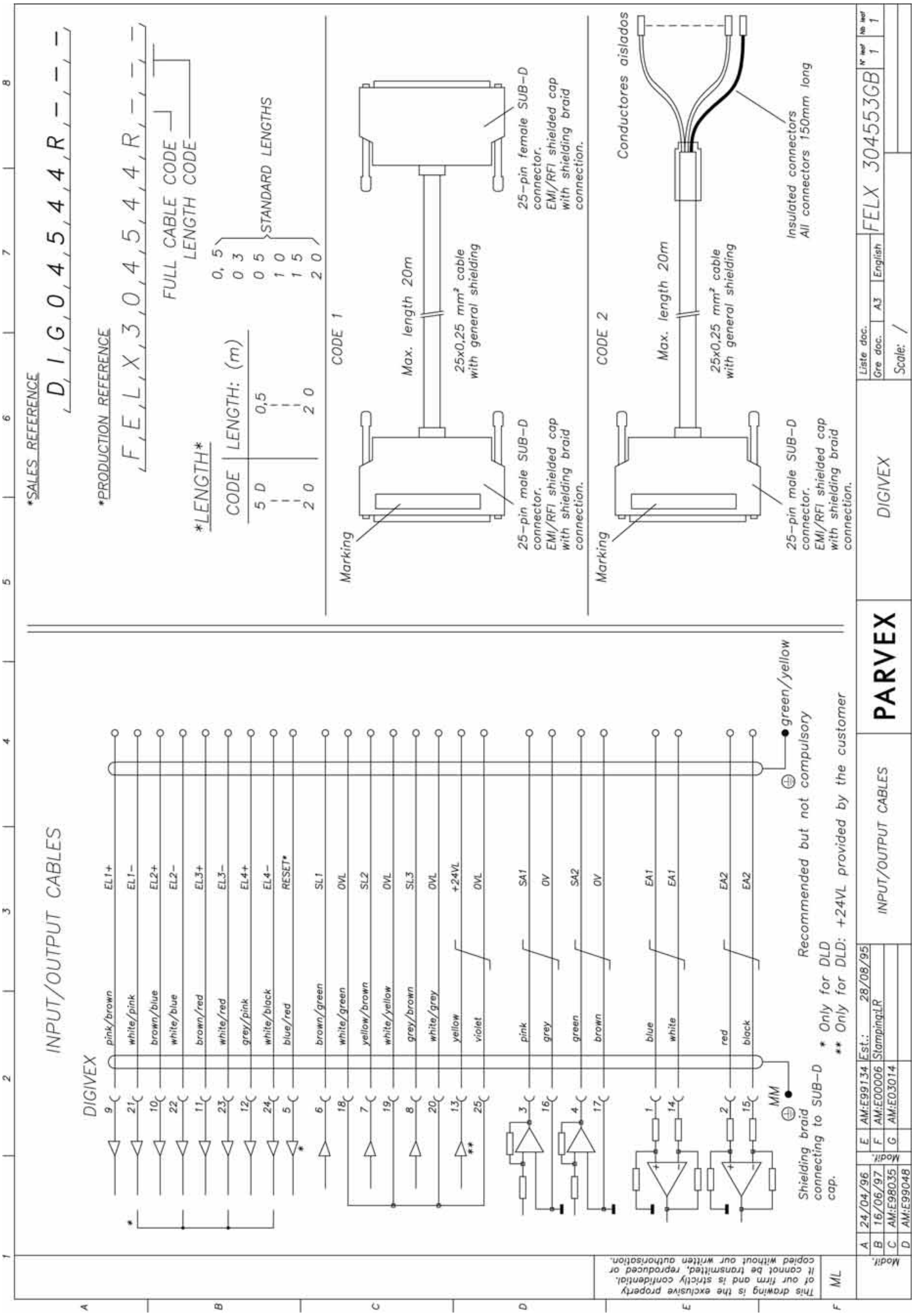
CONTACT	TYPE	FUNCTION	CHARACTERISTICS
1 14	EA1 + EA1 -	Speed or current set point ±10V, **+** point Speed or current set point ±10V, **-** point	Analog conversion: 13 bits + sign Differential input
2 15	EA2 + EA2 -	Analog input ±10V, **+** point Analog input ±10V, **-** point Input assigned to external current limitation. +/-10V = max. current	Analog conversion: 9 bits + sign Differential input
3 16	SA1 0V	Analog output ±10V, **+** point **ANA1** 0V of analog output Output assigned to speed measurement 10V = maximum speed	Analog conversion: Max. voltage = 10V Max. current = 10 mA Protected against short circuits.
4 17	SA2 0V	Analog output ±10V, **+** point **ANA2** 0V of analog output Output assigned to current measurement 10V = maximum current	Analog conversion: Max. voltage = 10V Max. current = 10 mA Protected against short circuits.
9	EL1 +	SPEED RANGE Speed range choice	Type-1, optocoupled 24V logic inputs to IEC 1131-2.
10	EL2 +	CW: enables clockwise rotation if input is active (level 1)	(see characteristics on following pages)
11	EL3 +	CCW: enables counter-clockwise rotation if input is active (level 1)	These inputs must have a 24V supply to have level 1.

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

"Inputs / Outputs" Sub-D connector (continued)

CONTACT	TYPE	FUNCTION	CHARACTERISTICS
12	EL4 +	TORQUE: enables torque if input is at 1	Optocoupled 24V type 1 logic inputs under ICE 1131-2
5	EL+	RESET	Optocoupled 24V type 1 logic inputs under ICE 1131-2
21 22 23 24	Logic 0V	Logic inputs OV For EL1+, EL2+, EL3+, EL4+ and RESET	The logic inputs are common via the 0V logic
6 18	SL1 0V Logic	DRV OK	Max. 50 mA, optocoupled PNP 24V output
7 19	SL2 0V Logic	OUT1 speed detection	Max. 50 mA, optocoupled PNP 24V output
8 20	SL3 0V Logic	OUT2 speed detection	Max. 50 mA, optocoupled PNP 24V output
13 25	+24V Logic 0V Logic	+24V power supply input 0V power supply input	Max. voltage: 35V Max. current = 160mA

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


INPUT/OUTPUT CABLES
DIGIVEX
EL1+ EL1- EL2+ EL2- EL3+ EL3- EL4+ EL4- RESET*
SL1 0VL SL2 0VL SL3 0VL +24VL 0VL
SA1 0V SA2 0V EA1 EA1 EA2 EA2
pink/brown white/pink brown/blue white/blue brown/red white/red grey/pink white/black blue/red
brown/green white/green yellow/brown white/yellow grey/brown white/grey yellow violet
pink grey green brown blue white red black
green/yellow
Shielding braid connecting to SUB-D cap.
* Only for DLD
** Only for DLD: +24VL provided by the customer
Recommended but not compulsory
*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
Marking
25-pin male SUB-D connector. EMI/RFI shielded cap with shielding braid connection.
Max. length 20m
25x0,25 mm² cable with general shielding
25-pin female SUB-D connector. EMI/RFI shielded cap with shielding braid connection.
CODE 2
Conductores aislados
Insulated connectors All connectors 150mm long
PARVEX
DIGIVEX
INPUT/OUTPUT CABLES
FELX 304553GB
English
A3
Scale: /

4.3.2.4 Sub-D connector X3: encoder emulation

Sub-D 9-pin plug. Maximum conductor cross-section: 0.5 mm².

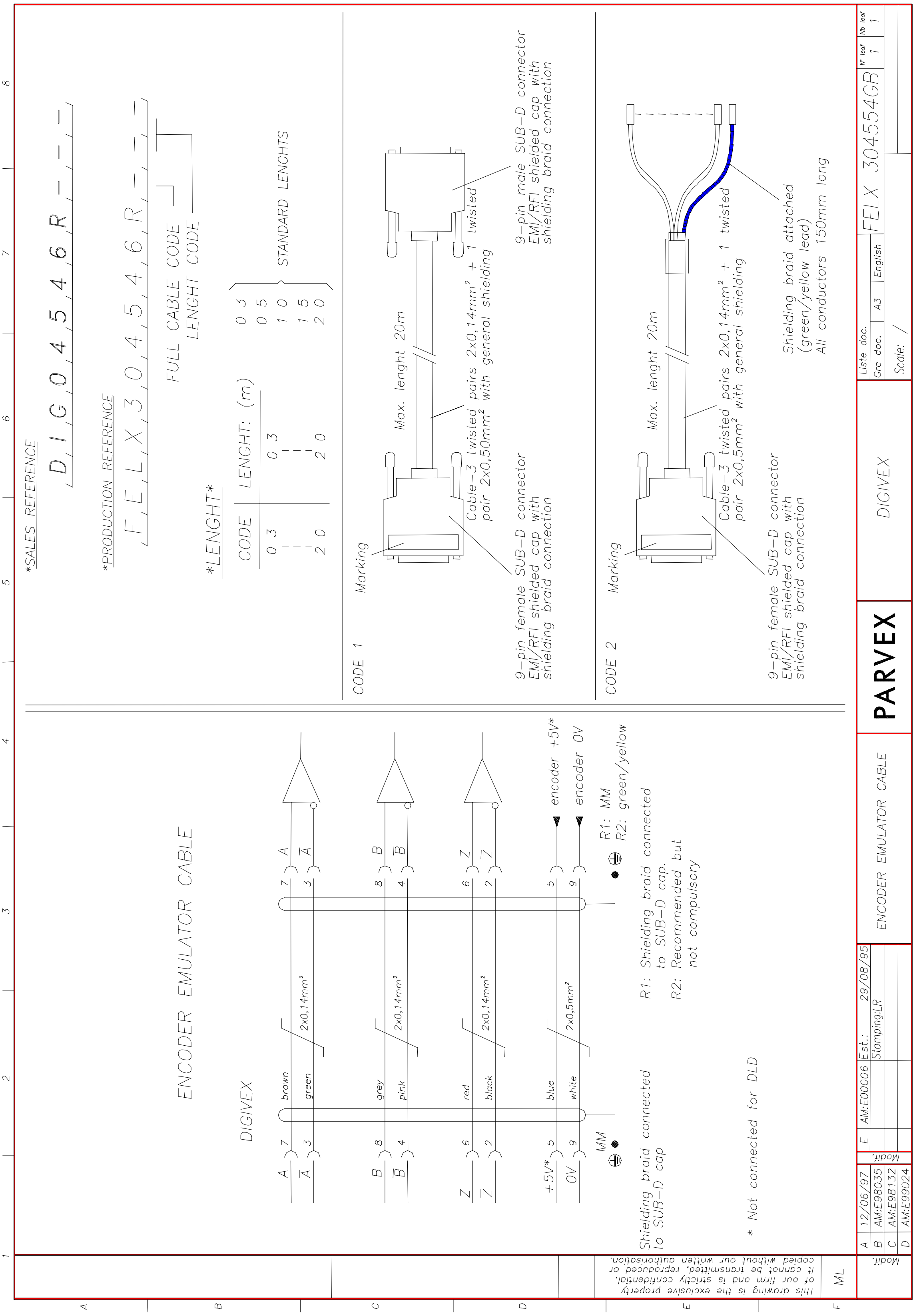
CONTACT	TYPE	FUNCTION
1	.	
2	Output	Top $\overline{0}$
3	Output	$\overline{A}$
4	Output	$\overline{B}$
5		
6	Output	Top 0
7	Output	A
8	Output	B
9	Input	0V

4.3.2.5 Encoder emulation cable

Cable formed from three twisted pairs of 0.14 mm^2, of one twisted pair of 0.5 mm^2 for 5 V supply and general shielding.

Cable reference recommend by PARVEX S.A., CB08307.

Cables equipped with Sub-D connectors can be supplied, see drawing FELX 304554.


ENCODER EMULATOR CABLE
DIGIVEX
brown
green
grey
pink
red
black
blue
white
2x0,14mm²
2x0,5mm²
+5V*
0V
MM
encoder +5V*
encoder 0V
R1: MM
R2: green/yellow
Shielding braid connected to SUB-D cap
R1: Shielding braid connected to SUB-D cap.
R2: Recommended but not compulsory
* Not connected for DLD
*SALES REFERENCE
D I G 0 4 5 4 6 R _ _
*PRODUCTION REFERENCE
F E L X 3 0 4 5 4 6 R _ _
FULL CABLE CODE
LENGHT CODE
LENGHT
CODE
LENGHT: (m)
0 3
2 0
0 5
1 0
1 5
STANDARD LENGHTS
CODE 1
Marking
Max. lenght 20m
Cable-3 twisted pairs 2x0,14mm² + 1 twisted pair 2x0,50mm² with general shielding
9-pin female SUB-D connector EMI/RFI shielded cap with shielding braid connection
9-pin male SUB-D connector EMI/RFI shielded cap with shielding braid connection
CODE 2
Cable-3 twisted pairs 2x0,14mm² + 1 twisted pair 2x0,5mm² with general shielding
Shielding braid attached (green/yellow lead)
All conductors 150mm long
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ML
Modif.
12/06/97
AM:E98035
AM:E98132
AM:E99024
AM:E00006
Est.: 29/08/95
Stamping:LR
ENCODER EMULATOR CABLE
PARVEX
DIGIVEX
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 304554GB
N° leaf 1
Nb leaf 1

4.3.2.6 Sub-D connector X4 : RS232

Maximum conductor cross-section: 0.5 mm²
Serial link configuration :

- 9600 bauds
- 8 data bits
- 1 start bit, 1 stop bit
- no parity
- no electrical isolation
- use an extension cable of 5 m maximum

SUB-D 9pts DIGIVEX		SUB-D 9pts PC	
NC	1	1	
TD (TXD)	2	2	RD (RXD)
RD (RXD)	3	3	TD (TXD)
NC	4	4	
0V	5	5	0V
NC	6	6	
NC	7	7	
NC	8	8	
NC	9	9	

NC= Not Connected

This input is for linking with a computer (PC) for parameter loading and setting via the DIGIVEX PC software.

4.4 Connection Details

4.4.1 Main supply characteristics

230 V single-phase or three-phase modules

PARAMETER	*VALUE*
Frequency	47 - 63 Hz
Minimum voltage	92 V rms
Maximum voltage	253V rms
Rated voltage	230V rms *
Dc voltage achieved	140 - 340V

* To guarantee mechanical power
  - single or three-phase for 2/4 and 4/8 caliber
  - Three-phase only for caliber 7,5/15

4.4.2 Power component dimensions

one single drive

Applicable to components ahead of the DLD (fuses, cables, contactors, etc.), these dimensions are dependent on:

Permanent current $\hat{I}_0$ (sine wave peak) at slow motor speed, as given in the characteristics.

Electrical power of mains supply $\cong$ 1.1 U rms $\hat{I}_0$

$$\text{Eff.I power source} = \frac{\text{eff.mainsP}}{\text{eff.U}\sqrt{3}} \times \frac{1}{0.65} \quad \text{in single-phase}$$

$$\text{Eff.I power source} = \frac{\text{eff.mainsP}}{\text{eff.U}\sqrt{3}} \times \frac{1}{0.8} \quad \text{in three-phase}$$

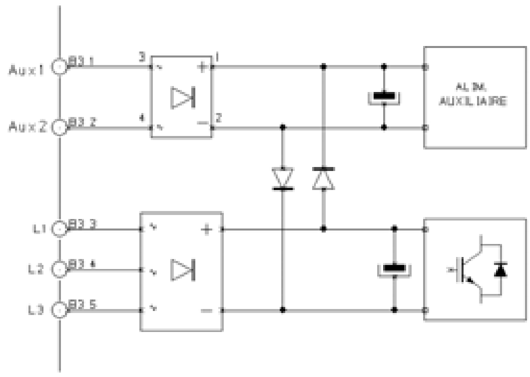
4.4.3 Auxiliary power supply

The power supplies required for the controls (+/- 15V, 5V, ventilators) are taken from an intermediate direct-current voltage which can be:

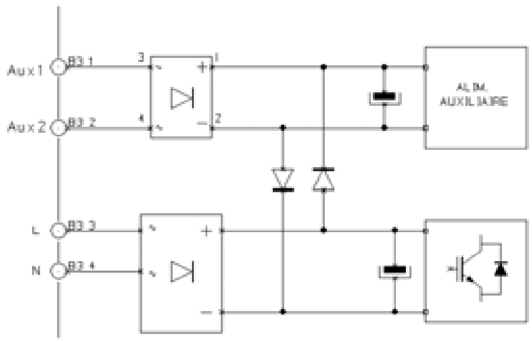
Either obtained via a single-phase power source coming from the mains, bled off between 2 phases upstream from the main contactor (B3 terminal block input).

- please remember that the internal wiring is as follows:

THREE-PHASE



SINGLE-PHASE



- The auxiliary power source input must be taken between two phases (L1,L2), (L2,L3) or (L1,L3) in the case of three-phase and between (L,N) in the case of single-phase, upstream from the main contactor (please refer to the relevant connection diagrams: FELX 306198 for single phase and FELX 306199 for three-phase).
- Or obtained via an independent single-phase power source, and connected to the B3 terminal block. In this case, this power source must be isolated from the mains via a transformer (secondary 230 +/-10% 100VA).
- Or obtained from the intermediary mains voltage, through diodes (B3 is not connected). In this option (not recommended), the cutting-off of the mains power source leads to the loss of the low level power sources and, in particular, the pulses generated by the "encoder emulation" option.

Clarification:

1) *Connection of the auxiliary power source is not **compulsory** because it is fed internally by the direct bus. Connection proves necessary if we want to save the position and the state through the encoder output (emulation) when for safety reasons, the mains power is turned off.*

2) *If the auxiliary power source is used, it is **essential** for it to be connected to the same phases (2 out of 3 for three-phase) as the mains power supply (see recommended diagram- FELX 306198 for single phase and FELX 306199 for three-phase.)**,** to avoid damage to the appliance.*

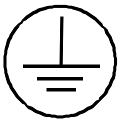
If this is not possible, this auxiliary power source can possibly originate from another circuit, but it must, imperatively, be isolated from the system using a transformer whose secondary will not be earthed. The voltage of the transformer secondary must be identical to the mains voltage (230V for mono appliances or three-phase 230V).

4.4.4 Terminal block B1: brake supply

This terminal block is also able to receive a 24V power source voltage for the brake fitted to the motor. It is supplied to the B2 motor terminal.

The customer is responsible for supplying an isolated, regulated, and filtered 24VDC voltage. Protection against overvoltage by 1 Joule varistor, this protection is effective from 30V.
A 4A UL fuse must be used (UL recommendation) for $+24V_{DC}$ voltage.

4.4.5 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.

4.4.6 Short-circuit capacity (UL 508 C certification)

“Suitable For Use on a circuit capable of delivering not more than 5000 rms symmetrical amperes 230 volts maximum”

4.4.7 Fuse specifications (UL 508 C certification)

The auxiliary input must be protectected by the fuses F2 type : ATDR2, 2A, 600V class cc made by Ferraz SHAWMUT.

4.5 Connecting Servomotors

4.5.1 Power cable definition

Attention! Only use copper core cables

The motor / drive power connection cables will have as a minimum:

three isolated conductors connected to phases U, V, W. Cross-sections as in the table on the next page.
1 earth conductor (green and yellow).
2 twisted and shielded pairs for connection of the motor thermal protection. Cross-section in the order of 1mm².
2 twisted and shielded pairs for connection of the holding brake (if present). Cross-section in the order of 1mm².

Power cable cross-section
The cross-sections given are for copper conductors.
The cable cross-sections given in the table below take account of:

The rated drive current.
The motor / drive distance, service voltage loss = RI.
The ambient temperature, cable Joule losses = RI².
the standardized increase in cable sections.

The cable section to be used is given in the table below

Distance →	0m 50m	50m 120m
DIGIVEX rating	Copper cable cross-section in mm²	Copper cable cross-section in mm²
2/4 and 4/8	0.5	1
7.5/15	1	2

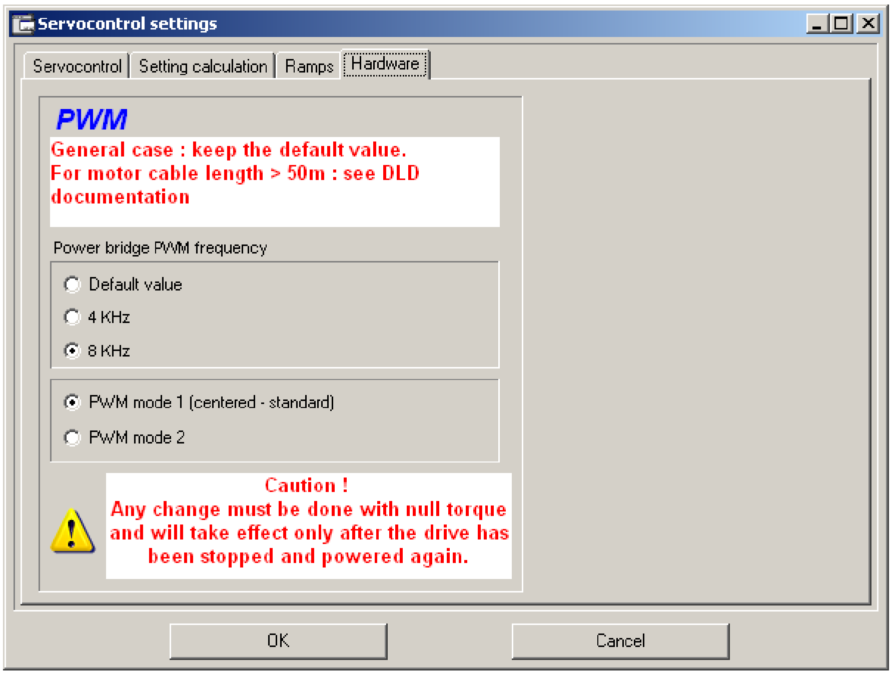
Use for standard lengths

Copper cable length	Normal	L ≤ 20 m	20 < L ≤ 30m	30 < L ≤ 50m	L > 50m
	Shielded	L ≤ 15 m	15 < L ≤ 20 m	20 < L ≤ 50 m	L > 50m
2/4 – 4/8		-	DSF01	DSF01	See table below
7.5/15		-	-	DSF01	See table below

- DSF01: three inductances of 50 mH weakened to rise on rail DIN
- For lengths superior to 50 m, consult us.

In the case of long lengths

In the case of long cable lengths, there is a special function in the DLD variable speed drive for versions of software above or equal to AP516V07, running with PME version 4.04 or above. This function is used to adapt the variable speed drive switching mode according to the length of the cable. Parameters can be set with PME in "Servo-control settings" under the hardware tab.



<u>There are three possibilities:</u>

- Default values (8kHz) + PWM mode 1
- 4kHz + PWM mode 1
- 4kHz + PWM mode 2

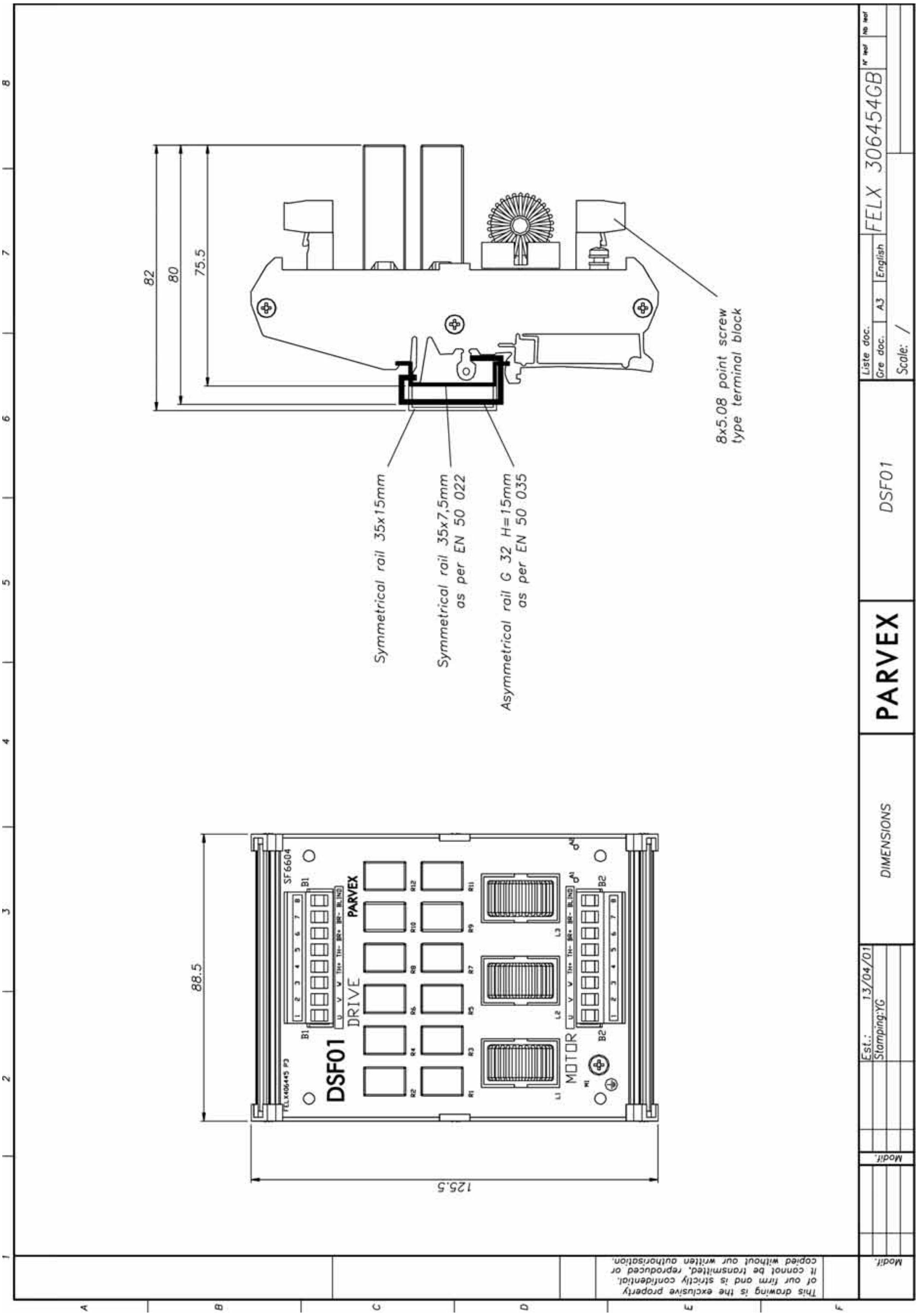
<u>The parameters to be applied are as follows:</u>

Cable length (shielded and non-shielded)	L< 50m	50m < L < 80m	80m < L < 120m
Settings	Default value+DSF01	4kHz PWM mode1+DSF01	4kHz PWM mode 2+DSF01

<u>Only modify the parameters in these specific cases. Follow any modification by shutting down and restarting the variable speed drive.</u>

Connection by connector

The power connection on the motor by connector is available as an option. The mating part of the connector (plug) can be supplied on request.


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
English
A3
Est.: 13/04/01
Stamping:YG
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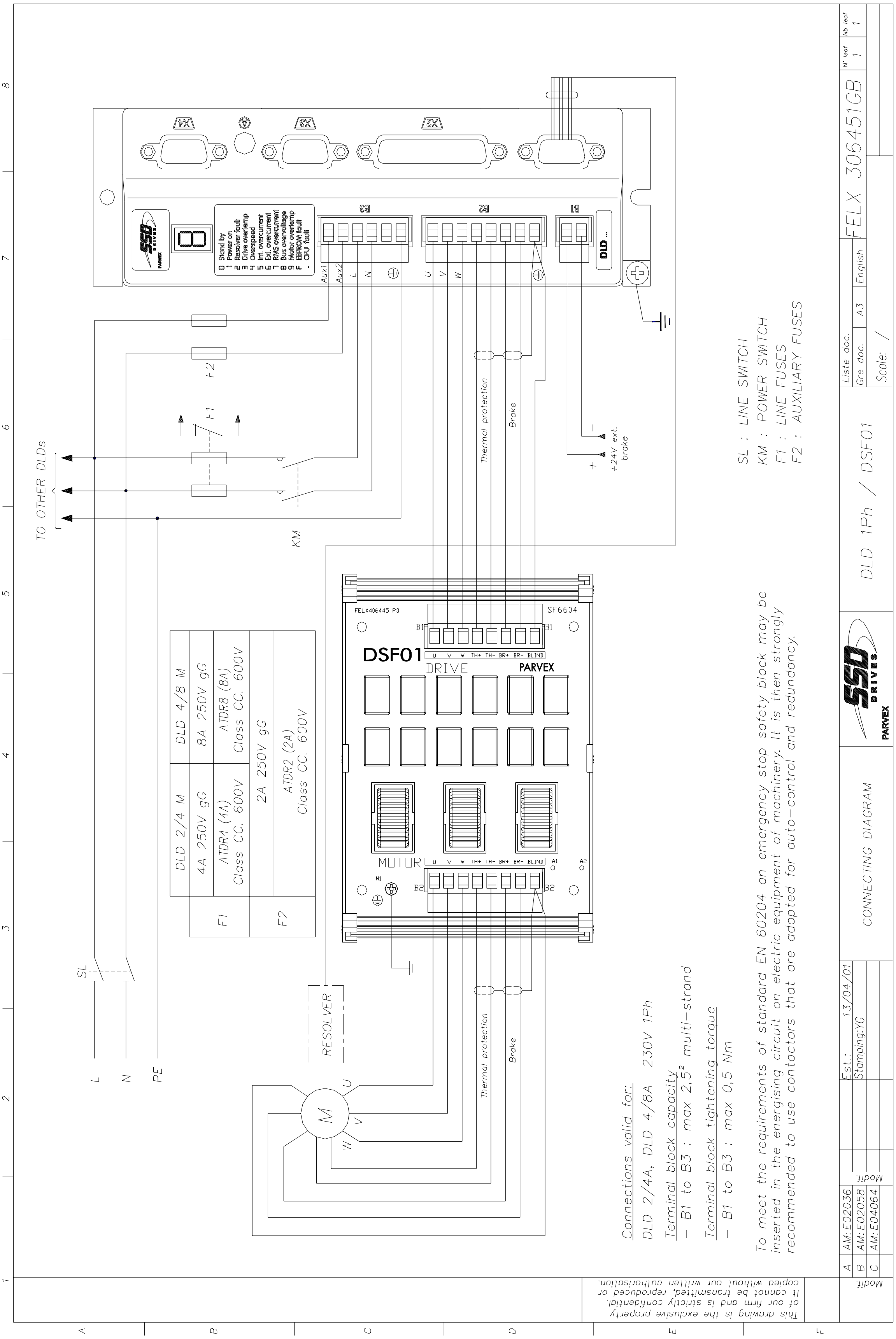
TO OTHER DLDs
SL : LINE SWITCH
KM : POWER SWITCH
F1 : LINE FUSES
F2 : AUXILIARY FUSES
DLD 2/4 M
4A 250V gG
ATDR4 (4A)
Class CC. 600V
DLD 4/8 M
8A 250V gG
ATDR8 (8A)
Class CC. 600V
2A 250V gG
ATDR2 (2A)
Class CC. 600V
F1
F2
DSF01
DRIVE
MOTOR
PARVEX
RESOLVER
Thermal protection
Brake
+24V ext. brake
Connections valid for:
DLD 2/4A, DLD 4/8A 230V 1Ph
Terminal block capacity
- B1 to B3 : max 2,5² multi-strand
Terminal block tightening torque
- B1 to B3 : 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.
CONNECTING DIAGRAM
DLD 1Ph / DSF01
FELX 306451GB
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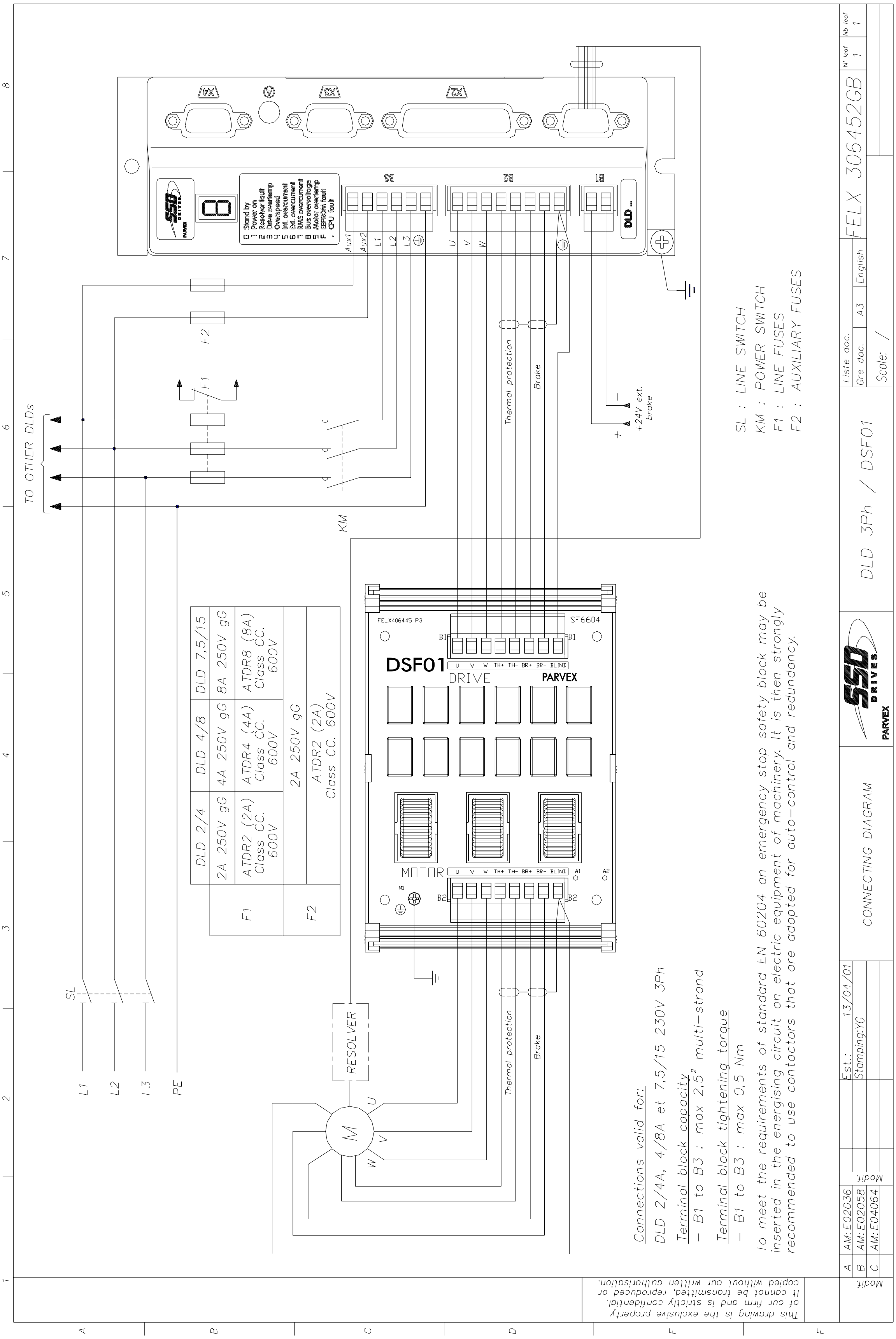
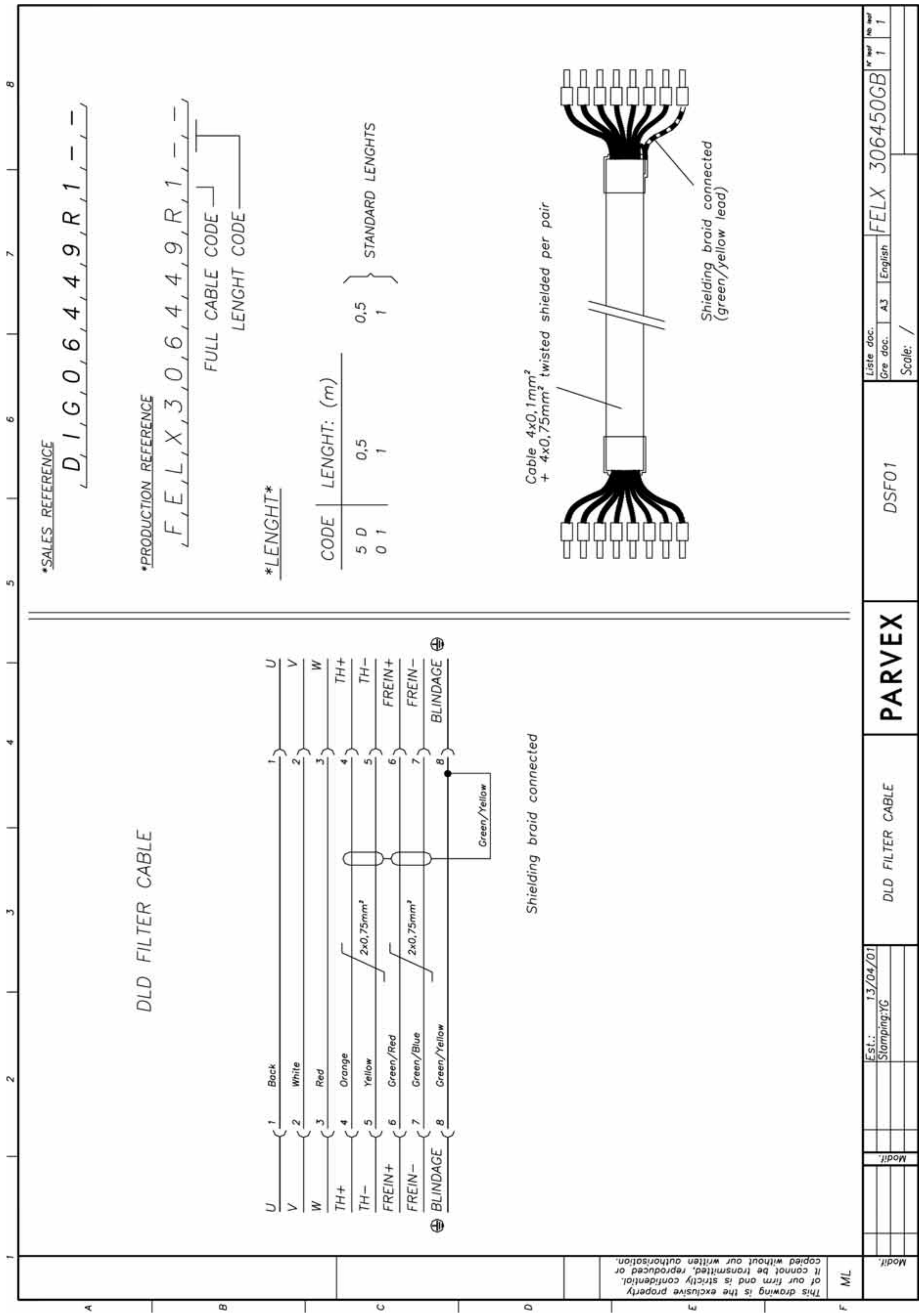

TO OTHER DLDs
L1
L2
L3
PE
SL
KM
F1
F2
DLD 2/4
2A 250V gG
ATDR2 (2A) Class CC. 600V
DLD 4/8
4A 250V gG
ATDR4 (4A) Class CC. 600V
DLD 7,5/15
8A 250V gG
ATDR8 (8A) Class CC. 600V
2A 250V gG
ATDR2 (2A) Class CC. 600V
X4
X3
X2
B3
B2
B1
DLD ...
Aux1
Aux2
U
V
W
Thermal protection
Brake
+24V ext. brake
DSF01
DRIVE
MOTOR
PARVEX
SF6604
RESOLVER
M
SL : LINE SWITCH
KM : POWER SWITCH
F1 : LINE FUSES
F2 : AUXILIARY FUSES
Connections valid for:
DLD 2/4A, 4/8A et 7,5/15 230V 3Ph
Terminal block capacity
- B1 to B3 : max 2,5² multi-strand
Terminal block tightening torque
- B1 to B3 : 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.
CONNECTING DIAGRAM
DLD 3Ph / DSF01
FELX 306452GB
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.


DLD FILTER CABLE
U
V
W
TH+
TH–
FREIN+
FREIN–
BLINDAGE
Back
White
Red
Orange
Yellow
Green/Red
Green/Blue
Green/Yellow
2x0,75mm²
2x0,75mm²
Green/Yellow
Shielding braid connected
*SALES REFERENCE
D I G 0 6 4 4 9 R 1 _ _
*PRODUCTION REFERENCE
F E L X 3 0 6 4 4 9 R 1 _ _
FULL CABLE CODE
LENGHT CODE
LENGHT
CODE
LENGHT: (m)
5 D 0,5
0 1 1
0,5
1
STANDARD LENGHTS
Cable 4x0,1mm² + 4x0,75mm² twisted shielded per pair
Shielding braid connected (green/yellow lead)
Est.: 13/04/01
Stamping:YG
DLD FILTER CABLE
PARVEX
DSF01
Liste doc.
Gre doc.
A3
English
Scale: /
FELX 306450GB
Modif.
ML

4.5.2 Motor end connection

Power connection

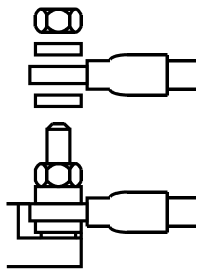
There are two possibilities for connection:

Terminal block + resolver connector.
Power connector + resolver connector.

Terminal block connection

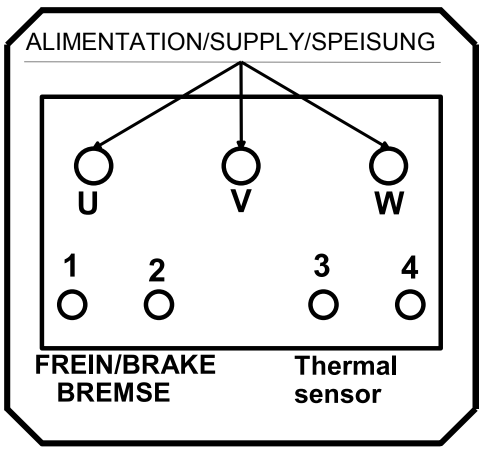
For the terminal block, the clamping nuts and washer come in a bag
Take care when fitting the lugs not to loosen the connecting leads between the motor and the terminal block.

The power connection lugs are to be inserted between the striated washer and the flat washer.



Digpl3.D

Motor direction of rotation: by wiring as recommended, a positive set point applied to the drive entails clockwise rotation (viewed from the power shaft end).



U Phase U

V Phase V

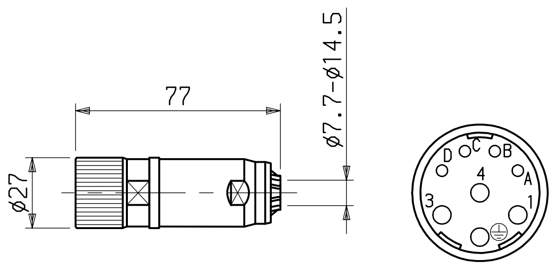
W Phase W

1 Optional brake +24 V — cable ≥ 1mm²

2 Optional brake 0 V

3 Thermal sensor — cable ≥ 1mm²

4 Thermal sensor



PLUG 220065R1610/1611

CABLE CROSS-SECTION FOR PLUGS

PLUG 220065R1610 : power & earth: 0.14 - 1.5 mm². Brake & thermal: 0.14 - 1 mm²
PLUG 220065R1611 : power & earth: 0.75 - 2.5 mm². Brake & thermal: 0.14 - 1 mm²

FUNCTION	PLUG PINS		CABLE COLOR
	220065R1610/R1611	220065R3610/R3611	
BRAKE + BRAKE **-**	A B	**+** **-**	Green-red Green-blue
THERMAL PROTECTION THERMAL PROTECTION	C D	1 2	Orange Yellow
EARTH	2	⏚	Yellow-Green
U**2** V**2** W**2**	1 4 3	U V W	Black White Red

Holding brake connection

Brushless motors can be equipped with a specially sized brake to maintain the axis immobilized. If
24 V ±10% dc voltage is applied across the brake terminals, the brake disc is free and the motor can rotate.

The 24 V dc supply used for brake control must be regulated and filtered. The brake is to be connected to terminals B2/6 and B2/7.

Thermal protection connection

The two terminals of the thermal sensor located in the motor terminal box are to be connected to B2/4 and B2/5.

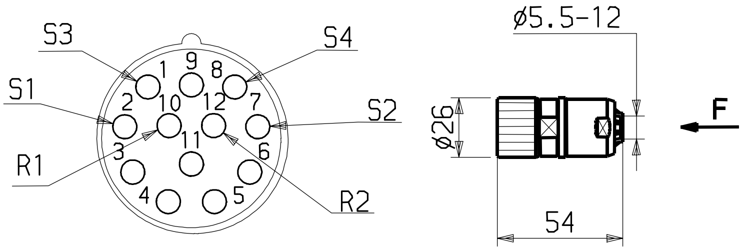
4.5.3 Resolver connection

The resolver is a high-precision sensor (±10 angular minutes as standard) which must be wired carefully:
- Separate power cable routing.
- Cable twisted and shielded in pairs (no general shielding). The shielding must be linked to the metal SUB-D plug cover. The shielding must not be linked to the motor side.

PARVEX SAS. can supply this cable in either of two forms:
- Separate cable, in this case wire as in the drawing below.
- Cable fitted with Sub-D plug at the drive end and connector at motor end. This solution is **highly recommended** as the cable is ready for use.

Maximum distance between the resolver and the DIGIVEX Little Drive: 50 m (Please ask about greater distances).

Maximum permissible cross-section:
- by the Sub-D connector: 0.5mm².
- by the connector removable plug: 0.14 - 1 mm² (solder- or crimp-fit contacts)



Viewed from F

RESOLVER CONNECTOR REMOVABLE PLUG (motor end connector)
220065R4621 (solder-fit contacts - standard)
220065R1621 (crimp-fit contacts)

For XD motors :
Connect by Sub-D connector under rear cover (cable routed through special cable gland).

Please ask for details.

4.5.4 Automatic control Input / Output connection

See functions and characteristics of these inputs / outputs in Section 5.
Sub-D X2 : use the cable as in drawing FELX 304553 (see § 4.3.2.3).
Sub-D X3 : Encoder emulation cable reference (see § 4.3.2.5).
Sub-D X4 : RS232 link with PC: use a standard 9-pin - RS232 cable - extension (see § 4.3.2.6).

4.6 Accessories and Tools

4.6.1 Cables

Plain cables.

- *Resolver cable: 6537P0001*
- *Input / Output cable : CB 08304*
- *Emulation cable: CB 08307*

Complete cables (equipped with connectors and/or Sub-D connectors).

- *Resolver cable: 220049R61-- (-- = length in meters) 5m/10m/15m/25m/50m.*
- *Input / Output cable: DIG 04544R --- (code 1 or 2 and length in meters 3m/5m/10m/15m/20m).*
- *Encoder emulation cable: DIG 04546R --(-- = length in meters) 3m/5m/10m/15m/20m.*

For the RS232 cable (Sub-D X4), see commercially available cables with 9-pin Sub-D extension.
Power cable (supplied unequipped or equipped with connector plug).
See § 4.5.3. connection by connector.

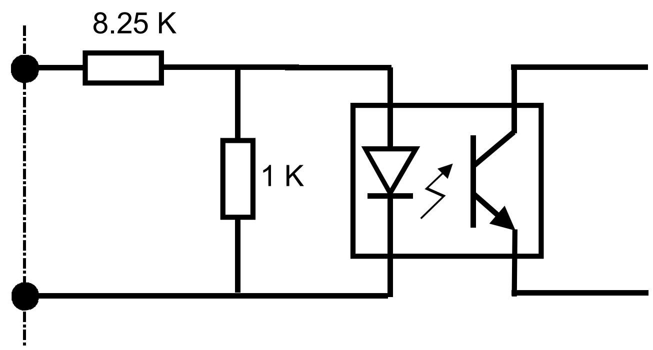
5. AUTOMATIC CONTROL INPUT / OUTPUT FUNCTIONS AND CHARACTERISTICS

5.1 Input / Output Characteristics

5.1.1 Logic inputs

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

LOGIC INPUTS



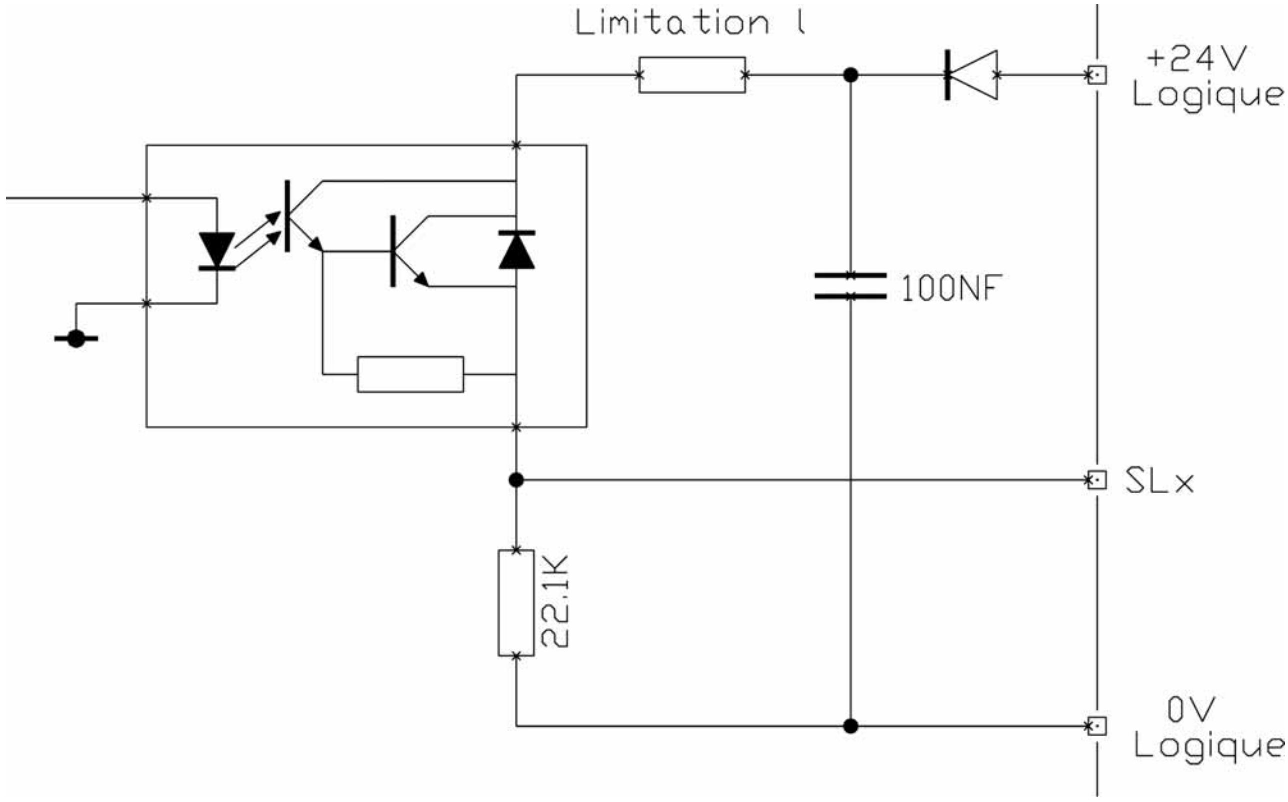
	MINI	TYPICAL	MAXI
Level 0 input voltage	-	0V	5V
Level 1 input voltage	15V	24V	30V
Level 0 input current	-	0mA	0.5mA
Level 1 input current	1.7mA	2.8mA	3.6mA
Ton response time (0 to 1)	-	1 ms	-
Toff response time (1 to 0)	-	1 ms	-

5.1.2 Logic outputs

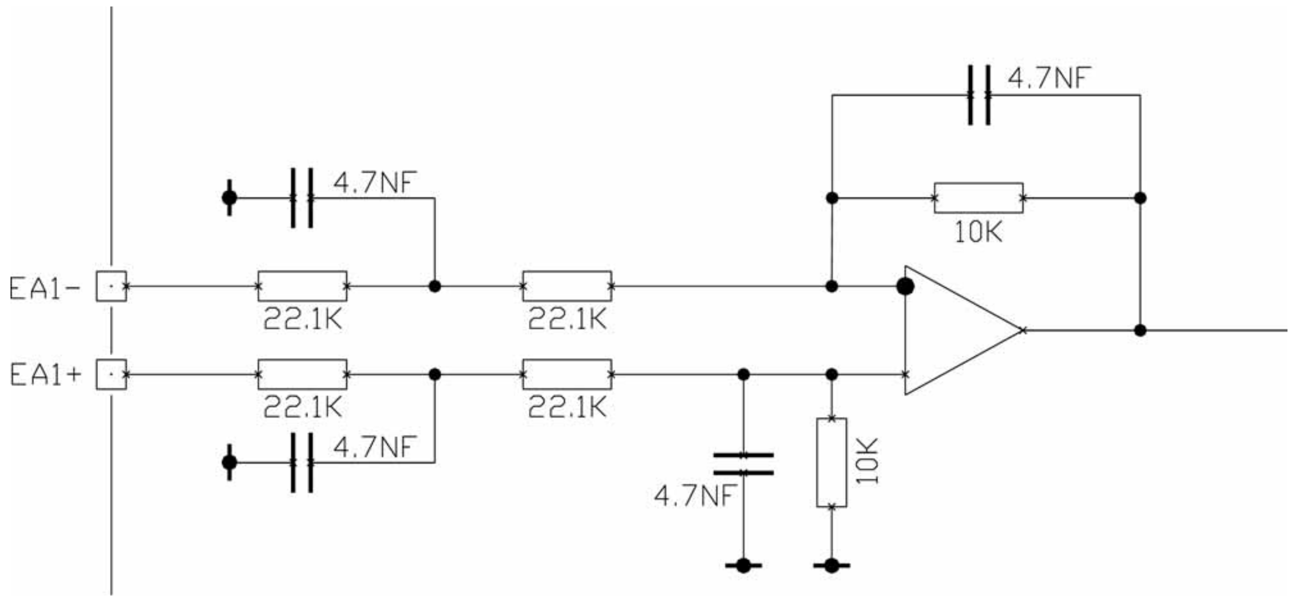
The outputs are fed by an external 24V (24V terminal 13 and 0V terminal 25). The three 0V outputs are linked to terminal 25.

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

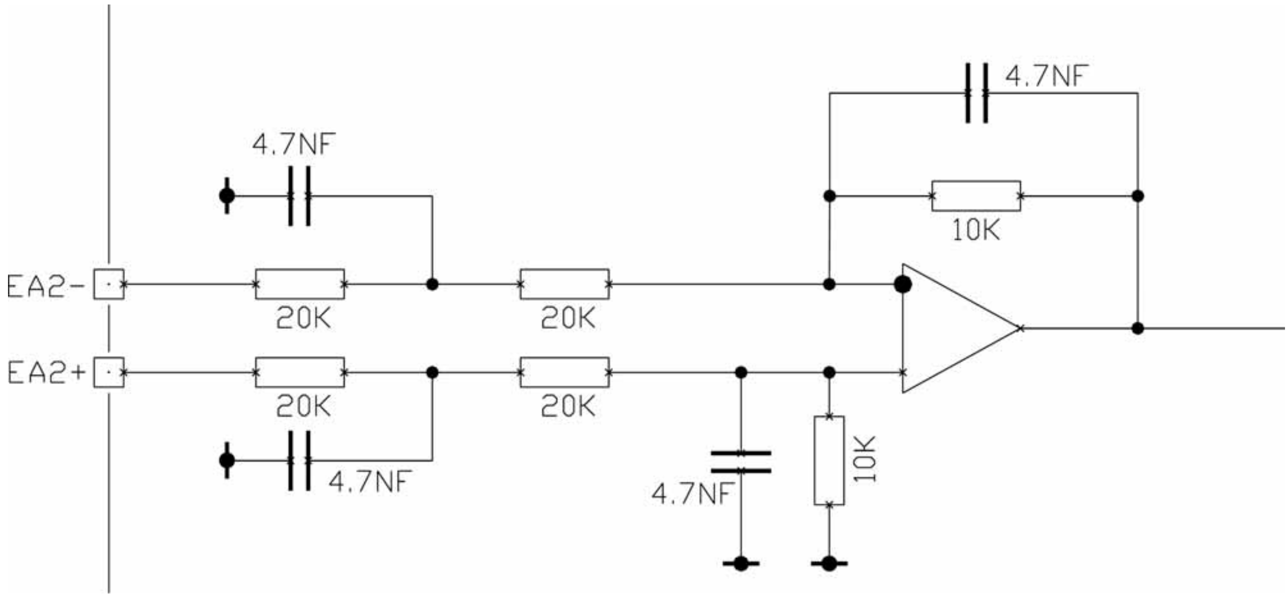
Opto-isolated output (opto-mos), PNP type, the load being for connection to the 0V logic (i.e. between the two contacts allocated to this output).



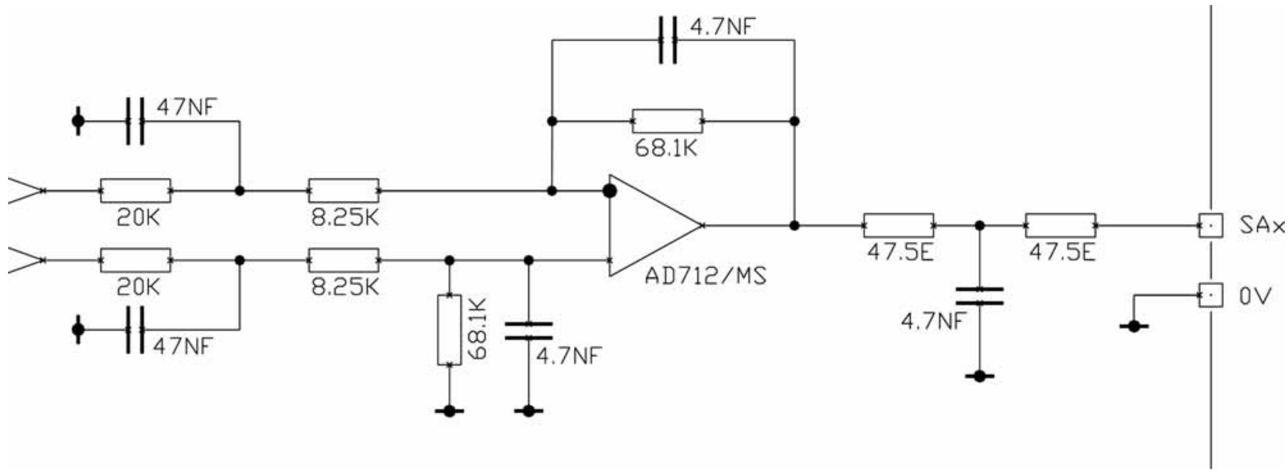
5.1.3 Speed set point input



5.1.4 Current limitation input



5.1.5 Analog outputs



5.1.6 Encoder emulation

Electrical characteristics

The electrical output interface meets standard RS422 for differential serial links. The circuit used is a "LINE DRIVER" of the MC26C31D type. The electrical characteristics are therefore closely related to the use of this component.

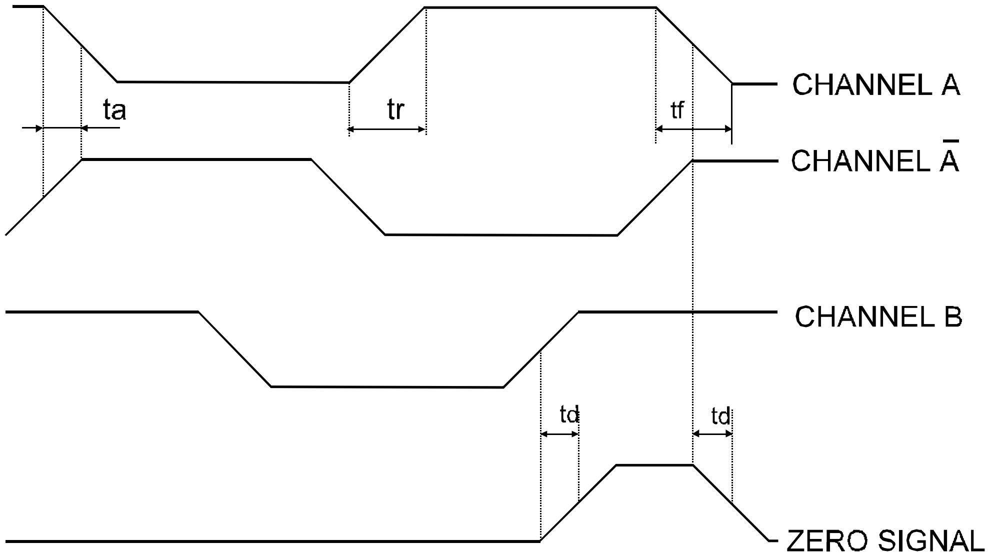
Short-circuit capability

A single output may be short-circuited at 0 V at any given time

Signal form

Signal levels:

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

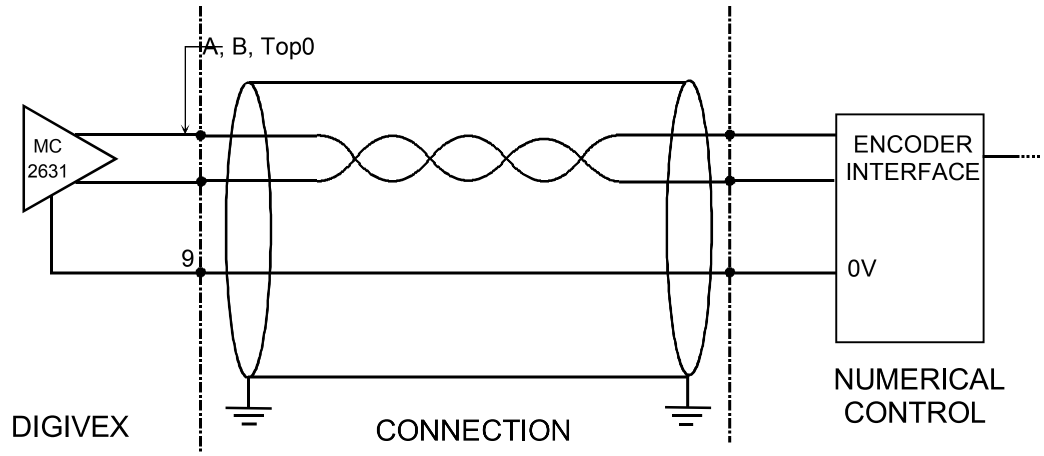
Time delay defined at 50% of magnitudes in question without cable and without load.

-6ns ≤ ta ≤ 6ns (maximum)

Time delay between channels A, B and the zero mark

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 zero mark position

This is done with the DIGIVEX PC software.

Resolution

Adjustable between 1 and 16384, either by +/- keys, or be 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 confirms by acknowledging the zero mark.

5.2 RESET and Contactor Control

- X2/5 **Reset +**
- X2/21 to X2/24 **Reset -**

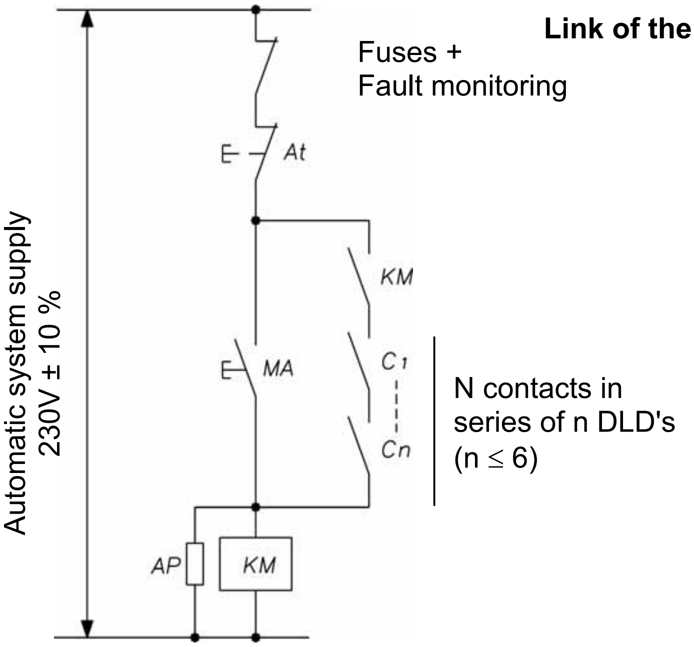
A rising 24V front applied to X2/5 as compared to X2/21 induces the reset after a fault.
Its worth noting that the reset can also be carried out by turning off the power supply completely (mains and auxiliaries).
This control has no effect during normal operation. The system must be "reset" after any active fault.

- X2/6 **DRV OK+**
- X2/18 **DRV OK-**

- This logic output is at level 0 if:
  - the amplifier has neither low levels or neither power on the amplifier
  - the amplifier has low levels without power.
- This logic output is at level 1 if:
  - The dc bus voltage is present and the amplifier does not display a fault
- This logic output shifts from level 0 to level 1 on the setting up of a power bus, due to the closing of the main contactor (KM power contactor)
  This output must, through an interface, authorise the self-support of the main contactor. This logic output shifts from level 1 to level 0 in the folowing cases:
  - On normal stoppage, obtained by voluntary opening of the main contactor, when the dc bus voltage shifts to the minimum value of authorised bus voltage.
  - On amplifier fault requiring amplifier stoppage.

Caution: The shift to 0 of this logic output during running must imperatively induce the opening of the main contactor, with a maximum delay of 100ms.

Link of the DC buses from n DLDs case



KM : Main power contactor
MA : On
At : Off
AP : Anti-interference
C1 to Cn : dry relay contact (outside of the DLD) driven by the DRV OK logic output (24V, 50 mA max)
Interruption capacity 250 V, 1 A max (interface between logic output and relay by automaton)
Logic output level 0, Relay open
Logic output level 1, Relay closed

5.3 Initilialization Sequence

After auxiliary power has built up: (approx. 300 ms)

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 X2 plug shifts to 0 for minimum Bus voltage. This off-load time depends on the activity of the amplifier during this phase. The motor continues to be driven until the output switchover, then, 0 is displayed.

5.4.2 Stoppage due to a fault

To	⇐ Fault detection
To + 20ms	⇒ Fault type displayed. The external automatic system must then open the main contactor at the latest 100ms after the transition of the X2 plug from 0 to the "DRV OK" output. The motor can no longer be driven.

6. SERVO-CONTROL PARAMETER FUNCTION AND SETTING

6.1 Servocontrol Parameter Functions

6.1.1 List of parameters

Choice of regulation type:
Speed Proportional: P
⇒ Proportional integral: PI
⇒ Proportional double integral: PI^2
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/min	100 000 rpm /min
• Speed for 1 V	10 rpm /min	14150 rpm /min
• Proportional gain	I pulse - drive /156	I pulse - drive x 210
• Integration stop	0,1 Hz	100 Hz

- Predictors (gravity, dry or dynamic friction, acceleration).

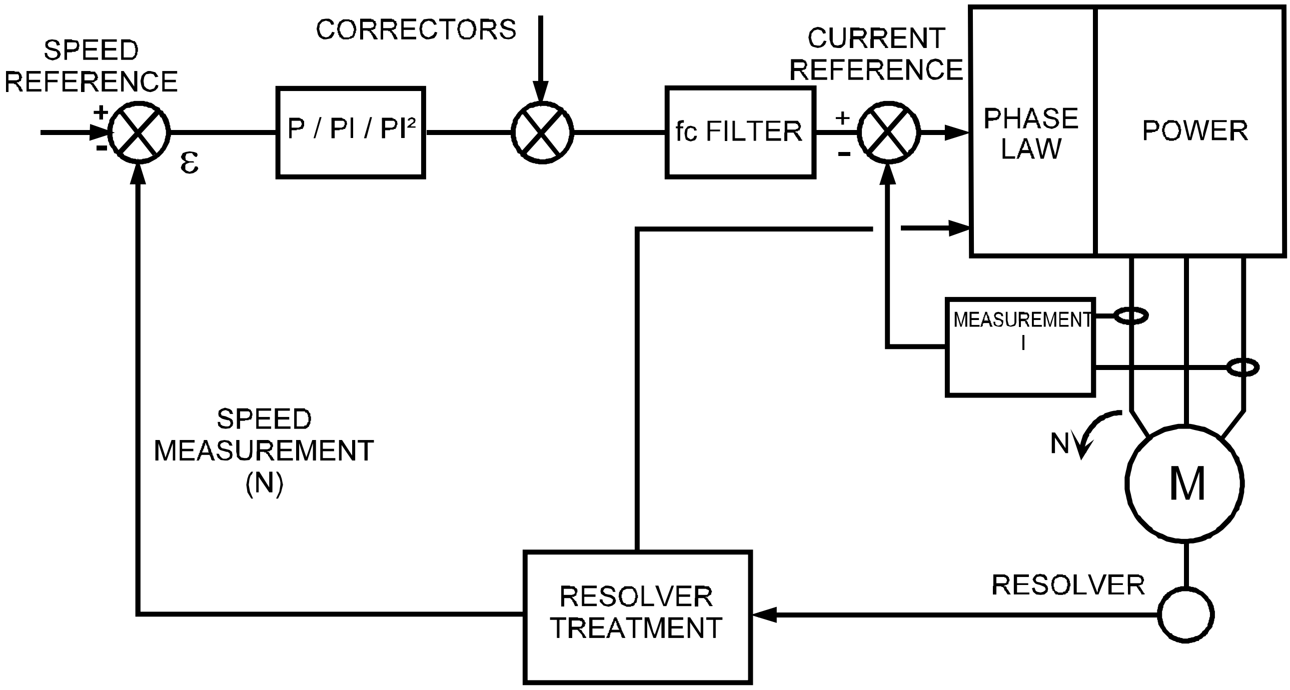
6.1.2 Regulation selection: current, proportional, PI, PI²

Current regulation

Choosing "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, PI/PI^2 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.

Choosing P

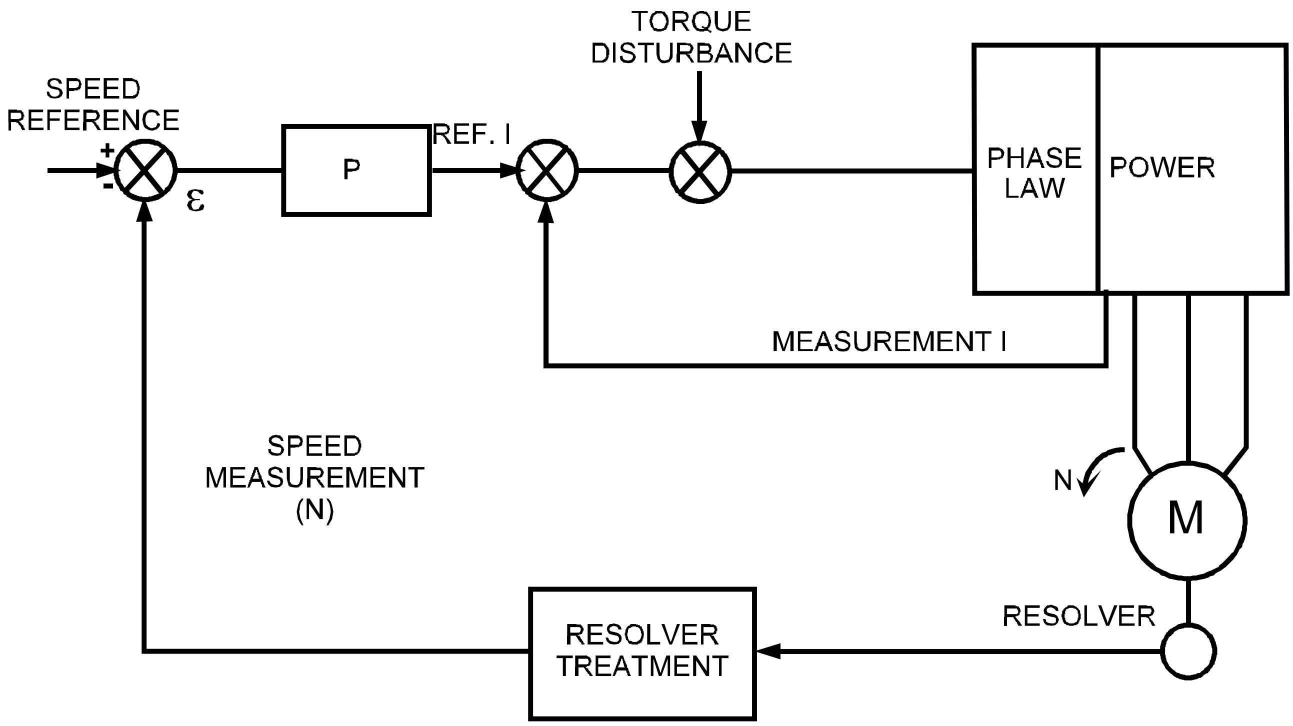
The drive is used in a speed loop with purely proportional gain. This gain is the ratio between the output current and the speed error. It is expressed in mA / rpm.



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 may 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.



Choosing 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 compared with the state at rest. This angle will be proportional to the torque applied 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.

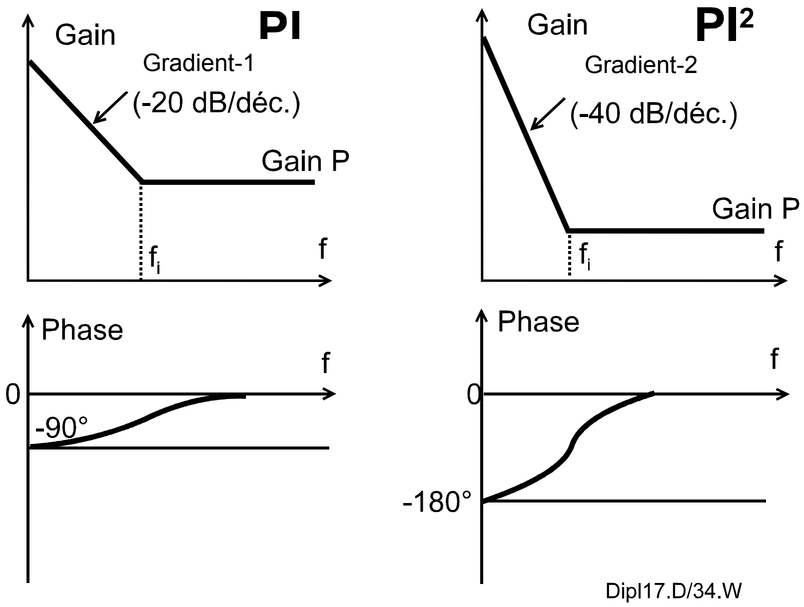
The proportional gain P sets the bandwidth f_0 (system rapidity). The integral action entails -90° phase shift, which creates instability. This phase shift is not troublesome at low frequencies, but may make the system unstable at higher frequencies. It is therefore best to adjust the "integral stop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

Choosing PI^2 action (proportional and double integration)

Compared with P action alone, PI^2 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 at rest (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 may entail instability in the system. Restrict to 0.1 to 0.2 times the bandwidth f_0.

6.1.3 Integration stoppage

See the previous paragraph for the function of this parameter. Below is its definition after the Bode graphs only (gain / frequency and phase / frequency).



6.1.4 Speed scaling

The choice of motor - drive combination 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 positioning control).

6.1.5 Filtering frequency

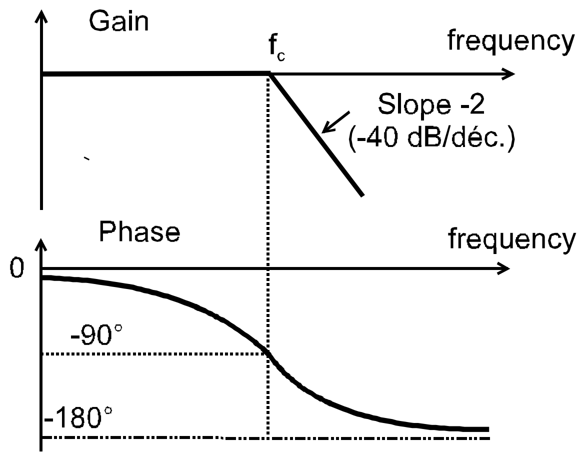
Resonance phenomenon

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/PI^2 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.



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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 the 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, PI^2 branch and therefore to reduce the speed error.

As these predictors are outside the speed loop (which must be adjusted first), they do not affect stability. 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)

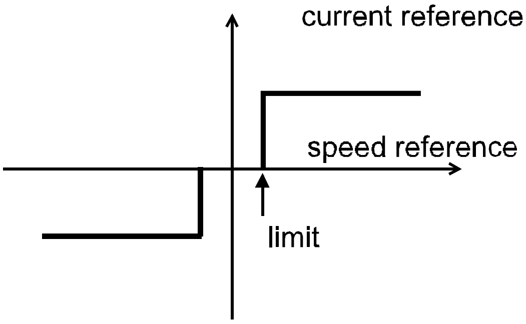
The current value, in amps, required by the motor to move the mass at constant speed (average between up and down) is introduced directly into the parameter.

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 rest 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 / ΣJ. 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.

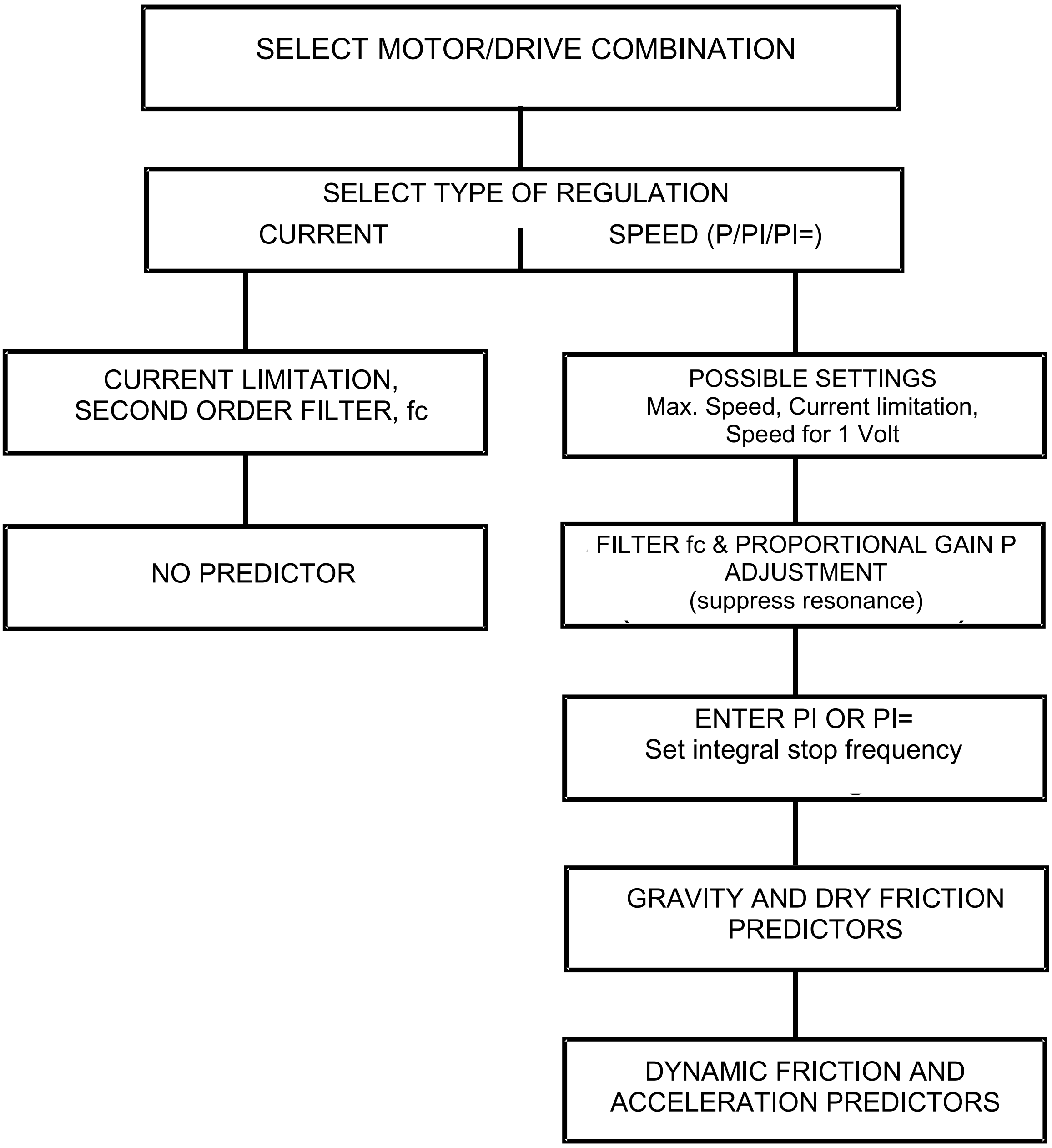
6.2 Inputting Parameters

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

The transition of this customization to a different calibre amplifier leads to the generation of a fault. The parameters contained in the EEPROM are saved.

6.3 Setting with DIGIVEX PC Software

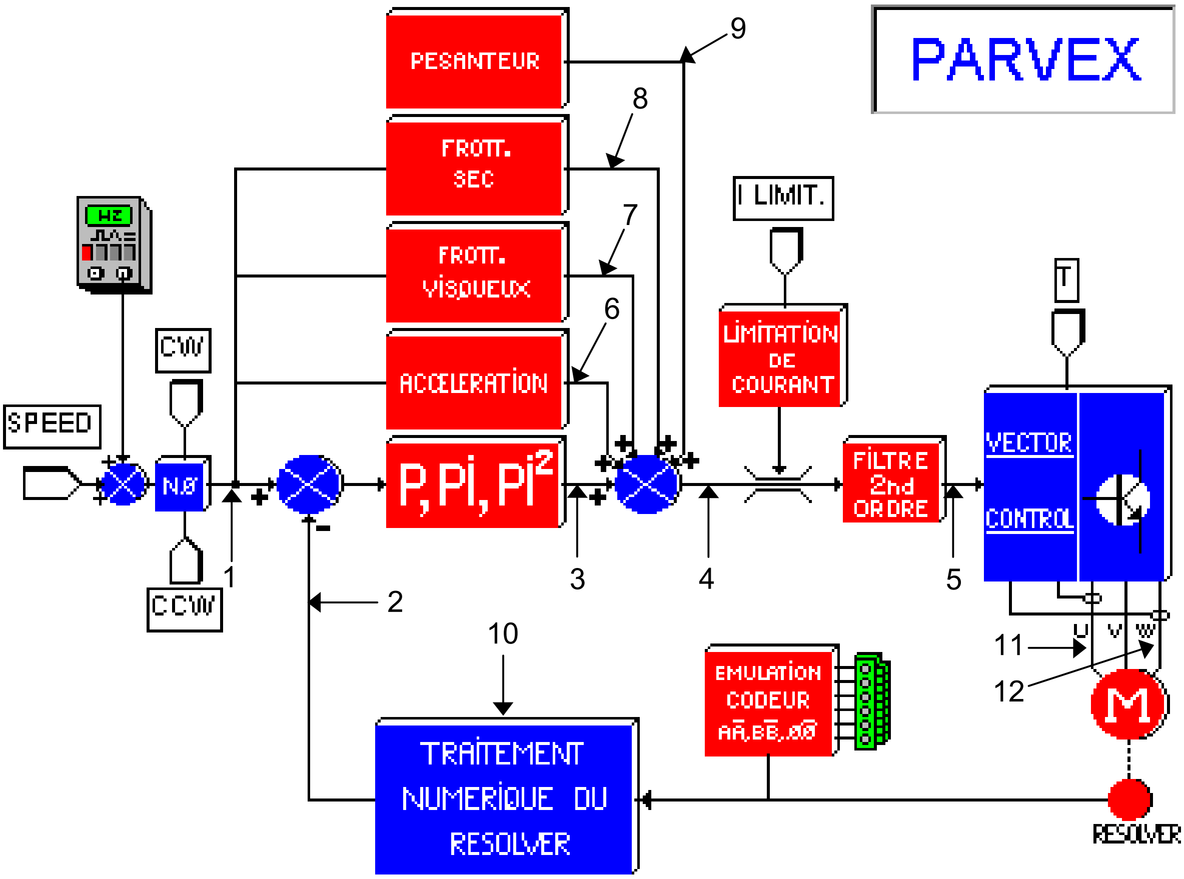
6.3.1 Outline



6.3.2 internal variables

Accessible internal variables (via DIGIVEX PC software)

The following internal variables may be selected:



Reference

- ♦ 1 Input set point in rpm
- ♦ 2 Speed measurement in rpm
- ♦ 3 P, PI, PI^2 output in Amps
- ♦ 4 Sum in Amps
- ♦ 5 Current set point in Amps
- ♦ 6 Acceleration in ms
- ♦ 7 Viscous friction in Amps
- ♦ 8 Dry friction in Amps
- ♦ 9 Pesenteur in Amps
- ♦ 10 Position in degrees
- ♦ 11 Phase current U in Amps
- ♦ 12 Phase current W in Amps

The 4 selected variables are chosen from the list of variables.

Access via the name of the variable, this is valid for the 16 above plus the following variables:

- Temperature in °C
- Bus voltage in Volts
- Active I in Amps
- Reactive I in Amps
- Id current in Amps
- Iq current in Amps
- Ud voltage in Volts
- Uq voltage in Volts
- Auxiliary input in Volts

LF generator
Position – filtered in degrees
Speed – filtered
DLD thermal load
Motor thermal load
Recovery thermal load

It should be noticed that these variables can be assigned to the two analog outputs, which means a separate oscilloscope can be used.

6.3.3 Entering parameters via DIGIVEX PC software

See DIGIVEX PC software instructions:

Choice of rating
Choice of motor (standard or special)
Choice of resolver
Entering servo-control parameters (global transfer)
Assigning inputs / outputs and variables
Use of the oscilloscope function
Use of 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 choice is made.

It can be reduced only here:

Choose a "dc" stimulus of, say, 1 volt.
Check the value obtained for the "measure speed in rpm" variable using the variable observation 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 advisable proportional gain, depending on the drive rating, and corresponding to maximum current oscillation.

RATING	P In mA/ rpm
2/4	35
4/8	75
7,5/15	150

N.B. This gain may be exceeded under certain circumstances. Please ask for details.

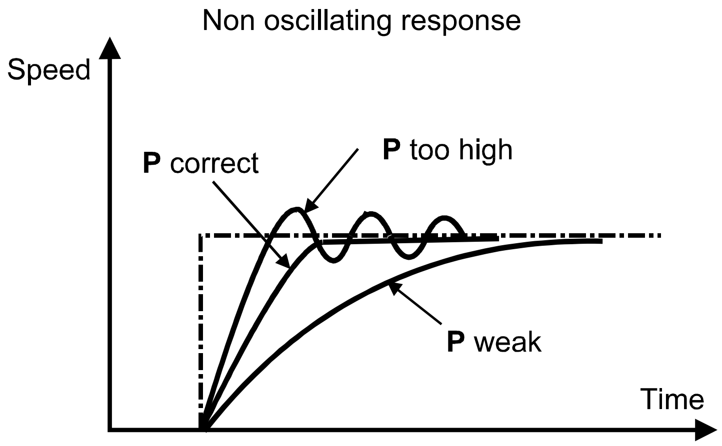
Generate a speed set point scale (0.5 to 1 V).

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 percent of N max, leading edge.

Increase gain P

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

There are three possibilities :



Dipl43gb.D/W

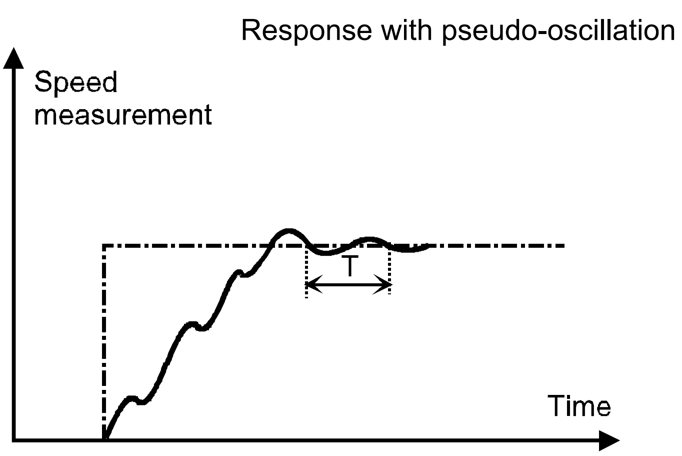
A response must be obtained without overshooting and oscillation. For example, increase gain until oscillations gradually appear, then reduce it by 20 to 30%.

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

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

Filtering frequency setting

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



Dipl43gb.D/44.W

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

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

If possible, gain can be increased again until a response is obtained without oscillation. Oscillation may reappear. Reduce the filtering frequency a little more.

Notice that it is essentially P and 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

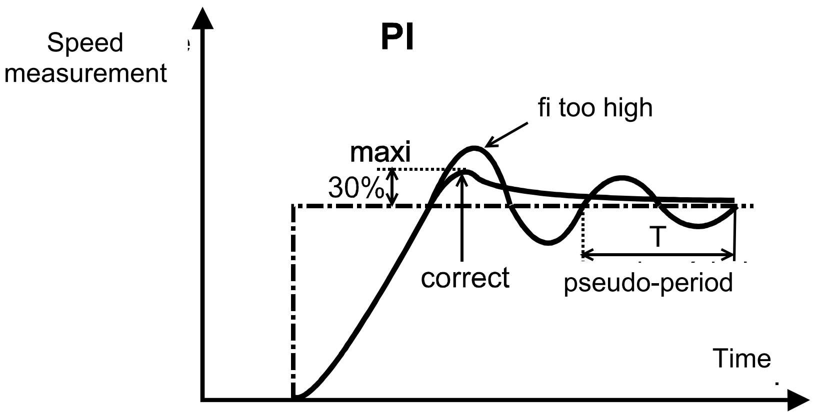
Initial status

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

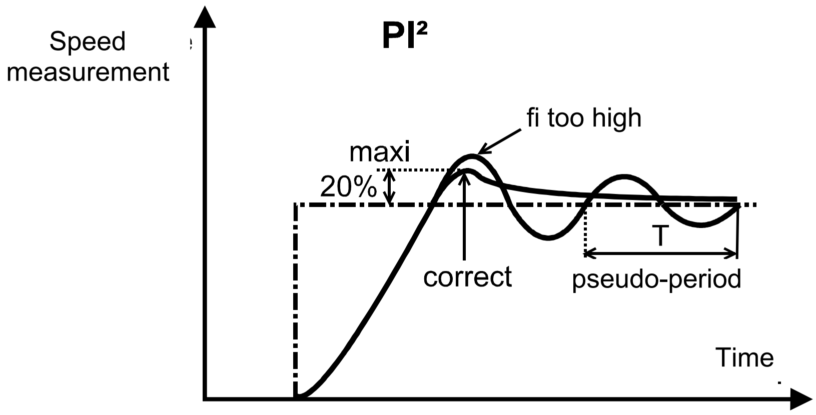
- Select PI or PI².
- Use the same stimulus as before (index analysis).
- "On line", increase the integration stop frequency until overshoot is obtained in the order of:
  - 25 - 30% in PI
  - 15 - 20% in PI²

Without oscillation.

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



Dipl43gb.D/45W



Dipl43gb.D/46W

Do not change PI to PI^2 without setting the integral frequency to 0.

6.3.5 Setting predictors

Initial conditions

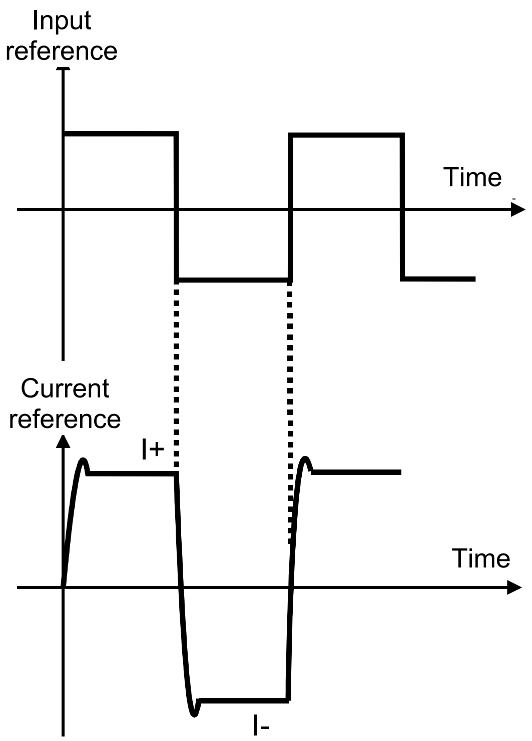
All loop parameters (P, integral and filtering frequency, max. speed, current limitation) are set (without predictors).
The system is ready to run.

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 1 Hz.
Using the oscilloscope function, display:

- The input set point,
- The current set point.



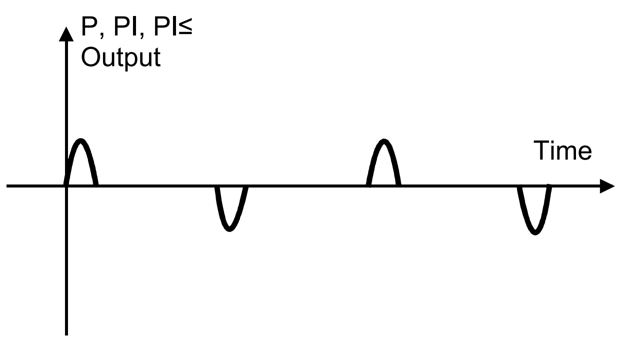
Diggb43.D/47W

N.B. 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 = max. speed / 1000).
After introducing the values, the result obtained can be checked with the same stimulus.
Check the input set point on one channel and the P, PI, PI^2 output on the other channel. This should give a result close to:

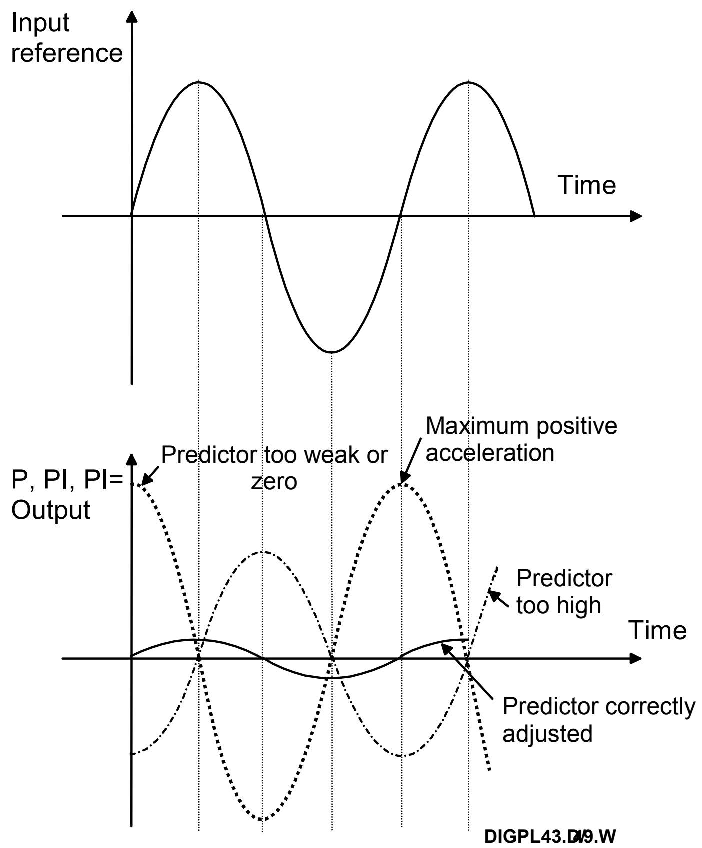


Setting the dynamic friction and acceleration parameters. (It is assumed that the dry friction and gravity predictors have been set).

Use a sine stimulus, offset 0, peak to peak value 10 to 20% of maximum speed, frequency 0.2 to 1 Hz.
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 P, PI, PI^2 output is minimized. Too high a value increases P, PI, PI^2 with a phase change



Very marked difference between optimum setting and no predictor

The correct setting corresponds to minimum amplitude P, PI, PI^2 output. The predictor must allow the P, PI, PI^2 output to be reduced in a ratio of at least 5 to 10.

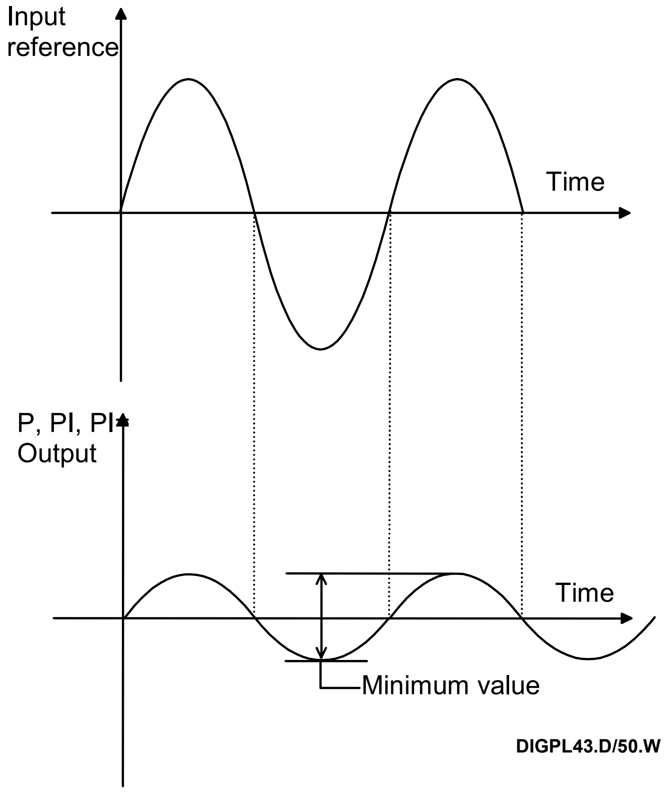
Remember that the value of t_{pr} (prediction time) (in ms) is close to td (start up time) with:

$$td = \frac{(\text{Load inertia} + \text{motor inertia}) . \omega \ \max}{\text{Max torque}}$$

td is the acceleration time from 0 to maximum speed with maximum torque,
td in seconds, inertia in kgm^2, max. 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 chosen, 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, servo-control parameter adjustment function.

This means that it is possible to:

assign one of the internal variables to each of the two 10 V analog outputs.
assign a constant value (up to -12V and +12V) to the analog outputs
force the logic inputs to 0 or 1.

The logic inputs / outputs are assigned permanently.

Encoder emulation

Choice of number of marks between 1 and 16384 per turn (off line).
Validating by teaching of zero mark position (on line).

Miscellaneous choices

Choice of processing strategy for monitoring of mean or rms currents: current reduction or power opening.
Choice of brake strategy: current reduction or not in the event of brake closure.
Choice of user strategy for thermal protection of motor (with or without thermal protection).

(See PME MODULE DIGIVEX Little Drive PVD 3536 manual)

7. COMMISSIONING - SERVO-CONTROL PARAMETER SETTING - DETECTING REASONS FOR STOPPAGE

7.1 Start-up Sequence

7.1.1 Preliminary checks

Wiring check
Power and auxiliary connections to DLD.
Reset wiring.
External 24 V supply for brake.
Check the resolver connections.

- Motor end
- DLD end

Check the power, brake and thermal connections.

- Motor end
- DLD end

Supply type check
Power: 50/60 Hz, 230 V single or three-phase
Auxiliaries: single-phase 50/60 Hz, 230 V.
Brake supply: 24 V dc ±10% (including oscillation).

Caution: Before doing any work on the system, make sure the power bus is at 0 V. Wait at least three minutes after the motors have come to a complete stop before starting work. **Wait for the 7-segment display to go off.**

7.1.2 Commissioning with DIGIVEX PC software

Connect the PC via the RS232 serial link.
Energize the auxiliary parts (low levels) alone; 0 is displayed
Go "On line" via the PC, with the PC in interactive mode. Parameter adjustment functions' connection. 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 (DIGIVEX, DLD).

Once "on line" all the parameters in the DIGIVEX Little Drive can be read.

Using the PC help functions, check the fault analysis for the lack of faults.
Check the SPEED, RANGE, CW, CCW, TORQUE input status.
Then configure the amplifier. This can be done "off line" in a file and then transferred or modified "on line".

- Choice of motor.
- Choice of servo-control parameters (without the power part, their validity cannot be checked).
- Ancillary checks: validate brakes, analog outputs, safety strategy, etc...

Use the software to force the drive to zero torque.
Power up. 1 is displayed.

Remove "zero torque" locking using the software or via hardware contact (set "TORQUE" input at 24V)
Carry out system adjustment using stimuli.

- "dc" stimuli (square with peak-to-peak = 0). Check max. N.
- "Square" stimuli or setting procedure for adjusting servo-control parameters.
- DIGIVEX PC 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 drive operation can be displayed in two ways.

- On the 7-segment display situated **on the front panel of the amplifier**
- Via the 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 2 kinds of malfunction:

- Malfunctions that require stoppage of the system

These malfunctions must lead to:

- ♦ The opening of the main contactor and disconnection of the power supply (controlled by the DRV OK X2/6, X2/18 logic output) (See § 5.2)
- ♦ The fault is stored in the axis and the data is displayed on the front panel.

Malfunction leading to a reduction in the system's dynamic characteristics.

- ♦ For excessive DLD dissipater temperature.
- ♦ For excessive mean drive current or excessive rms motor current, if the drive parameter setting allows operation to continue. The choice of continuing operation with reduced current or stopping is made by the "current protection" strategy in the "servo-control" window of the parameter setting software.

These malfunctions lead to:

- ♦ A reduction in the motor current
- ♦ The data being displayed on the front panel (7-segment display flashes).

7.2.1.2 Current monitoring

Mean drive current

To prevent the motor thermal tripping by the thermal sensor, the drive monitors the rms current [$I^2 = f(t)$].

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 time constant). This data, which is characteristic of the motor, is known to the drive when the choice of motor - drive is made.

As before there is a choice between two strategies:

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

Drive output current

There are two forms of monitoring:

- Short-circuit protection: monitoring of current drift.
- Excessive output current (maximum current). Check whether the current as measured exceeds the drive pulse current by 30%.

In both cases, there is stoppage due to the "DRV OK" output shifting to logic 0 which must induce the opening of the main contactor.

7.2.1.3 Temperature monitoring

DIGIVEX Little Drive dissipater temperature

- If the temperature is less than 85°C at the dissipater, nothing happens.
- Between 85 and 109°C, there is a reduction in the pulse current which can release the ("7-segment" display flashes at low frequency).
- At 110°C, stoppage of the amplifier

Servo-motor winding temperature

Each motor has a thermal sensor. When customizing the drive, this sensor can be taken into account or ignored. If it is taken into account (usual case), excessive motor temperature causes a fault.

Ambient temperature

This is measured between the electronic boards and operations are stopped when it exceeds 60°C.

7.2.1.4 Monitoring the DC Bus voltage

Recovery fault:

Motion controller electrical breaking capacity needs updating, cycle too restricting.

Bus overvoltage

Motion controller 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

7.2.1.6 7-segment display

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

Display	Description
0	Drive live, no power present
1	Drive OK, power present
2	Resolver fault
3	Excessive ambient temperature 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
9	Excessive motor temperature
. (dot)	CPU fault
F	Back-up error
r	Recovery fault

PC SOFTWARE FAULT-FINDING	COMMENTS
Max. drive current reached	Output or earth short circuit
Excessive mean current	Too much current asked of drive
Excessive rms current	Too much current asked of drive. Cycle too demanding.
Excessive motor temperature	Cycle too demanding or no motor fan cooling
Excessive dissipater temperature	Fan cooling stopped or excessive 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. Disconnected from mains supply.
Motor not connected	Motor wrongly connected
Liaison impossible	No power supply
Excessive mean current	Current reduction. I mean > drive rating
Excessive rms Current	Current reduction. Drive RMS current > Îo motor
Excessive dissipater temperature	Max. current reduced depending on temperature

7.2.1.7 Corrective actions

The incidents that may arise (from wiring errors or mishandling) are as follows:

Resolver fault

- Check the resolver connection.

Overcurrent

- poor motor connection (motor phase missing)
- programmed motor does not correspond to 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). The torque has been forced to zero during a global transfer. Reset system torque (see software).
- The motor is not connected.

Motor fails to run, but torque present

- CW and CCW inputs set to zero (hardware or software). Check with software.

7.3 Defaults description

DEFAULT	TYPE	ACTION
2	Resolver fault	Detection of S1,S2, S3 and S4 signal absence. Loss of resolver excitation: Veff rated value = 7V, Frequency = 8012 Hz on R1, R2/R3. Loss of sin (S2 S4) or cos (S1 S3) signals or too low resolver transformation ration. 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 60°C Dissipater: If the temperature is less than 85°C: nothing happens 85°C < T< 109°C: there is a progressive reduction of current authorized by the motion controller. 110°C < T: operations stop. Can be linked to large braking cycles. Check: • Electrical control cabinet ventilation • Good circulation around the motion controller
4	Excessive speed	Rotation speed measured at more than 15% above the maximum application speed Check: • Motion controller customization inappropriate to the motor and/or the application • Speed instruction more than 15% above the maximum authorized value. • Driving load
6	Maximum motion controller current reached	The measured current exceeds the motion controller'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 motion controller does not correspond to the connected motor

DEFAULT	TYPE	ACTION
7	Excessive mean or rms current	Mean current: measurement of the mean current supplied by the motion controller Rms current: calculation of the rms current supplied by the motion controller Causes: • Oversized operating cycle • Mechanical binding spot
8	Bus overvoltage	Braking recovery impossible Causes: • Oversized operating cycle • Motion controller braking capacity much too low with regard to the application
9	Excessive motor temperature	Causes: • Check connections • The motor is confined and cannot cool down • Motor does not have a temperature sensor: this sensor was not acknowledged during customization.
r	Recovery fault	Causes: • Cycle too restricting • Axis recovery capacity exceeded.

8. APPENDIX

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