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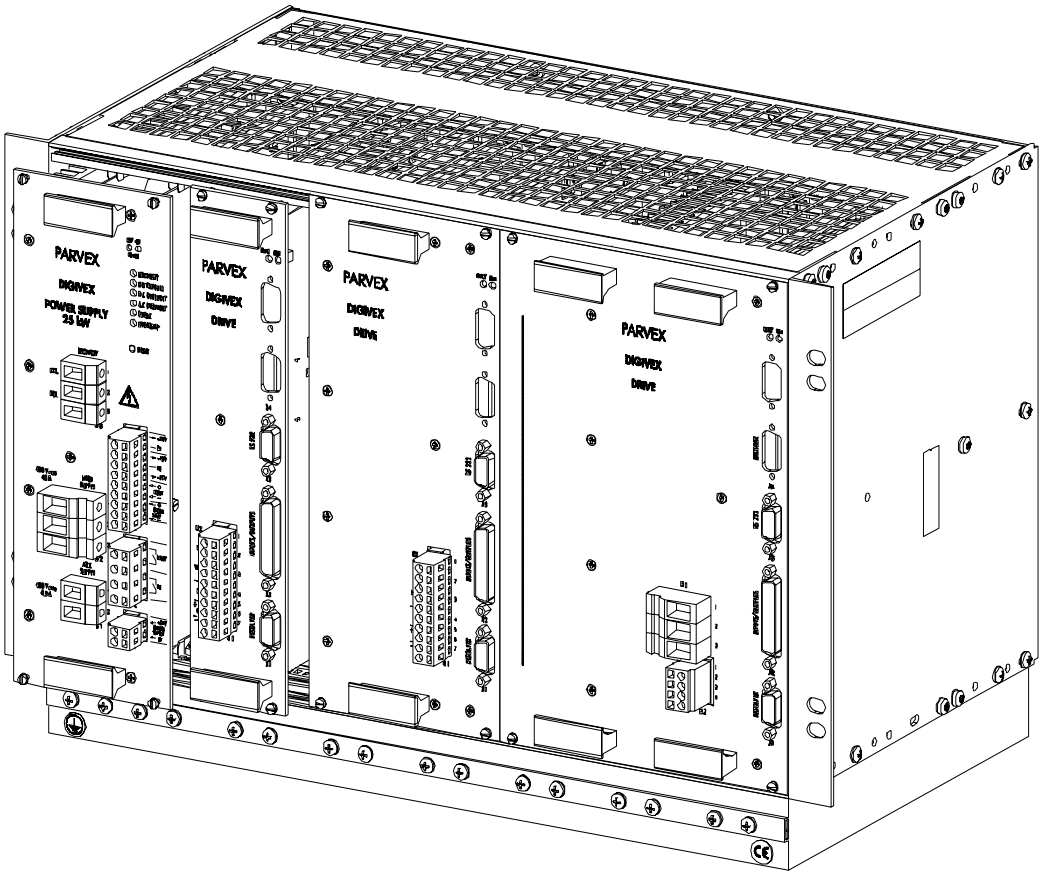
PARVEX

DIGIVEX Multi Drive

DIGITAL SERVOAMPLIFIER

User and commissioning manual

PVD 3464 GB – 04/2004



PRODUCT RANGE

1 - « BRUSHLESS » SERVODRIVES

TORQUE OR POWER RANGES

- **BRUSHLESS SERVOMOTORS**, LOW INERTIA, WITH RESOLVER
  Very high torque/inertia ratio (high dynamic performance machinery):
  - ⇒ NX -HX - HXA — 1 to 320 N.m
  - ⇒ NX - LX — 0,45 to 64 N.m

  High rotor inertia for better inertia load matching:
  - ⇒ HS - LS — 3,3 to 31 N.m

  Varied geometrical choice :
  - ⇒ short motors range HS - LS — 3,3 to 31 N.m
  - ⇒ or small diameter motors : HD, LD — 9 to 100 N.m

  Voltages to suit different mains supplies :
  - ⇒ 230V three-phase for «série L - NX»
  - ⇒ 400V, 460V three-phase for «série H - NX»
- **"DIGIVEX Drive" DIGITAL SERVOAMPLIFIERS**
  - ⇒ SINGLE-AXIS DSD
  - ⇒ COMPACT SINGLE-AXIS DµD, DLD
  - ⇒ POWER SINGLE-AXIS DPD
  - ⇒ MULTIPLE-AXIS DMD
- "PARVEX MOTION EXPLORER" ADJUSTING SOFTWARE

2 - SPINDLE DRIVES

- **SPINDLE SYNCHRONOUS MOTORS**
  - ⇒ "HV" COMPACT SERIES
  - ⇒ "HW" ELECTROSPINDLE,frameless, water-cooled motor — From 5 to 110 kW up to 60,000 rpm
- **"DIGIVEX" DIGITAL SERVOAMPLIFIERS**

3 - DC SERVODRIVES

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

4 - SPECIAL ADAPTATION SERVODRIVES

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

5 - POSITIONING SYSTEMS

- **Numerical Controls** « **CYBER 4000** » 1 to 4 axes
- **"CYBER 2000"** NC 1 to 2 axes
- **VARIABLE SPEED DRIVE - POSITIONER**
  - ⇒ SINGLE-AXIS DSM
  - ⇒ POWER SINGLE-AXIS DPM
  - ⇒ MULTIPLE-AXIS DMM
- ADJUSTMENT AND PROGRAMMING SOFTWARE PARVEX MOTION EXPLORER

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PLUGS AND CABLES FOR DIGIVEX AND HX, HS, HD 104

Characteristics and dimensions subject to change without notice.

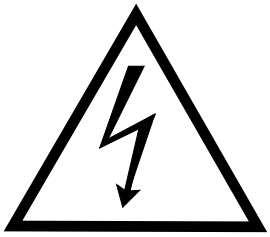
YOUR LOCAL CORRESPONDENT

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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 comries with 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 within 24 hours.

Caution :

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

- User Manual,
- Connectors.

Storage

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

Special instructions for setting up the equipment

	CAUTION
	For this equipment to work correctly and safely it must be transported, stored, installed and assembled in accordance with this manual and must receive thorough care and attention.. Failure to comply with these safety instructions may lead to serious injury or damage. The cards contain components that are sensitive to electrostatic discharges. Before touching a card you must get rid of the static electricity on your body. The simplest way to do this is to touch a conductive object that is connected to earth (e.g. bare metal parts of equipment cabinets or earth pins of plugs).

1. GENERAL

1.1 Digital Servodrive

These drives comprise :

- Sinusoidal emf, permanent magnet, brushless servomotors with resolvers for position measurement NX, HX, HS and HD range servomotors. HV and HW range spindel motors may also be used (these two ranges of motor are covered by separate documents).

- A multi-axis electronic control system composed of :
  - A rack ;
  - A power supply module directly receiving the 400 V / 50-60 Hz mains supply and providing 550 V bus voltage. This module also controls energy dissipation via internal or external resistors.
- Control modules connected to the servomotor (power and resolver).

Two connection arrangements for servomotors are proposed (except HX300 which comes in the connector version only):

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

1.2 Servoamplifier General Characteristics

1.2.1 Power Supply Modules

TYPE	MAINS	MEAN BUS CURRENT	RATED BUS VOLTAGE	REGENERATION
DIGIVEX SUPPLY 12 kW	400 V+/-10% 50 - 60 Hz	25 A	540 V	INTERNAL RESISTOR
DIGIVEX SUPPLY 25kW	400 V+/-10% 50 - 60 Hz	50 A	540 V	INTERNAL OR EXTERNAL RESISTOR

1.2.2 Servoamplifier Modules

TYPE	PEAK PERMANENT CURRENT	* PEAK PULSE CURRENT	MODULE FORMAT
DIGIVEX Drive 2/4	2 A	4 A	SINGLE
DIGIVEX Drive 4/8	4 A	8 A	SINGLE
DIGIVEX Drive 8/16	8 A	16 A	SINGLE
DIGIVEX Drive 16/32	16 A	32 A	DOUBLE
DIGIVEX Drive 32/64	32 A	64 A	TRIPLE

***** Peak pulse current up to 2 s, non repetitive

1.2.3 Possible Combinations

Different versions of several rack models are available :

- 6-location single module racks (19 inch, double Europe rack).
- 3-location single module racks.
- Single module 13-slot racks (19-inch 15U rack).

Rack composition is further restricted by the POWER SUPPLY format.

1.3 Rack, general

The rack provides the following functions :

- Mechanical support of power supply and drive cards.
- Support for regeneration resistors and power bus capacitors.
- Power transfer from supply to drive (550 V power bus).
- Low-level supply transfer from DIGIVEX Power Supply to DIGIVEX Drive (low-level bus).
- Logic signal transfer between drive and power supply :
  - ♦ Drive OK
  - ♦ Reset
- Emergency stop control
- 24V brake supply transfer. The 24V filtered-regulated supply is not part of our supply, see § 3.4.3.3 (brake connection).

1.4 DIGIVEX Power Supply

1.4.1 Presentation

The power supply is located at the left side of the rack :

- Receives 400 V three-phase mains supply and provides dc power (550 V internal bus) to the DIGIVEX servoamplifiers (terminal block B2).
- Receives the 400V single phase auxiliary supply (terminal block B1) as input and provides 550V direct voltage as output. Each DIGIVEX Drive generates its own ±15V, 5V and 24V voltages from this "low level bus".
- May receive 24 V supply for servomotor brakes and distributes it to drives via the internal bus (terminal block X1).
- Braking energy dissipation (terminal block B3 on 25 kW calibre).
- 24 V and ± 15V "customer" auxiliary supplies (terminal block X3).
- Logic interface with main switch (terminal block X2).
- Interface with emergency stop and external reset (terminal block X3).

Two versions of the power supply are available :

- 12 kW DIGIVEX Power Supply (rectified current = 25 A)
- 25 kW DIGIVEX Power Supply (rectified current = 50 A)

The 12 or 25 kW can be considered as the sum of the mechanical power really used simultaneously by the axis at a given time.

A series of LEDs is used to check the status of the power supply and drives

1.4.2 Block Diagram

See following pages. The left-hand side shows inputs that can be accessed by plug-in terminal blocks on the front panel. The right-hand side shows card end connection to the rack mother card.

For the power section :

- Hexaphase diode rectification.
- Current limitation resistor in diodes at start up (short circuited when bus voltage is adequate).
- Control of energy regeneration via resistor (top right), internal only for 12 kW supply (resistor at rear of mother card), internal or external for 25 kW supply.
- Control of insufficient or excessive mains voltage and control of bus voltage.

The low-level supply unit (auxiliary) comprises :

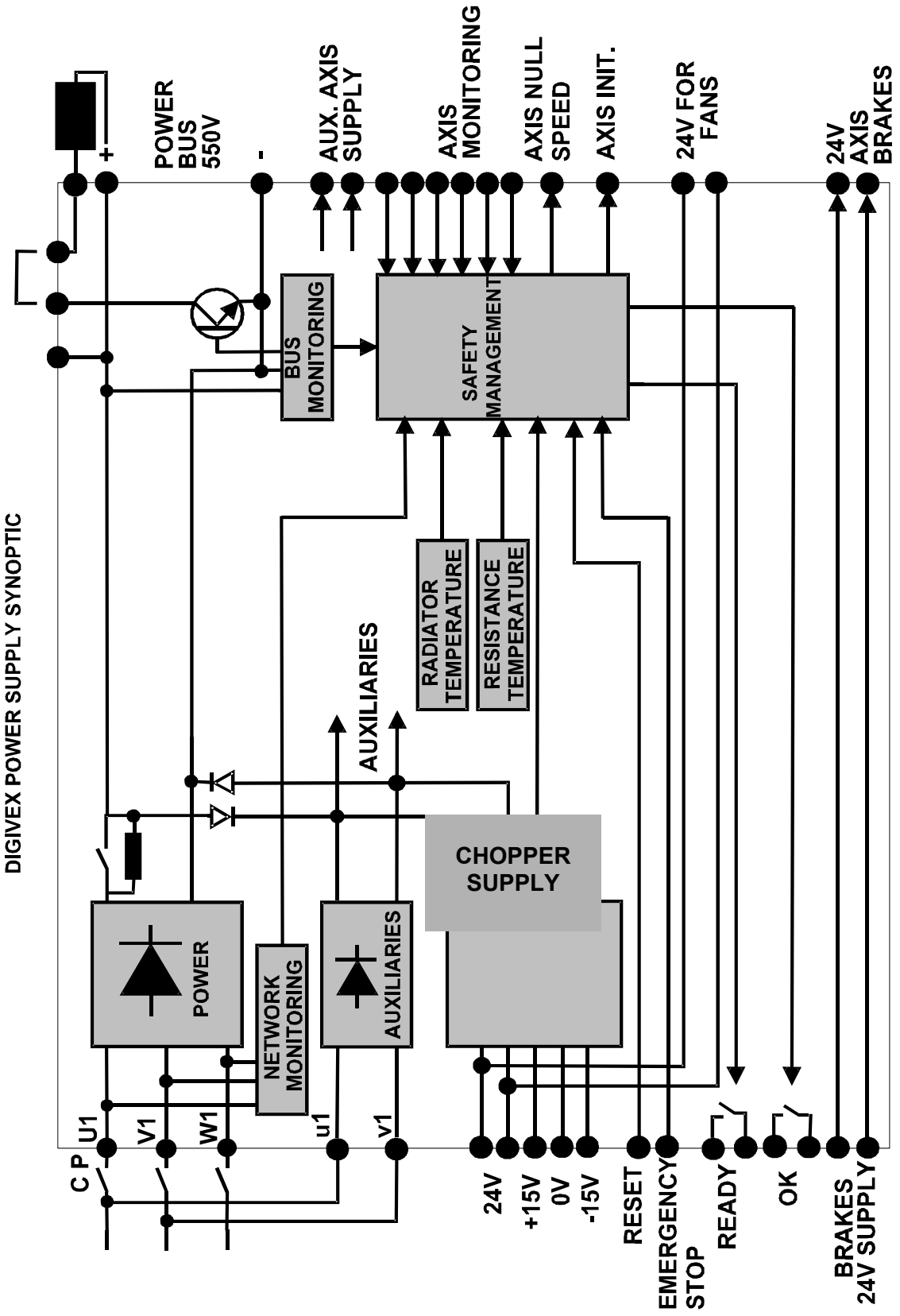
- Single-phase rectification, the "auxiliary bus" from which each drive derives the voltage required to power its regulation card (chopping and isolation transformer for drive cards).
- Auxiliary supplies :
  - ♦ 24 V common to "customer" terminal block and rack fans.
  - ♦ ± 15 V common to "customer" terminal block and internal supply regulation.
- 24 V brake which simply passes through the power supply (at bottom of block diagram).
- Terminal block logic inputs/outputs, including on left-hand side of block diagram : Reset - Emergency Stop - Ready - OK

Logic links with drives:
Supply :

- Sends initialization signal to drives (Init).
- Sends reset signal.
- Sends emergency stop signal.
- Receives logic signal (Drive OK) from each drive possibly tripping "OK relay".
- Receives a signal « Axis present », **if at least** 1 axis is located in the rack.

"Protection Management" block

- Logic block carrying out protection sequences (locking drives, controlling Ready and OK relays) and ordering LEDs to be energized on the front panel.


DIGIVEX POWER SUPPLY SYNOPTIC
+
POWER BUS 550V
-
AUX. AXIS SUPPLY
AXIS MONITORING
AXIS NULL SPEED
AXIS INIT.
24V FOR FANS
24V AXIS BRAKES
BUS MONITORING
SAFETY MANAGEMENT
RADIATOR TEMPERATURE
RESISTANCE TEMPERATURE
AUXILIARIES
CHOPPER SUPPLY
POWER
NETWORK MONITORING
AUXILIARIES
C P U1 V1 W1 u1 v1
24V +15V 0V -15V RESET EMERGENCY STOP READY OK BRAKES 24V SUPPLY

1.4.3 Braking Energy Dissipation

Braking energy is dissipated by a **rack-mounted** resistor for the 12 kW power supply, or **rack-mounted or external** resistor for the 25 kW power supply.

Regeneration is controlled on the basis of two voltage limits measured across the power bus :

- Resistor cuts in at U = 700 V.
- Resistor cuts out at U = 690 V.

Upon energising the system tests the value of the current through the braking resistor. It should be 10 A < I ≤ 70 A. This means either no resistance (break) or a short circuit can be detected. If a fault occurs the OK relay is tripped.

There are two models of external resistor in insulated enclosures (See § 3.5.2) :

- 2 kW - 27 Ω (RE91001).
- 4.5 kW - 12 Ω (RE91002).

12 kW Power Supply with internal rack resistor

Internal resistor only whose temperature is monitored by thermal sensor.

25 kW Power Supply with internal rack resistor
In terminal block B3 there must be a strap between terminals INT B3/2 - B3/3.

CAUTION : Strap ST2 must remain in position 2-3 without fail. See § 4.1.1 for strap positions.

Power Supply with external resistor
In terminal block B3 there is not strap between terminal INT (B3/2 and B3/3). The external resistor is connected between terminal EXT (B3/1 B3/2).

SUMMARY CHART OF BRAKING ENERGY DISSIPATION ARRANGEMENTS FOR POWER SUPPLY MODULES

		12 kW POWER SUPPLY	25 kW POWER SUPPLY		
		INTERNAL RESISTOR	INTERNAL RESISTOR	EXTERNAL RESISTOR	
				RE 91002	RE 91001
Resistor value	Ω	22 (66)	22	12	27
Max. current	A	32 (10)	32	60	26
Pulse power	kW	22(7.5)	22	40	18
Permanent power	kW	1.1 (0.37)	1.1	4.5	2
ST2 in position 2-3 (Int Res)					
Max. non-repeat time	s	2	2	2	2
Max. repeat cycle time	s	0.2	0.2	0.2	0.2
Repetition	%	5	5	5	5
ST2 in position 1-2 (Ext Res)					
Max. non-repeat time	s	N/A	N/A	5	5
Max. repeat cycle time	s	N/A	N/A	0.5	0.5
Repetition	%	N/A	N/A	12	12

(--) Values for reduced ventilation racks.

Max. current : Maximum controlled current, the resistor is activated at 700 V, the controlled current is equal at most to 700 / resistor value.

Pulse power : Maximum power dissipated by the resistor, this power can only be demanded for short periods and in keeping with a specific cycle.

Permanent power : Mean power that can be dissipated permanently by the resistor.

Max. non-repeat time : Maximum time in seconds for which pulse power can be demanded (from cold); the resistor must be allowed to cool before braking again. With internal resistors, temperature is monitored by a thermal sensor.

Max. repeat cycle time : Maximum time in seconds during which pulse power can be demanded provided that the power is established for only a certain percentage of the total time (repetition).

N.B. The characteristics given for external resistors correspond to natural ventilation conditions of these resistors and at an ambient temperature not exceeding 30°C.

Regeneration monitoring.

- Upon starting, detection of resistor presence. This prohibits starting (OK relay remains open) if the resistor is broken or short-circuited (strap on terminal block B3 in wrong position).
- In addition monitoring is carried out at each regeneration period.
- During operation the internal resistor temperature is monitored.

Calculation of power dissipation by braking resistor

The permanent and pulse power values shown in the previous table are limited by the braking resistor characteristics.
Where the application includes intensive cycles or long periods of deceleration, the mean power to be dissipated by each drive must be calculated.

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

J : Moment of inertia of servomotor and load, in kgm^2.
N : Angular speed of motor shaft at start of braking, in rpm.
f : Repetition frequency of braking cycles in s^{-1}.

The formula is for the worst-case scenario. Where the mechanical parts produce substantial friction or reverse yield is low, the power to be dissipated may be substantially less.

The total power to be dissipated from all drives must not exceed the permissible permanent power for the resistor. Durations and repetitions must not exceed the values in the preceding table.

1.5 DIGIVEX Drive SERVOAMPLIFIER

1.5.1 Presentation

DIGIVEX servoamplifiers are IGBT four-quadrant, transistor control modules for auto-drive (brushless) synchronous motors with resolvers.

The power supply and regulation supply are provided by two 550 V buses located in the double Europe rack which also contains the DIGIVEX Power Supplymodule.

Customized requirements for the motor - drive unit (servo-control parameters) are entered :

⇒ either using a PC with DIGIVEX - PC software under Windows

⇒ or using a display and parameter setting terminal.

These parameters are placed in two EEPROM stores :

⇒ one fixed store for DIGIVEX parameters

⇒ one plug-in store for application-specific parameters.

Modules come in three sizes and five ratings: 2/4, 4/8, 8/16, 16/32 and 32/64.

1.5.2 General Characteristics

1.5.2.1 Functions

Motor phase law control to obtain the maximum torque-speed working range.

Resolver power supply and digital demodulation providing rotor position and speed measurement.

Digital processing of current and PWM loops and of power-related monitoring features : mean and rms current limitations, zero torque setting, etc.

Digital processing of speed loop, comprising :

- loop optimisation (P, PI or PI^2 correctors)
- scaling (10 V = max. N)
- introduction of anticipatory actions:
  - ♦ gravity compensation (fixed torque)
  - ♦ compensation for dry friction, fixed value depending on direction of rotation
  - ♦ viscous friction proportional to speed
  - ♦ compensation of acceleration torque
- second-order filter for reducing resonance at high frequencies
- analogue-digital conversion of speed or current reference
- memorisation of the 30 previous faults
- integration of "stimuli" for exciting the system and oscilloscope function for displaying internal variables.

1.5.2.2 Electrical Characteristics

Module Power Supply

From the DIGIVEX Power Supply via the rack power bus.

- Maximum voltage : 750 V
- Rated voltage : 540 V
- Minimum voltage : 200 V

Low-level auxiliary power supply

The DIGIVEX Drive internal voltages (5 V, ±15 V) are taken after chopping and galvanic insulation from the low-level bus. Same voltage values as the power bus.

DIGIVEX Drive Module

DIGIVEX Drive MODULE	2/4	4/8	8/16	16/32	32/64
Permanent current (sinusoidal peak)	2 A	4 A	8 A	16 A	32 A
Pulse current (sinusoidal peak)	4 A	8 A	16 A	32 A	64 A
Power dissipated	20 W	35 W	70 W	130 W	260 W
Low-level consumption*	20 W	20 W	20 W	20 W	25 W

* Add 5 W if an encoder emulation option card is used

DIGIVEX Drive GENERAL TECHNICAL CHARACTERISTICS

Power loss with altitude	Power loss of 1% per 100 m above 1000 m up to maximum 4000 m.
Operating temperature and relative humidity	Normal use: 0 to +40°C Power loss of 20 % per 10°C above 40°C m up to maximum 60°C 85 % (without condensation).
Storage temperature	-30°C to + 85°C
Chopping frequency	8 kHz
Current bandwidth	to 600Hz -3dB
Speed bandwidth	Up to 300 Hz
Minimum speed	0.05 rpm or 1/30,000 of maximum speed
Maximum speed	Controlled by DIGIVEX: 100,000 rpm
Static speed accuracy for zero load variation at rated current and for rated voltage of DIGIVEX	With digital reference : 0.1% (field bus). With analogue reference: 1% regardless of speed
Electrical protection	Galvanic insulation of power bridge. Mean current protection in line with drive calibre. Pulse current protection of drive and motor. Rms current protection of motor. Protection against short circuits at bridge output. Fuse protection against internal short circuits.
Mechanical protection	IP20 to IEC 529 when rack-mounted
Other protective features	Motor temperature Drive temperature Cooling air temperature Brake supply Resolver supply

1.6 Compliance with Standards

Servomotor

HX, HS and HD range servomotors meet Directive 73/23/EEC of 19th February 1973 (as amended by Directive 93/68/EEC of 22nd July 1993) and comply with standards EN 60034-1 and IEC 34-1/1994. The entire range bears the CE marking.

Compliance with these standards requires installation in accordance with our recommendations (see servomotor commissioning and use instructions). In addition, the installation must be on a mechanical support providing good thermal conduction and not exceeding 40°C in the vicinity of the servomotor flange.

Main standards that the servomotors comply with:

	AFNOR	DIN/VDE	IEC 34-5
IP protection	NF60034-5	DIN 40050	IEC 34-5
Flange	C 51-104	DIN 42948	IEC 72
Shaft end	C 51-105	DIN 42946	IEC 72
Flange tolerance	-	DIN 42955	IEC 72
Noise	C 51-119	-	IEC 34-9
Balancing	C 51-111 (add. 1)	DIN 45665	ISO 2373
Electrical values	C 51-111	VDE 0530/1	IEC 34-1

DIGIVEX

The CE mark is affixed to the front panel of the rack (on the ventilation block).

DIGIVEX DRIVE and DIGIVEX POWER SUPPLY bear the CE mark under European Directive 89/336/EEC as amended by Directive 93/68/EEC on electromagnetic compatibility. This European Directive refers to the harmonised generic standards EN50081-2 of December 1993 (Electrical Compatibility - Generic Standard for Emissions - Industrial Environments) and EN50082-2 of June 1995 (Electromagnetic Compatibility - Generic Standard for Immunity - Industrial Environments). These two harmonised generic standards are based on the following standards :

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

Compliance with the reference standards above implies adherence to the instructions and wiring diagrams in the technical documents supplied with the appliances.

Incorporation in Machinery

The design of the equipment means it can be used in machinery covered by Directive 89/392/EEC (Machine Directive) provided that it is integrated (or incorporated and/or assembled) in accordance with the rules-of-the-art by the machinery manufacturer and in keeping with the instructions in this booklet.

2. SPACE REQUIREMENTS, ASSEMBLY, LABELLING, CODES

2.1 Dimensions and mounting

Two sizes of rack are available in three versions :

- Rack to accommodate six single format servoamplifier modules in addition to the POWER SUPPLY
- Half-rack to accommodate three single format servoamplifier modules in addition to the POWER SUPPLY.

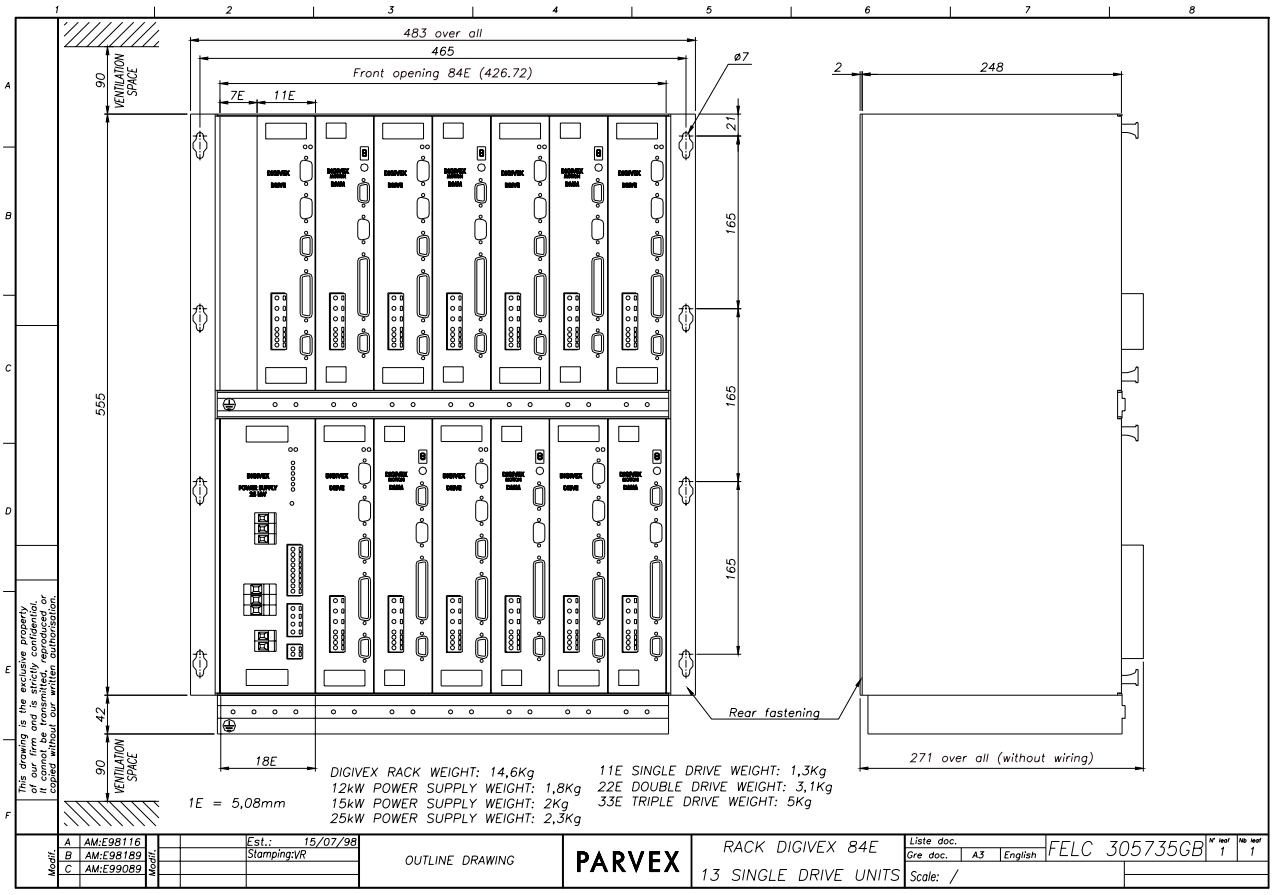
For each size, the following three versions are available :

- Standard ventilation and internal braking energy dissipation resistor;
- Standard ventilation and external braking energy dissipation resistor;
- Compact ventilation and internal braking energy dissipation resistor (reserved for cases where all DIGIVEX DRIVES are less than or equal to 4/8 calibre).

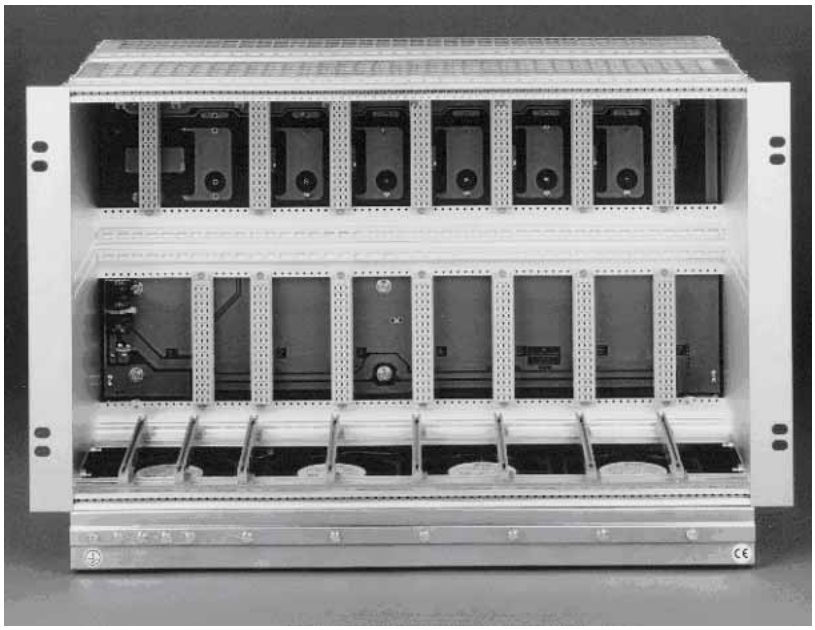
The fans are powered by the low-level source from the POWER SUPPLY.

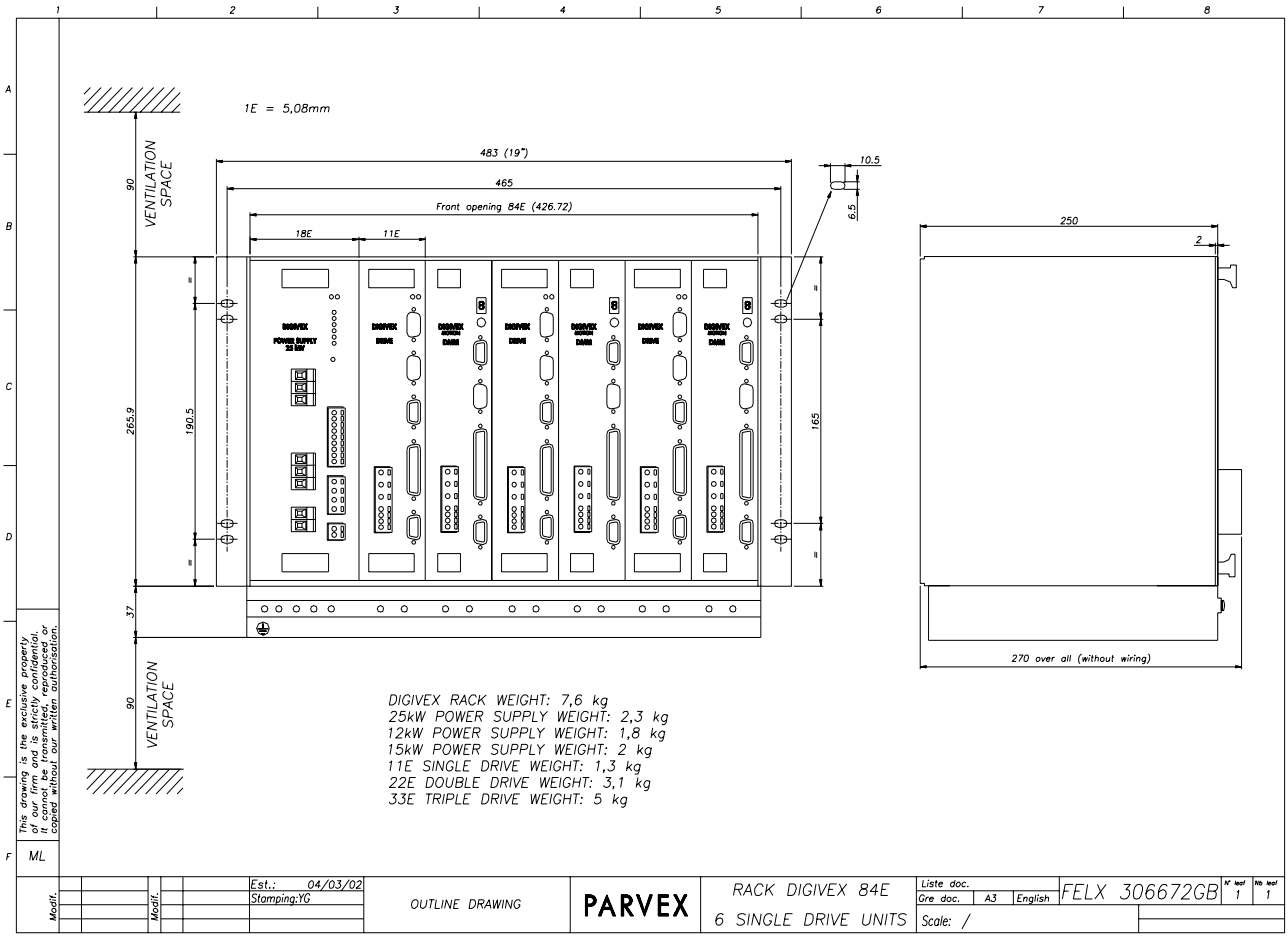
2.1.1 Rack and Power Supply

13 LOCATION SINGLE MODULE RACK

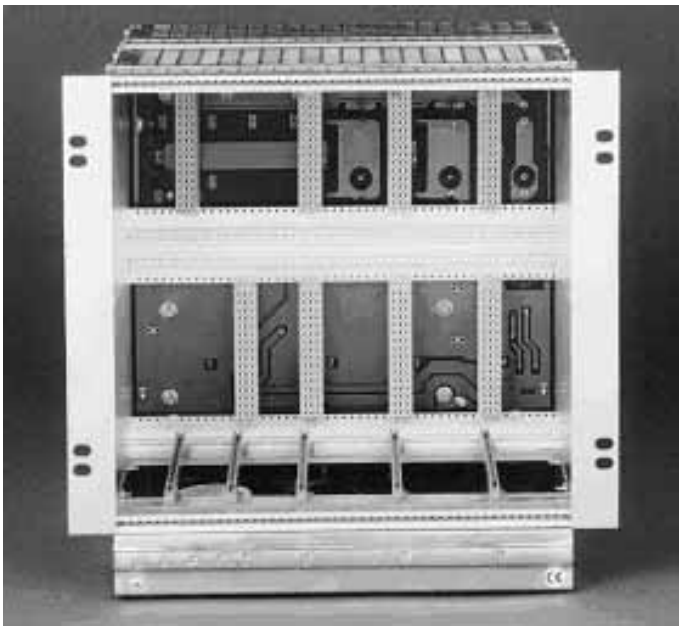


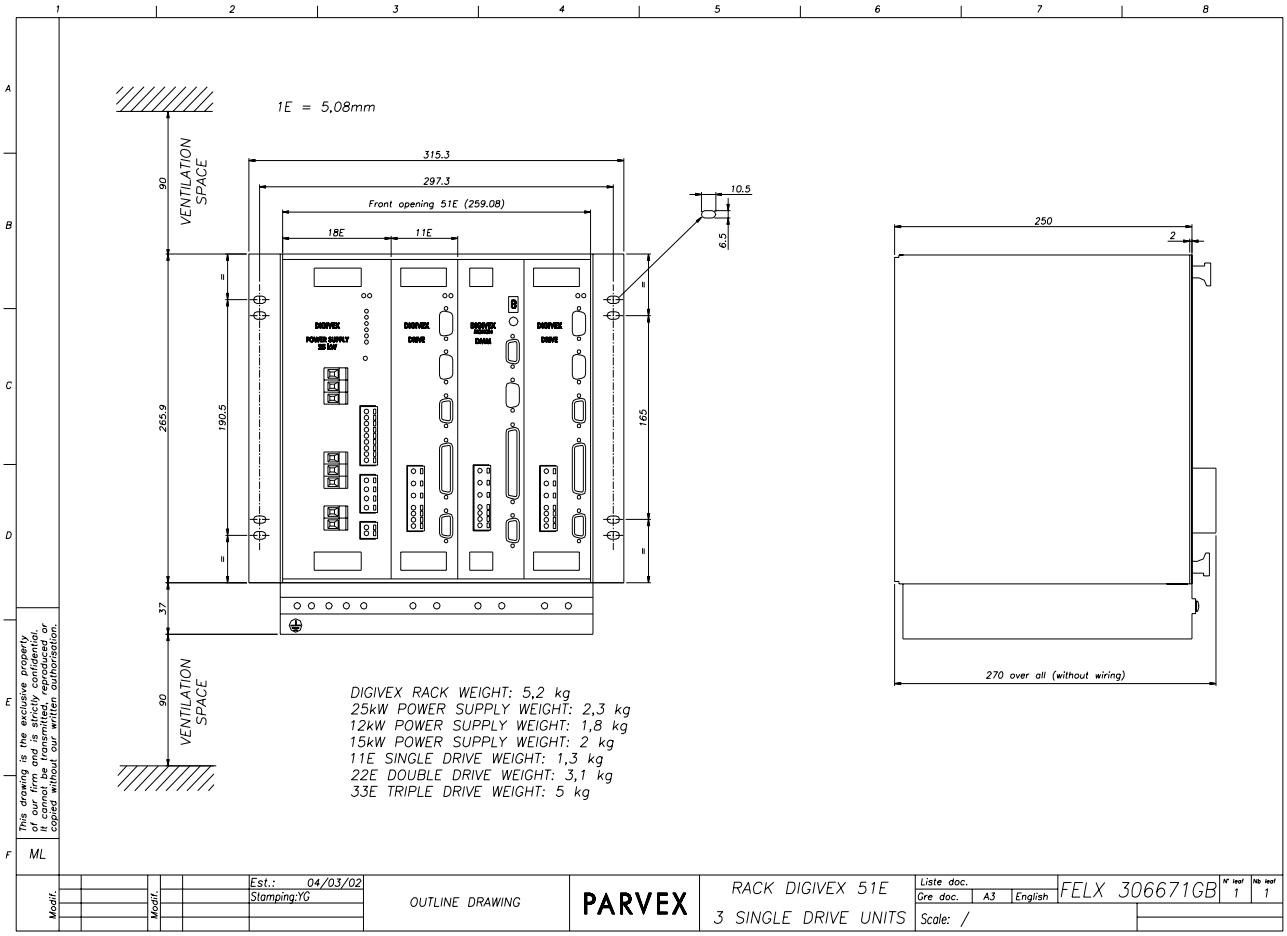
6 LOCATION SINGLE MODULE RACK





3 LOCATION SINGLE MODULE RACK





2.1.2 DIGIVEX Drive

Double Europe format cards, available in three widths: single, double, triple module.

DIGIVEX Drive MODULE	2/4	4/8	8/16	16/32	32/64
Weight	1.3 kg	1.3 kg	1 3 kg	3.1 kg	5 kg
Width	55.9 mm	55.9 mm	55.9 mm	111.8 mm	167.6 mm

2.2 Labels, Codes

2.2.1 Racks

Two stickers are affixed to the right-hand side of the rack :

- One shows the serial number and date of manufacture.
- One is equivalent to the specimen stickers below :

DIGIVEX 84E Rack Label
(6 single-module locations)

CE RACK DIGIVEX
DRA3168V63

DIGIVEX 51E Rack Label
(3 single-module locations)

CE RACK DIGIVEX
DRA3165V43

DIGIVEX 84E Rack Label
(13 single-module locations)

CE RACK DIGIVEX
DRA3128V63

Meaning of indications on labels :
. RACK DIGIVEX : Designation
. DRA .....: Rack Code

Codes

84Ex2 Racks (13 single module locations)
- DRA3128V63 Standard ventilation and internal resistor
- DRA3128L63 Standard reduced ventilation and internal resistor resistor bus
- DRA3128R43 Standard ventilation and external resistor

84E Racks (6 single module locations)
- DRA3168V63 Standard ventilation and internal resistor
- DRA3168V23 Standard reduced ventilation and internal resistor
- DRA3168R43 Standard ventilation and external resistor

51E Racks (3 single module locations)
- DRA3165V43.....Standard ventilation and internal resistor
- DRA3165V23.....Standard reduced ventilation and internal resistor
- DRA3165R23.....Standard ventilation and external resistor

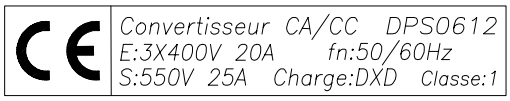
2.2.2 Power Supply

Two labels are fastened to the rear connectors of the DIGIVEX Power Supply module:

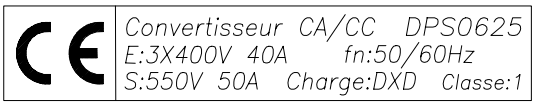
⇒ One shows the serial number and date of manufacture;

⇒ One is equivalent to the specimen stickers shown below

DIGIVEX Power Supply 12kW



DIGIVEX Power Supply 25 kW



Meaning of label indications :

- Convertisseur CA/CC	AC / DC converter
- DPS ----	DIGIVEX Power Supply code
- E: 3 x 400 V --A	Input voltage and current
- fn: 50/60 Hz	Authorised frequency range
- S: 550 V -- A	Output voltage and current
- Charge: DXD	Type of load (DIGIVEX DRIVE module)
- Class: 1	Service class to standard EN 60146, 1 = permanent

Codes

DIGIVEX Power Supply
DPS0612: 12 kW DIGIVEX Power Supply
DPS0625: 25 kW DIGIVEX Power Supply

EXTERNAL ENERGY DISSIPATION RESISTORS
RE 91001 : 2000 W - 27 Ω resistor
RE 91002 : 4500 W - 12 Ω resistor
RE 90020 : Pair of wall fastening resistor support

2.2.3 DIGIVEX Drive

Markings affixed to appliance:

- Two labels are affixed to the rear connectors :
  - one showing the serial number and date of manufacture
  - one in accordance with the model below.



Digpl28.T

Meaning of label markings :

- Convertisseur CC/CA	: DC/AC converter
- DXD----	: DIGIVEX Drive module code
- E: 550 V -- A	: Input voltage and current
- Class	: Service class to standard NF EN 60146, 1 = permanent
- S: 0-540V -- Â	: Output voltage and permanent output current (peak Amp)

- One label on the front panel, on the handle, indicating :
  - DXD module serial number
  - DXD module code
  - one line for miscellaneous information

- One label on the EEPROM (subprint SZ 6608B)
  - DXD module code
  - corresponding motor
  - maximum speed (N max.) for a given reference (usually 10 V)

- One label on the EEPROM (marked U47) indicating the software reference (e.g. AP501V3).

The drive customized parameters are stored in this plug-in EEPROM memory. The parameters can be read by :

⇒ DIGIVEX - PC software
⇒ Display / parameter setting terminal (see following sections)

Codes

DXD06002 : DIGIVEX Drive axis module 2/4
DXD06004 : DIGIVEX Drive axis module 4/8
DXD06008 : DIGIVEX Drive axis module 8/16
DXD06016 : DIGIVEX Drive axis module 16/32
DXD06032 : DIGIVEX Drive axis module 32/64

3. ELECTRICAL CONNECTIONS

3.1 General Wiring Requirements

3.1.1 Electromagnetic Compatibility

GROUNDING

- Adhere to all local safety regulations concerning grounding.
- Use a metal surface as a ground reference plane (e.g. cabinet wall or assembly grid). This conducting surface is termed the potential reference plane (PRP). All the equipment of an electrical drive system is connected to the PRP by a low impedance (or short distance) link. First make sure that the connections conduct electricity properly by scraping off the surface paint if necessary and by using fan washers. The drive will be grounded by a low impedance link between the PRP and the ground rod on the front panel of the DIGIVEX rack. If this link is longer than 30 cm, use a flat braid or standard wire instead.

CONNECTIONS

- Avoid routing low level cables (resolver, input/output, NC or PC links) alongside power cables (power supply or motor). Also avoid routing the supply cable and motor cables together in order to conserve mains filter attenuation. These various cables should be separated by at least 10 cm and never crossed or only at right angles if unavoidable.

- All low level signals shall be shielded and, except for the resolver connection, the shielding shall be connected at both ends. At the DIGIVEX end, the shielding is continued by the mechanical design of the SUB-D plug.

- Motor cables must be kept as short as possible. The green/yellow motor lead must be connected to the ground rod on the front of the DIGIVEX rack with as short a connection as possible.

- This usually saves the need for using a shielded motor cable. Chokes may be inserted on the motor phases (see 3.4.3.2).

MAINS FILTERING

The equipment complies with standard EN55011 with a filter on the power input with minimum 60 dB attenuation in the 150 kHz - 30 MHz range.

Avoid running cables together ahead of and after the filter.
For appliances requiring voltage adaptations, it is preferable to use a transformer. The transformer neutral is to be connected to earth by as short a wire as possible to the potential reference plate. For single-phase transformers, one of the two alternate outputs will be connected to the potential reference plate.
Filters sometimes have high leakage currents. In this case, the standard wiring diagrams must be respected when fitting.

OTHER REQUIREMENTS

The self-inducting components must be protected against interference : brakes, contactor or relay coils, fans, electro-magnets, etc.
The front panels of the rack-mounted appliances must be screwed down.

HANDLING MODULES AND CONNECTORS

Do not remove or fit the modules while the power is on.

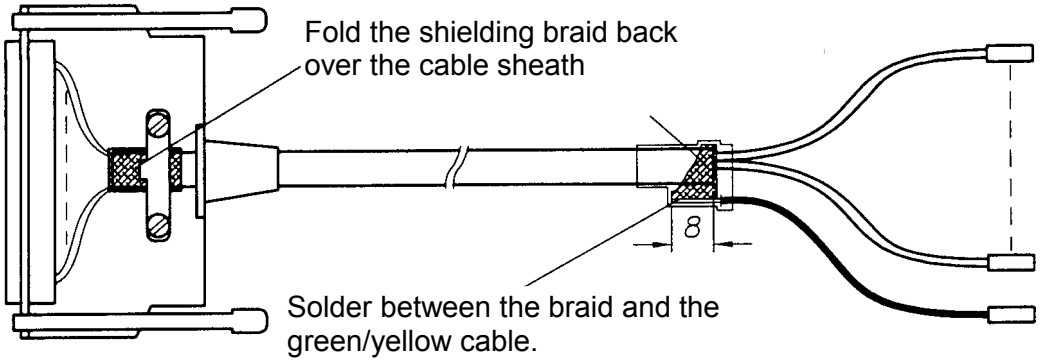
While the power is on do not connect or disconnect :

- the power connectors.
- the resolver and encoder emulation connections.

3.1.2 DIGIVEX DRIVE SUB-D Plug, general

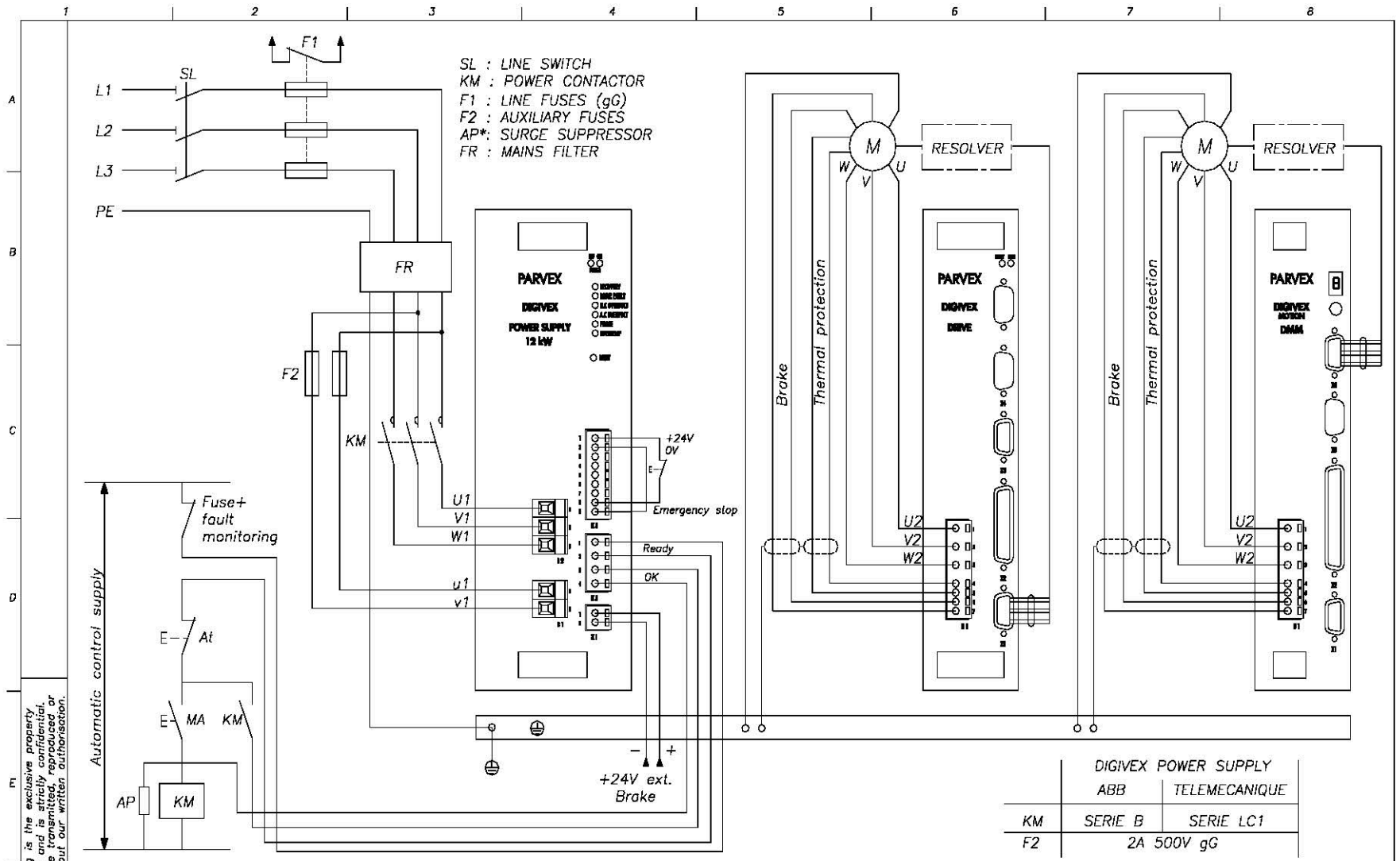
For immunity from interference it is essential for the rack to be correctly connected to the ground of the electrical cabinet and to use EMI/RFI shielded type SUB-D plug caps (metal with shielding braid connected). Make sure the SUB-D connectors and their caps are properly fixed (lock screws must be tight).
The shielding inside the SUB-D caps must be as shown :

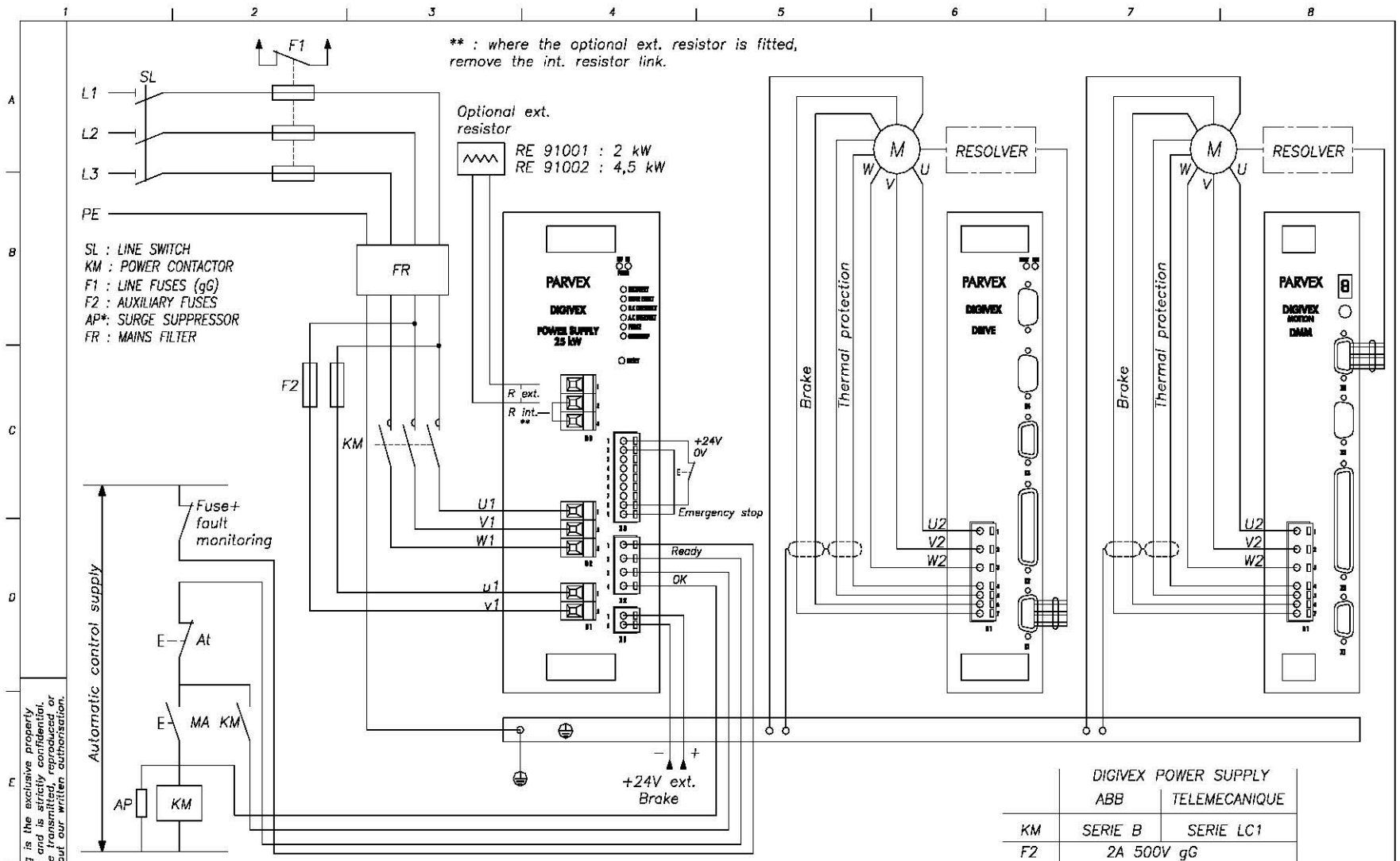
GROUND CONNECTION



3.2 Typical Connection Diagram

See drawings FELX 304541GB and FELX 304557GB below.


SL : LINE SWITCH
KM : POWER CONTACTOR
F1 : LINE FUSES (gG)
F2 : AUXILIARY FUSES
AP*: SURGE SUPPRESSOR
FR : MAINS FILTER
L1
L2
L3
PE
SL
F1
FR
F2
KM
PARVEX
DIGIVEX
POWER SUPPLY
12 kW
+24V
0V
Emergency stop
Ready
OK
U1
V1
W1
u1
v1
M
RESOLVER
W
V
U
Brake
Thermal protection
U2
V2
W2
PARVEX
DIGIVEX
DRIVE
PARVEX
DIGIVEX
MOTION
DMM
Fuse+
fault
monitoring
Automatic control supply
At
MA
AP
KM
+24V ext.
Brake
DIGIVEX POWER SUPPLY
ABB
TELEMECANIQUE
KM
SERIE B
SERIE LC1
F2
2A 500V gG
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.
CAUTION: Wire up the 24V ext. brake to use the brake control output on a drive.
* The power contactor coil KM should necessary have a surge suppressor AP connected.
This drawing is the exclusive property of our firm and is strictly confidential. It cannot be transmitted, reproduced or copied without our written authorisation.
ML
Modif.
A AM:E96020
B AM:E97018
C AM:E98004
D AM:E98160
E AM:E98198 Est.: 27/07/95
F AM:E99089 Stamping:JP
G AM:E02095
H AM:E04027
CONNECTING DIAGRAM
PARVEX
DIGIVEX
12kW POWER SUPPLY
Liste doc.
Gre doc. A3 English
FELX 304541GB
N° feuil 1
Nb feuil 1
Scale: /



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ML

Modif.						
E	AM:E98160	1	AM:E04027	Est.: 31/08/95	CONNECTING DIAGRAM	PARVEX
F	AM:E98198	Modif.		Stamping:JP		
G	AM:E99089					
H	AM:E02095					

DIGIVEX 25kW POWER SUPPLY

Liste doc. | Gre doc. | A3 | English | FELX 304557GB | N° feuil 1 | Nb feuil 1

Scale: /

3.2.1 Surge Suppressor

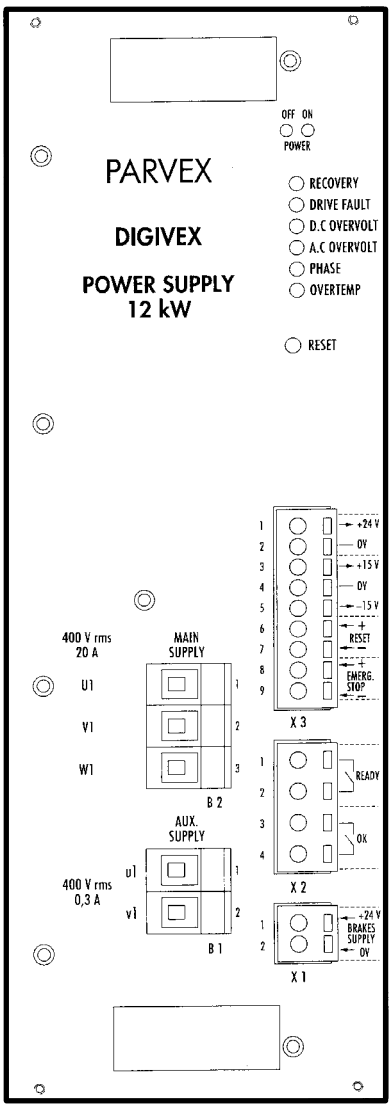
- KM: Power Contactor
- AP: Surge Suppressor

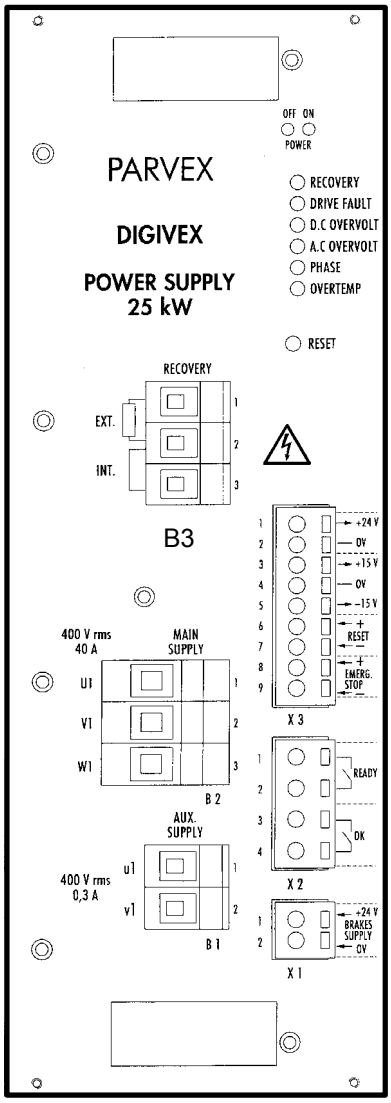
The power contactor coil KM should **necessary** have a surge suppressor AP connected in order not to destroy prematurely the internal relay contact of the drive. This module should be use whether the power contactor supply is AC or DC.

The relay manufacturers (Telemecanique: LC1 series, ABB: B series,…) provide surge suppressors fitted relays wether the power contactor supply is AC or DC for various voltages (RC module, Diode+Zener Diode, Varistor,…).

3.3 Power Supply connection

3.3.1 Front panel terminal blocks





All the connections are brought to the front panel :

- B1 : "Auxiliary" power supply (low level)
- B2 : Mains input
- B3 (on 25 kW DIGIVEX Power Supply): external resistor
- X1 : 24V power supply for brake
- X2 : main contactor automatic control interface
- X3 : 24V, +/-15V outputs, Reset and zero speed setting

3.3.2 Terminal block characteristics

Recap showing for terminal blocks B1, B2, B3, X1, X2 and X3 (DIGIVEX Power Supply) :

- terminal type.
- maximum permissible cable cross-section (S) for the terminal block.
- recommended torque value (T) for the terminal block.

TERMINAL	12 kW POWER SUPPLY	25 kW POWER SUPPLY
B1	screw-type, S = 4 mm² flexible wire S = 6 mm² rigid wire, T = 0.8 Nm	screw-type, S = 4 mm² flexible wire S = 6 mm² rigid wire, T = 0.8 Nm
B2	screw-type, S = 6 mm² flexible wire S = 10 mm² rigid wire, T = 1.8 Nm	screw-type, S = 6 mm² flexible wire S = 10 mm² rigid wire, T = 1.8 Nm
B3	-	screw-type, S = 4 mm² flexible wire S = 6 mm² rigid wire, T = 0.8 Nm
X1 à X3	spring-type, S = 2.5 mm≤	spring-type, S = 2.5 mm≤

3.3.3 Power component dimensions

Applicable to components ahead of the DIGIVEX POWER SUPPLY (fuses, cables, contactor, etc.), dimensions depend on :

- permanent currents (sinusoidal peak) at low speed of each motor as shown in characteristics ($\hat{I}_0$).
- the drive simultaneity coefficient.

Supposing this coefficient is equal to 1 and $\cos\varphi = 1$, gives :

$$P_{mains} \cong 1.1 \, U_{rms} \, \Sigma \hat{I}_0$$

$$I_{rms\ mains} = \frac{P}{U_{rms}.\sqrt{3}}$$

MAINS INPUT POWER 400 V kW	$\Sigma \hat{I}_0$ Â	**LINE CURRENT for mains Urms = 400 V** A eff.	**FUSE RATING** Type gG	**MAINS FILTER**
4.4	10	6.5	10	FR03016
6.6	15	9.5	16	
13.2	30	19	32	FR03036
24.2	55	36	50/63	

The cable cross-section and contactor rating must be selected accordingly.

3.3.4 Connection to mains

400 V rms three-phase mains supply via terminal block B2 : **terminals U1 - V1 - W1**
Single-phase operations possible (downgraded mode, please ask for details).
50/60 Hz mains supply voltage must be greater than 200 V rms and less than 470 V rms; a transformer or an auto transformer is necessary for use with 460 V ± 10% or 480 V ± 10% mains supply.

Current : **20 A** rms for 12 kW POWER SUPPLY
40 A rms for 25 kW POWER SUPPLY

Power loss with temperature :

- Power loss of 2% per °C above 40°C.
- Max. ambient temperature 60°C.

A thermal sensor trips the OK relay when the dissipater reaches 85°C.

Power loss with altitude: Power loss of 1% per 100 m above 1,000 m.

"MAIN SUPPLY " terminal block B2: Marked U1 - V1 - W1.

Mains monitoring :

- No phase (see strap ST1).
- Maximum mains voltage (470 V).

Power bus monitoring :

- Maximum bus voltage (750 V).
- Minimum bus voltage (200 V).

Power dissipated :

- 12 kW power supply : 50 W.
- 25 kW power supply : 100 W.

3.3.5 Low-Level and Auxiliary Supply

Terminal block B1.

Each DIGIVEX Drive derives its low-level supply from a low-level supply bus and restores the ± 15 V / 5 V it requires through a chopper supply and transformer.

The « low-level supply » bus, whose voltage is between 200 V and 750 V, may be obtained in either of two ways :
⇒ either via terminal block B1, from a single-phase source, which may be :

- 400 V single-phase, from 48 to 62 Hz between two phases ahead of the main switch;
- a separate 400 V source. In this case **a 200 VA isolating transformer must be provided** (e.g. primary 230 V ± 10%, secondary 400 V ± 10%)

The advantage with these solutions is that the power part can be cut out separately while the LED fault display and the encoder emulation counting capability are maintained.

⇒ Or from the power bus. In this case only terminal block B2 need be connected.

Drawback : If power fails, regulation supply and above all any encoder emulation card information is lost.

Internal fuse :

- Marked F1, protects the chopped supply : type 500V / 1.6A

Auxiliary supply monitoring, supply present.

- Auxiliary supply also provides 24 V dc for the rack fans, and the rack is therefore fan-cooled as long as the low-level supply is maintained.

Low-level consumption: 30 W.

3.3.6 External Energy Dissipation Resistor

For 25 kW DIGIVEX POWER SUPPLY with external resistor option :

- No link between terminals 2 and 3 of terminal block B3.
- The resistor is connected between terminal 1 and 2 of terminal block B3.

Maximum current in cable :

- With RE 91001 (2 000 W) : 30 A
- With RE 91002 (4 500 W) : 60 A

Cable type: unshielded, cross-section 2.5 mm² for 2 000 W, 4 mm² for 4 500 W.
Maximum recommended distance : 10 m.
Resistor end: connection by terminal box through packing gland PG 16 for 10 mm - 14 mm diameter cable.

3.3.7 Control signal connection (terminal Blocks X2 and X3)

Plug-in terminals

TERMINAL BLOCK X2		
1 - 2	Output	« READY » contact
3 - 4	Output	« OK » contact Potential free contacts Max. U = 250 V I =1A Cut-out power = 250 VA (ohmic load)

- X2/1.2 : Ready Contact

The contact is closed if :

- the auxiliary bus (low-level) is correct, >290 V dc on powering up,
- at least one drive is in the rack,
- drives signalled no faults when low-level supplies appeared.

This contact authorises the main switch to be closed

- the red POWER OFF LED glows.

- X2/3.4 : OK Contact

The contact is closed if :

- AUX. supply is correct,
- power supply is present (>200 V dc)
- the low-level and power drives signal no faults.

The contact authorises the main switch to be self-maintained

- the green POWER ON LED glows.

CAUTION : Opening the OK contact must cause the main contactor to open with a max 100 ms delay.

TERMINAL BLOCK X3		
1	Output	24 V regulated
2	Output	0V of 24 V
3	Output	15 V regulated
4	Output	0 V of ±15 V
5	Output	-15 V regulated
6	Input	+ Reset
7	Input	- Reset
8	Input	+ Emergency Stop
9	Input	- Emergency

- X3/1 24 V regulated

- X3/2 0 V of 24 V

- Max. 24 V - 50 mA power supply. **Do not use for brake supply**.
- Protection against overloads and short circuits by resettable fuse.

This supply is for logic inputs but is also used internally for the fan power supply. There is no common point with the metal case.

- X3/3 +15 V regulated

-X3/4 0 V of 15 V

- X3/5 -15 V regulated

- max. ±15 V - 10 mA power supply.
- Protected by 47 Ω resistor.

This supply is common with the internal supply of the POWER SUPPLY module. There is no common point with the metal casing.

- X3/6 to X3/9 Logic inputs

Common characteristics:

- 24 V dc optocoupled inputs (insulation voltage 1 kV)
- type two inputs to IEC 1131-2.

These inputs may be connected directly to PNP type outputs (external load resistor not required).

	MIN.	TYPICAL	MAX.
Level 0 input voltage	-	0V	5V
Level 1 input voltage	11V	24V	30V
Level 0 input current	-	0mA	2mA
Level 1 input current	7mA	13mA	15mA
Response time Ton (0 to 1)	-	1ms	-
Response time Toff (1 to 0)	-	1ms	-

- X3/6 and X3/7 Reset

A 24 V rising edge applied across X3/6 compared with X3/7 resets the system after a power supply or drive fault (clear).
Note that the front panel reset button can also be used, or turning off the power completely (power and auxiliaries).
This control has no effect during normal operation.

- X3/8 and X3/9 Emergency Stop , in speed loop mode only

A 24 V source must be applied between terminals X3/8 (+) and X3/9 (-) to enable drive operation: the 24 V may be taken from X3 terminals 1 and 2.

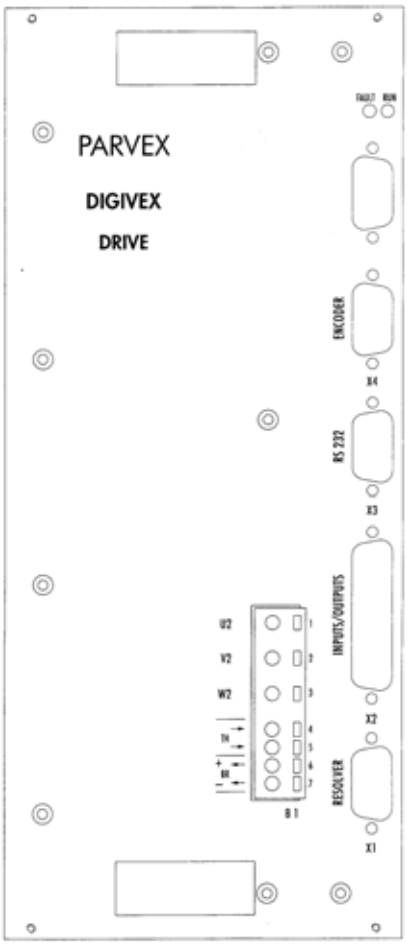
The collapse of 24 V across terminals X3/8 and X3/9 acts on all the drives causing dynamic braking. This is an aid for category 1 or 2 stops to standard EN 60204.

3.3.8 Terminal Block X1 "Brake Supply"

Plug-in terminal block.
This terminal block can accommodate a 24 V power supply for brakes fitted to motors. It is redistributed by the drives to the motor power terminal blocks.
Regulated / filtered 24 V ± 10% voltage - Overload protection by 26 Joule varistance. This protection is operational from 30 V.

3.4 DIGIVEX Drive connection

3.4.1 Front plate terminals



All the inputs/outputs required for operation are grouped on the front panel as :

- one or two terminal blocks grouping the servomotor, brake and thermal protection connections
- one X1 resolver connector, 9-pin female contact SUB-D for resolver
- one X2 input/output connector, 25-pin female contact SUB-D for all logic and analog inputs/outputs
- one RS232 X3 connector, 9-pin female contact SUB-D for the RS232 link with the PC.

The motor ground is to be connected to the "ground bar" located under the rack. The SUB-D plugs used must be metallised (or metallic) and provide continuous shielding to the rack metal ground.

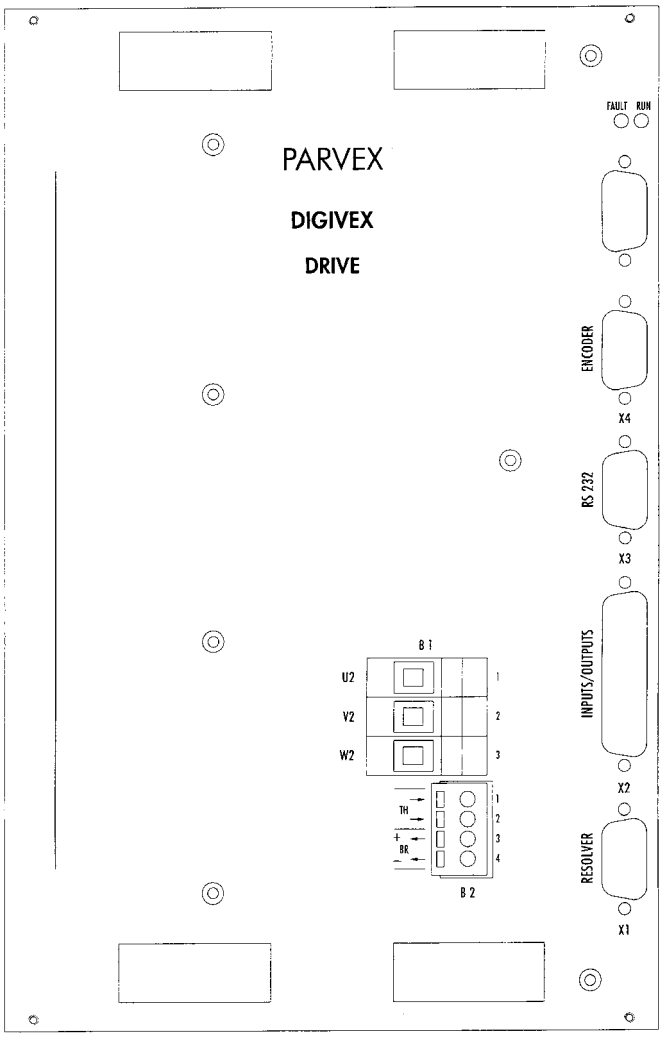
As option 1 encoder connector, 9-pin male contact SUB-D for pulse encoder emulation.

Terminal Blocks B1/B2: Power, Thermal Protection and Brake

- Terminal block B1 for calibre 2/4, 4/8, 8/16 and 16/32
- Terminal block B1 and B2 for calibre 32/64

DIGIVEX Drive calibres 2/4, 4/8, 8/16 and 16/32

- One plug-in terminal block B1 comprising :
  - terminals 1, 2 and 3 marked U2, V2 and W2 for power.
  - terminals 4 and 5 for motor thermal protection (TH) input (current less than 3 mA).
  - terminals 6 and 7, 24 V for brake supply (BR).



DIGIVEX Drive calibre 32/64

- One fixed terminal block B1 (screw terminals), terminals 1, 2 and 3 (U2, V2, W2) for power.
- One plug-in terminal block B2 comprising :
  - ♦ terminals 1 and 2 for motor thermal protection (TH) input (current less than 3 mA).
  - ♦ terminals 3 and 4 (marked Br+ and -) 24 V for braking supply (BR).

24 V brake output terminals : Outputs assigned to motor brake control (terminal 6 to positive, terminal 7 to negative for calibres 2/4 to 16/32; terminal 3 to positive, terminal 4 to negative for calibre 32/64).
Normal braking voltage: 24 V dc ±10%.

The 24 V source enters the rack via the DIGIVEX POWER SUPPLY terminal X1. It is supplied externally and passes through the DIGIVEX unit to be redistributed to the drives. Protection is provided by a resettable 1.8 A fuse for calibres up to and including 8//16, and a 2.7 A fuse for calibres 16/32 and 32/64.

Voltage is monitored by the DIGIVEX DRIVE software and, if a brake is engaged, the drive acknowledges the disappearance of the 24 V.

3.4.2 Terminal blocks and sockets characteristics

Summary chart showing for terminal blocks (or sockets) B1, B2, X1 - X4 (DIGIVEX Drive) :

- terminal block type (or socket).
- maximum cross-section (S) of cable for the terminal block (or socket).
- recommended torque value (T) for the terminal block.

TERMINAL	DIGIVEX Drive 4/8 - 16/32	DIGIVEX Drive 32/64
B1	spring-type, S = 2.5 mm≤	screw-type, S = 6 mm≤ flexible wire, S = 10 mm≤ rigid wire, T = 1.8 Nm
B2	-	spring-type, S = 2.5 mm≤
X1	Resolver SUB-D S = 0.5 mm≤	Resolver SUB-D S = 0.5 mm≤
X2	Input/output SUB-D S = 0.5 mm≤	Input/output SUB-D S = 0.5 mm≤
X3	RS 232 SUB-D S = 0.5 mm≤	RS 232 SUB-D S = 0.5 mm≤
X4	Encoder S = 0.5 mm≤	Encoder S = 0.5 mm²

3.4.3 DIGIVEX Drive Servomotor connection

3.4.3.1 "POWER" Cable Definition

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

- 3 insulated conductors connected to U, V, W phases. Cross-sections as in the table below. The internal chokes of the DIGIVEX Drive mean that, as a general rule, there is no need to use shielding on the three power conductors.
- 1 ground conductor (green/yellow).
- 2 shielded twisted pairs for connection of the motor thermal protection. Cross-section of about 1 mm².
- 2 shielded twisted pairs for connection of the holding brake (if fitted). Cross-section of about 1 mm².
- 1 “shielding continuity” conductor (green/orange) to be connected to the servoamplifier earth ⏚

Power cable cross-section

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

- rated drive current;
- motor/drive distance, loss in useful voltage = RI.
- ambient temperature, cable loss of Joules = RI^2.
- standardised increase of cable cross-sections.

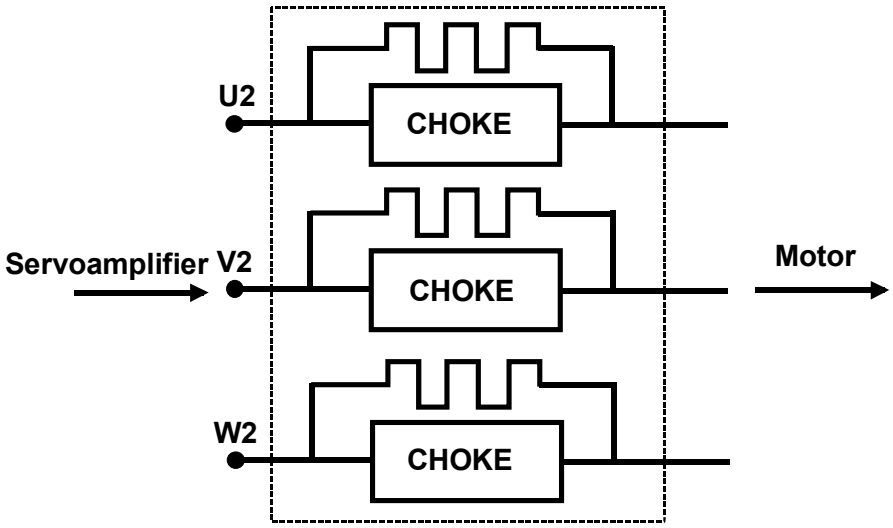
PARVEX proposes cables for distance of up to 50 m and ambient temperatures of less than 40° C.

Distance →	0m	50m	100m	200m	PARVEX SUPPLY
DIGIVEX Calibre	Cable cross-section in mm≤				L = 50m, $\theta \leq 40°C$
2/4 and 4/8	0.5	1	2.5		1
8/16	1.5	2.5	6*		2.5
16/32	2.5	6*	10*		2.5
32/64	6	10*	16*		6

* Cross-sections incompatible with DIGIVEX DRIVE power terminal blocks (See § 3.4.2).
Fit an intermediate terminal block close to the DIGIVEX DRIVE.

3.4.3.2 Guidelines for use of inductors and resistors for long cables between the motor and drive

The inductors and, where necessary, the resistors are to be fitted between the DIGIVEX Multi Drive (as close as possible to the drive) and the motor when used with long cable lengths.



References of inductors (Dimensions : see § 3.5.5)

	Cable length (L)	Normal	L ≤ 20 m	20 < L < 30 m	30 ≤ L < 70 m	70 ≤ L < 100 m
		Shielded	L ≤ 15 m	15 < L < 20 m	20 ≤ L < 50 m	50 ≤ L < 70 m
DIGIVEX Multi Drive	2/4 – 4/8		-	DSF02	DSF02	Not recommended
	8/16		-	-	DSF02	SF02032 + resistor
	32/64		-	-	SF02025	SF02025

- DSF02: three inductances of 50 mH damped by resistors to rise on rail DIN
- For lengthes superior to 100 m, consult us.
- Damping resistor to be used with SF02032 :RE 40008 470 Ω 25 W

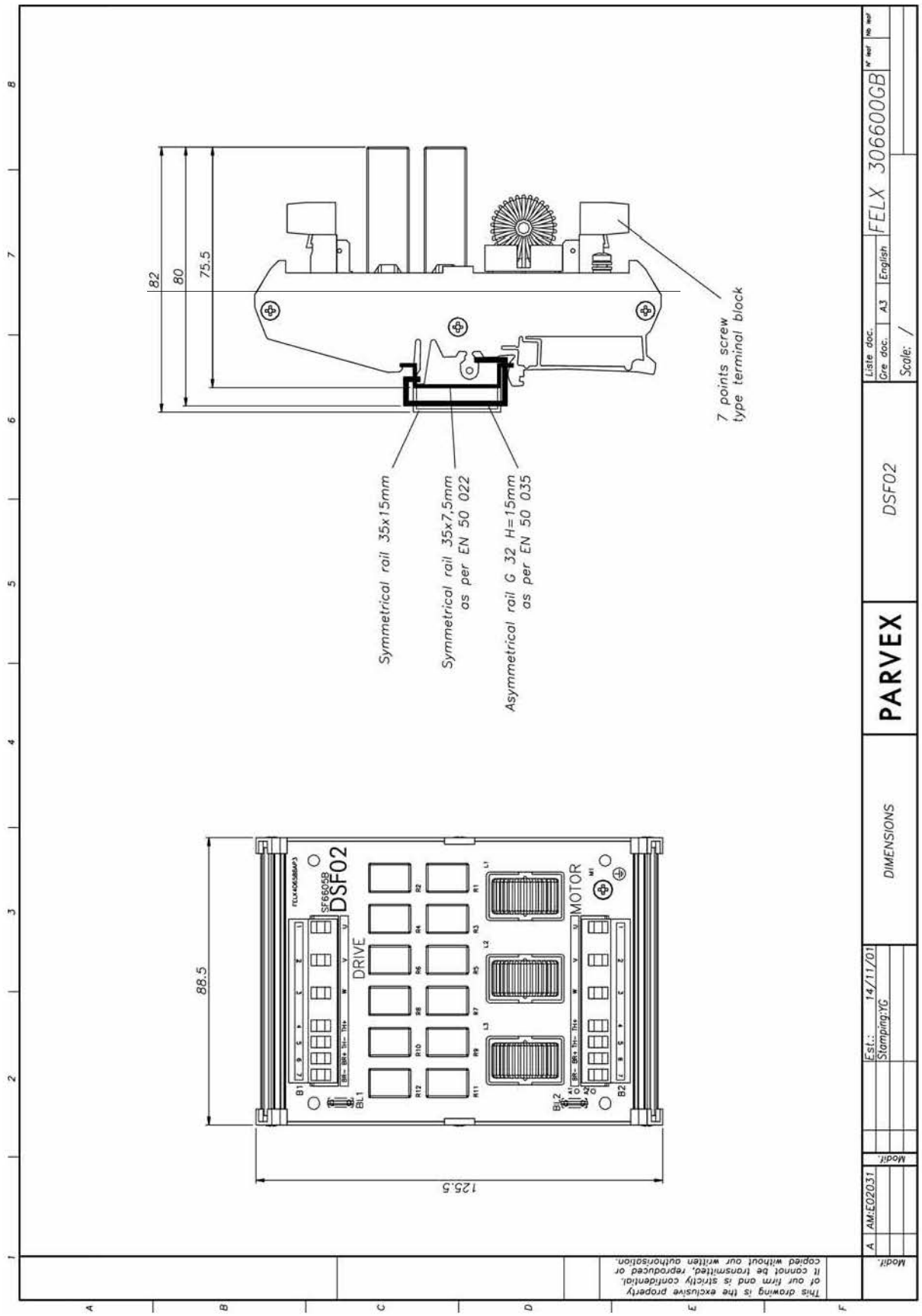
The use of self dampers for shorter distances can be envisaged to reduce parasite reception, caused by capacitive coupling with power cables.

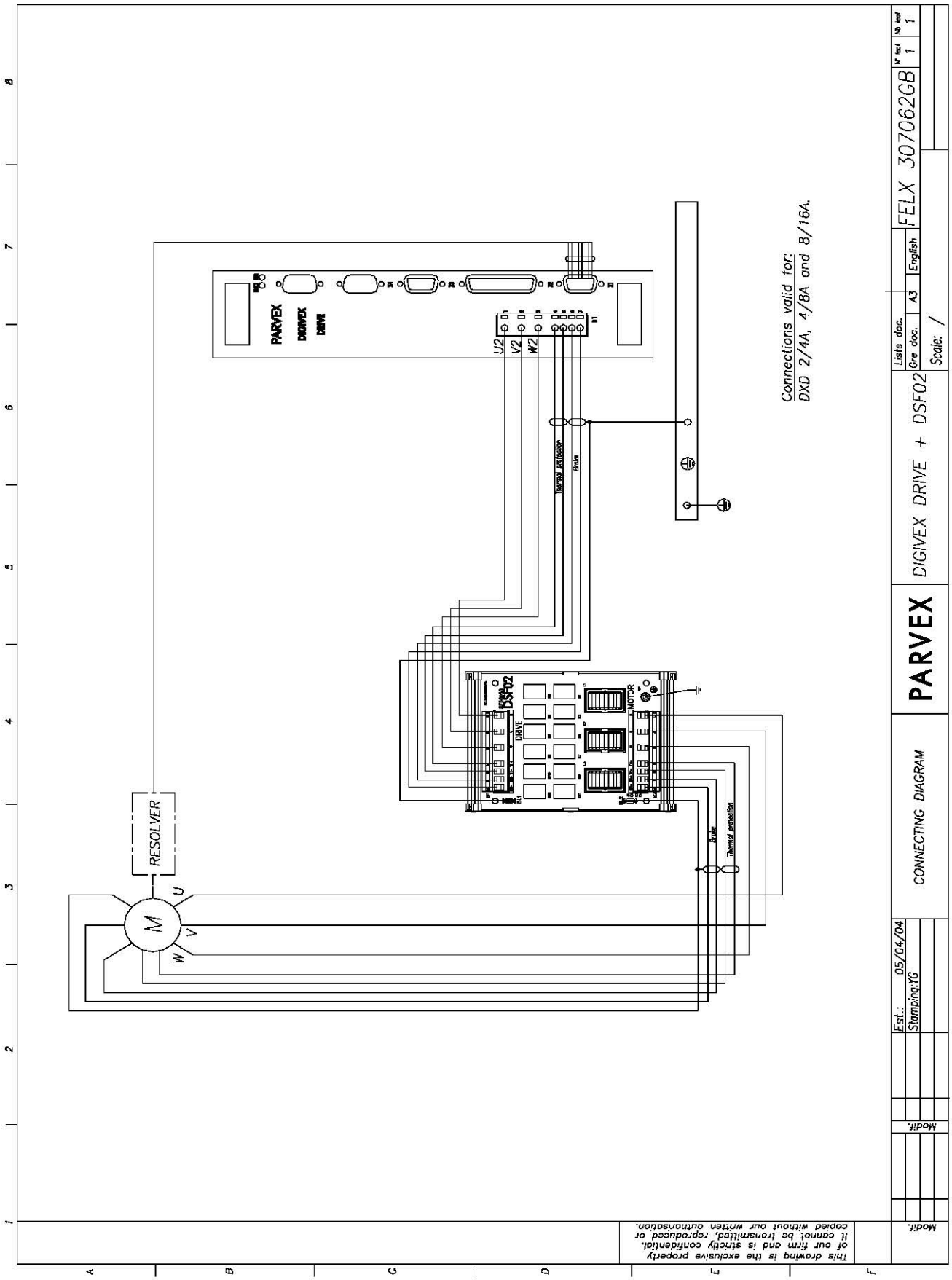
3.4.3.3 Connection to motor (power, brake, thermal protector and ventilation)

Power Connection

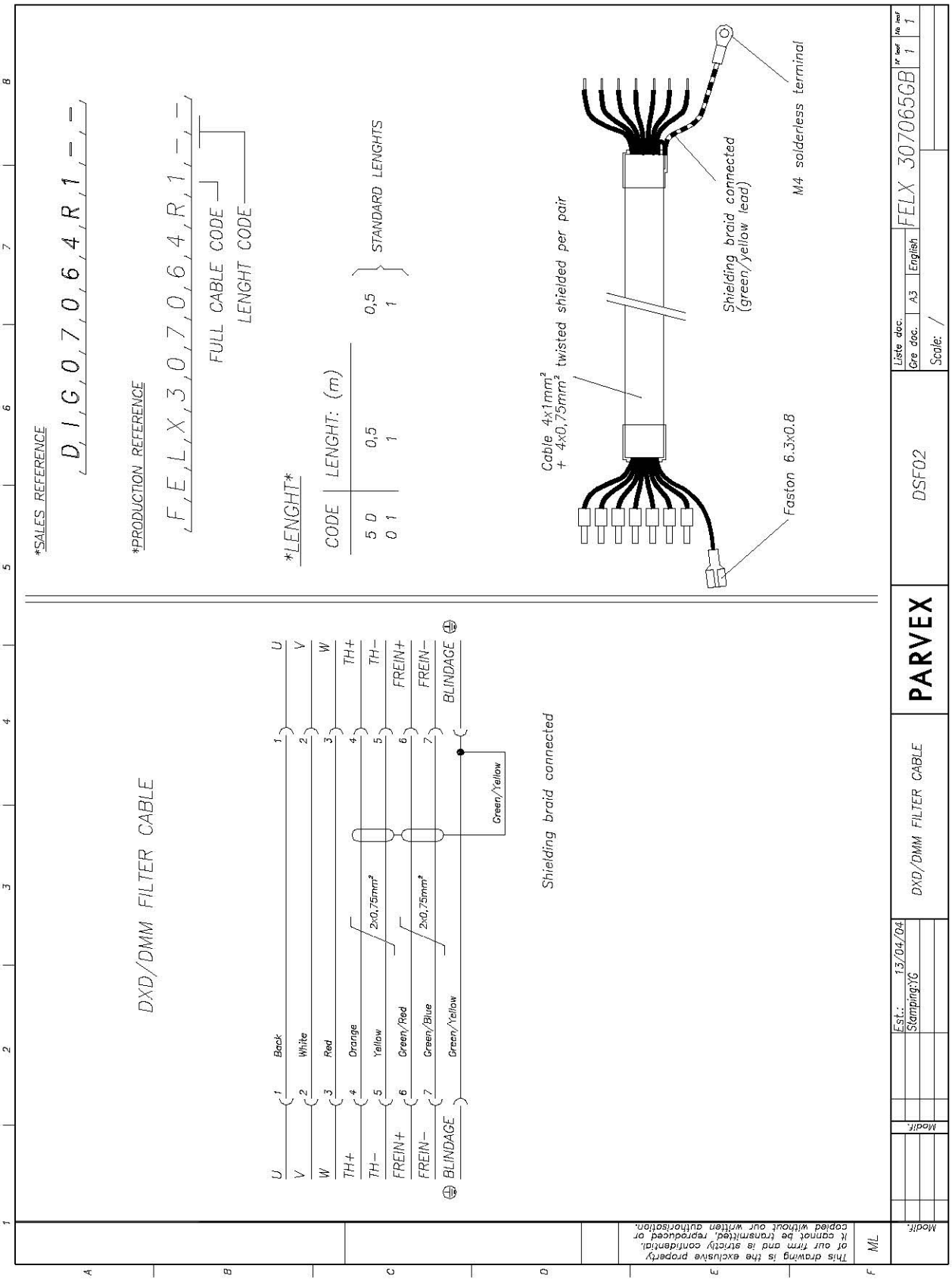
Two connection arrangements are provided (except HX300 which has the connector version only) :

- terminal box + resolver connector.
- power connector + resolver connector.


82
80
75.5
7 points screw type terminal block
Symmetrical rail 35x15mm
Symmetrical rail 35x7,5mm as per EN 50 022
Asymmetrical rail G 32 H=15mm as per EN 50 035
88.5
125.5
DSF02
DRIVE
MOTOR
PARVEX
DIMENSIONS
DSF02
FELX 306600GB
English
Scale: /
AM:E02031
14/11/01
Stamping:YG
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PARVEX
DIGIVEX
DRIVE
U2
V2
W2
Thermal protection
Brake
Connections valid for:
DXD 2/4A, 4/8A and 8/16A.
DSF02
DRIVE
MOTOR
RESOLVER
U
V
W
M
Brake
Thermal protection
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Modif.
Est.: 05/04/04
Stamping:YG
CONNECTING DIAGRAM
PARVEX
DIGIVEX DRIVE + DSF02
Liste doc.
Gre doc. A3
English
FELX 307062GB
N° feuil 1
Nb feuil 1
Scale: /

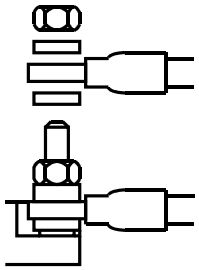
Connection cable between DMD and DSF02



Terminal Box Connection

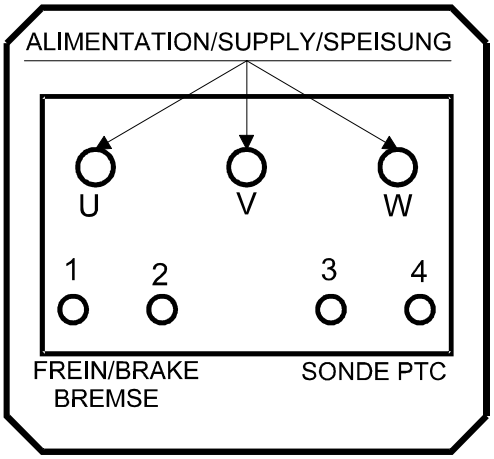
The clamp nuts and washers for the terminal box come in a sachet. Take care when fitting the terminals not to loosen the connecting wires between the motor and the terminal box.

Insert the power connection lugs between the striated washer and the flat washer.



Dipl3gb.ds4

Direction of Motor Rotation: When wired as specified a positive speed reference applied to the drive causes clockwise rotation (as viewed from power shaft).



Dipl2gb.D/W

U Phase U

V Phase V

W Phase W

1 Optional brake + 24 V

2 Optional brake 0 V

câble ≥ 1mm²

3 PTC sensor

4 PTC sensor

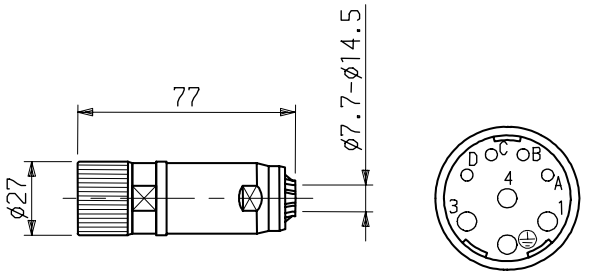
câble ≥ 1mm²

Connector Connection

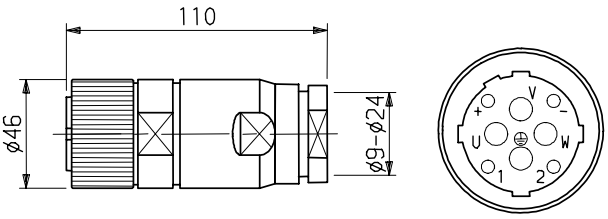
Power can be connected using a connector as an option. The removable part of the connector (plug) can be supplied on request.

LIST OF CONNECTOR PLUGS FOR MOTORS
(STANDARD CRIMP-CONTACT STRAIGHT PLUG)

MOTOR	PLUG
HX300 ($\hat{I}_0 < 7A$)	**220065R1610** **Cable for power 0,5 and 1mm²** **220065R1611** **Cable for power 2,5 mm²**
HX400/ HX600, HS600/ HD600, HS800 ($\hat{I}_0 < 14A$)	
HS800 ($14 \leq \hat{I}_0 < 32A$)	
HX800/ HD800, HS900 ($\hat{I}_0 < 32A$)	**220065R3611** **Cable for power 2,5mm²** **220065R3610** **Cable for power:** **6 mm²** **10 mm²** **16 mm²**
HX800/ HD800, HD900 ($32 \leq \hat{I}_0 < 60A$)	
HD900 ($60 \leq \hat{I}_0 < 80A$)	



PLUG 220065R1610/1611



PLUG 220065R3610/3611

PERMISSIBLE CABLE CROSS-SECTION FOR PLUGS

PLUG 220065R1610: Power & Ground: 0.14 - 1.5 mm². Brake & thermal protection: 0.14 - 1 mm².
PLUG 220065R1611: Power & Ground: 0.75 - 2.5 mm². Brake & thermal protection: 0.14 - 1 mm².
PLUG 220065R3611: Power & Ground: 1.5 - 4 mm². Brake & thermal protection: 1 - 2.5 mm².
PLUG 220065R3610: Power & Ground: 6 - 16 mm². Brake & thermal protection: 1 - 2.5 mm².

	PIN OUT		
FUNCTION	220065R1610/R1611	220065R3610	CABLE COLOUR
BRAKE + BRAKE -	A B	+ -	Green/ Red Green/ Blue
THERMAL PROT. THERMAL PROT.	C D	1 2	Orange Yellow
GROUND	2	⏚	Green/Yellow
U_2 V_2 W_2	1 4 3	U V W	Black White Red
Shielding to be connected to the earth at the servoamplifier end ⏚	-	-	Green/Orange

Holding Brake Connection

Brushless motors may be fitted with a brake of suitable dimensions to hold the drive immobilised. If 24 V dc ±10% is applied across the brake terminals, the brake disc is released and the motor can rotate.

The 24 V dc current for brake control must be regulated/filtered. It is to be connected to terminal block X1 of the DIGIVEX Power Supply and is then distributed internally to the DIGIVEX Drive modules. The brake is to be connected to terminals B1/6 (+) and B1/7 (-) for 2/4, 4/8,8/16 and 16/32 and to B2/1 and B2/2 of the DIGIVEX Drive for calibre 32/64.

Thermal protection Connection

The two terminals of the PTC probe located in the motor terminal box to be connectec to DIGIVEX Drive terminal blocks B1/4 and B1/5 for calibres 2/4, 4/8, 8/16 and 16/32 and to DIGIVEX Drive terminal blocks B2/1 and B2/2 for calibre 32/64.

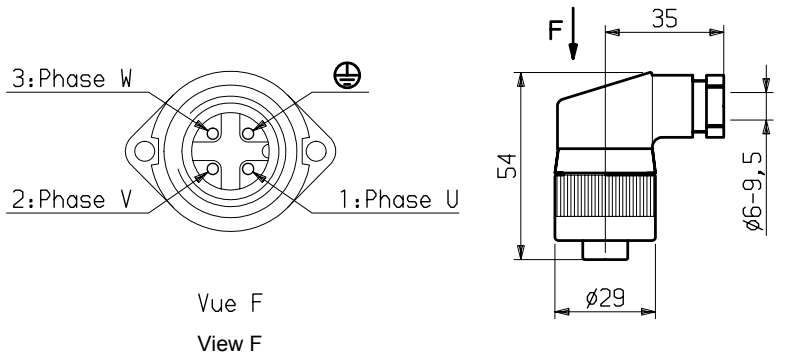
Motor Ventilation Connection

Some motors can be delivered as fan-cooled versions.

Fan characteristics :

- Supply voltage : 400 V three-phase, 50/60 Hz as standard.
- Power consumption : 45 W
- Connector type connection (plug 220056P0200 supplied on request).

When connecting check the direction of fan rotation and check that airflow is produced. The direction of airflow is shown on the dimension drawings.



Vue F

View F

Dipl7gb.T/dm8.h

3.4.3.4 Resolver Connection

The resolver is a high precision sensor (± 10 angular minutes as standard). It must be carefully wired :

- Separately routed power cable.
- Twisted pair (sine, cosine, excitation) with general shielding. The general shielding must be connected to the metal cap of the SUB-D plug. Do not connect the shielding at the motor end.

PARVEX SA can supply the cable in either of two versions :

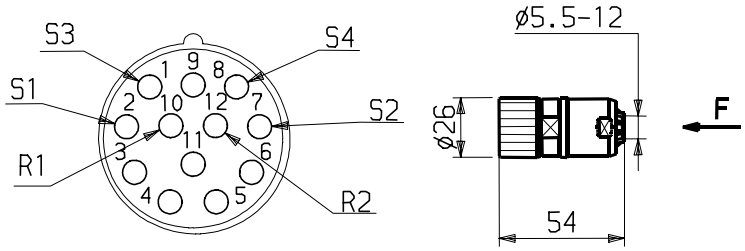
- Separate cable, in this case wire as shown in the diagram below. Reference see § 3.5.4.
- Cable fitted with SUB-D plug at drive end and connector at motor end. This solution is strongly recommended as the cable is ready for use. Reference, see § 3.5.4.

Maximum distance between resolver and DIGIVEX DRIVE : 200 m. Please ask about longer cables.

Maximum permissible cross-sections :

- For SUB-D plug : 0.5 mm≤.
- For removable connector plug. 0.14 to 1 mm² (solder or crimp-fit contacts)

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

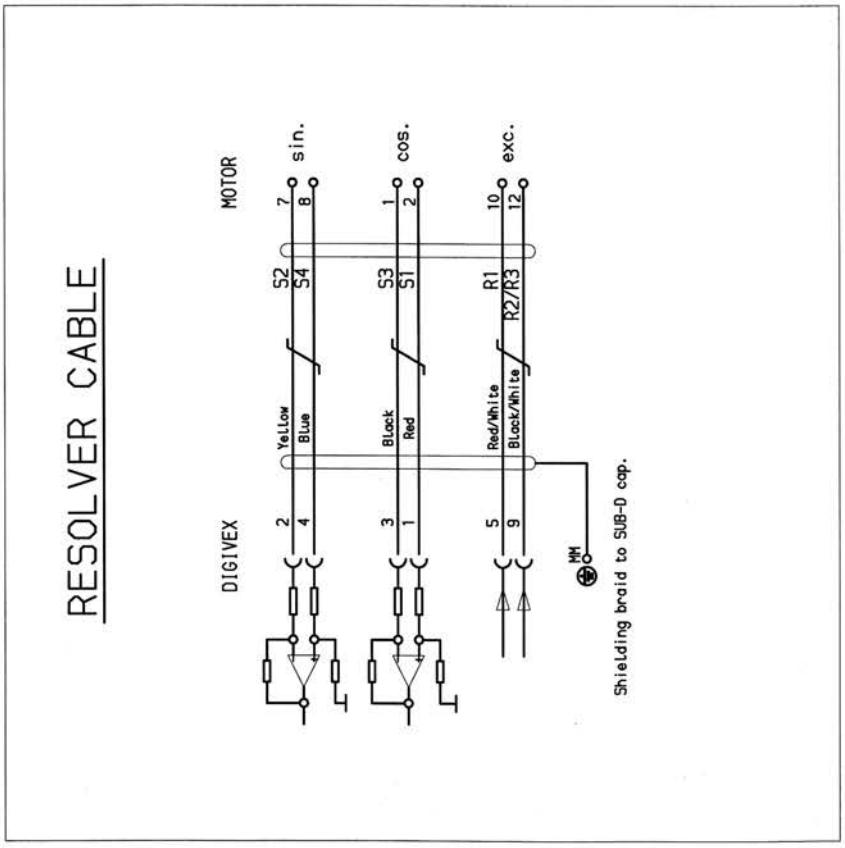


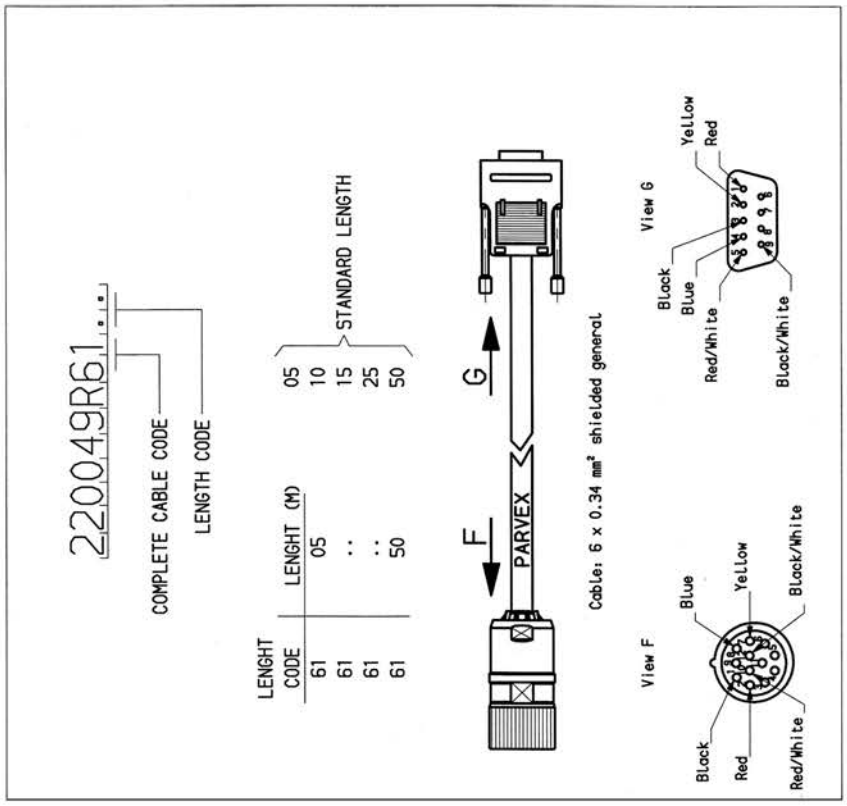
View F

"Resolver" SUB-D Plug (connection at DIGIVEX Drive end)

Maximum conductor cross-section: 0.5 mm²

CONTACT	TYPE	PURPOSE
1	Input	Cosine S1
2	Input	Sine S2
3	Input	Cosine S3
4	Input	Sine S4
5	Output	Excitation R1
6	Output	
7	Output	
8	Output	
9	Output	0 V R2/3 Excitation


RESOLVER CABLE
DIGIVEX
MOTOR
sin.
cos.
exc.
S2
S4
S3
S1
R1
R2/R3
Yellow
Blue
Black
Red
Red/White
Black/White
Shielding braid to SUB-D cap.


220049R61...
COMPLETE CABLE CODE
LENGTH CODE
LENGHT CODE
LENGHT (M)
05
10
15
25
50
STANDARD LENGTH
F
G
PARVEX
Cable: 6 x 0.34 mm² shielded general
View F
View G
Blue
Yellow
Black/White
Black
Red
Red/White
Yellow
Red
Black
Blue
Red/White
Black/White

3.4.4 "Input/Output" SUB-D Plug

3.4.4.1 Inputs/Outputs description

Maximum conductor cross-section: 0.5 mm≤

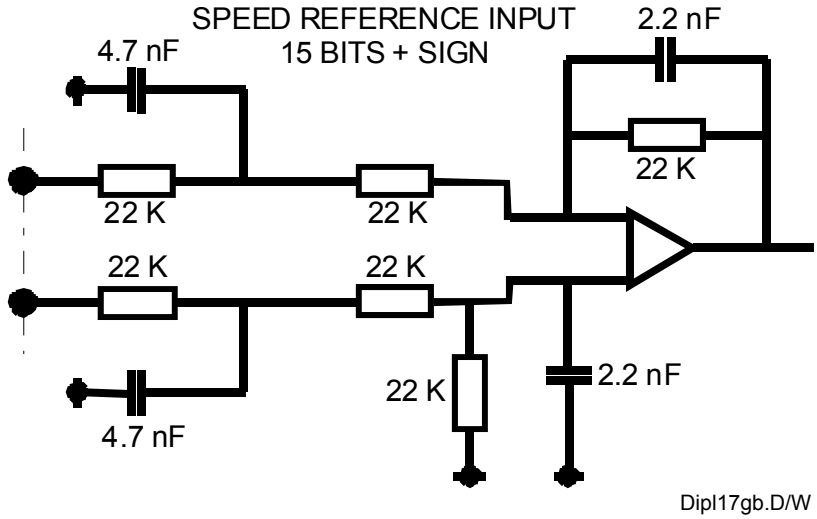
CONTACT	TYPE	PURPOSE	CHARACTERISTICS
1 14	AI1 + AI 1 -	±10 V speed or current reference, + point ± 10 V speed or current reference, - point	Analog conversion : 15 bits + sign Differential input
2 15	AI 2 + AI 2 -	± 10 V analog input, + point ± 10 V analog input, - point Input assigned to external current limitation. 10 V = max. current	Analog conversion : 9 bits + sign
3 16	A01 0V	Analog output ±10V, **+** point **ANA1** 0V of analog output Output assigned to speed measurement 10V = maximum speed	Analog conversion 7 bits + sign Max. voltage = 10 V Max. current = 3 mA Protected against short circuits
4 17	A02 0V	Analog output ±10V, **+** point **ANA2** 0V of analog output Output assigned to current measurement 10V = maximum current	Analog conversion 7 bits + sign Max. voltage = 10 V Max. current = 3 mA Protected against short circuits
9 21	EL1 + EL1 -	SPEED RANGE Speed range choice	24 V optocoupled logic inputs type 2 under IEC standard 1131-2 5 (see characteristics on following pages) These inputs must be supplied with 24 V
10 22	LI2 + LI2 -	CW: enables clockwise rotation if input is active (level 1)	
11 23	LI3 + LI3 -	CCW: enables counter-clockwise rotation is input is active (level 1)	

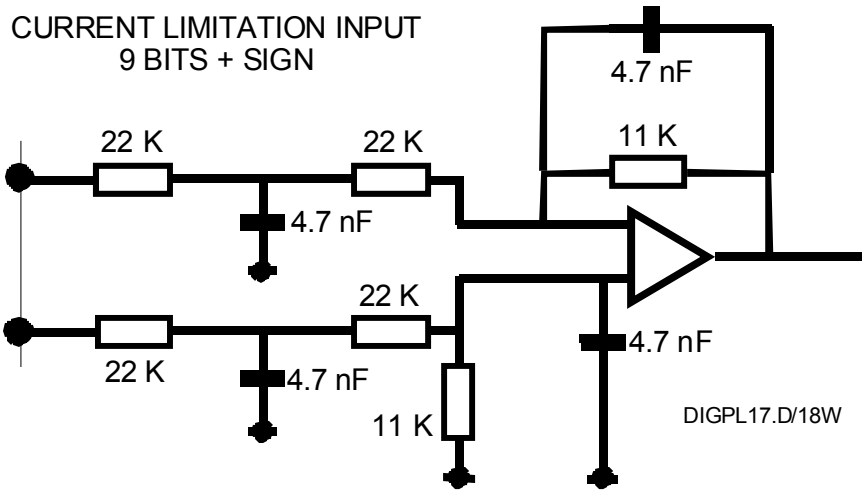
AI = Analog Input, **LI =** Logic Input, **AO =** Analog Output, **LO =** Logic Output

"Input/Output" SUB-D Plug

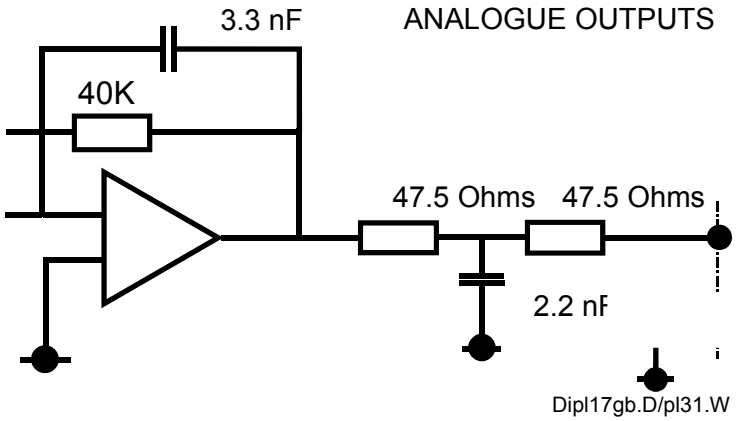
CONTACT	TYPE	PURPOSE	CHARACTERISTICS
12 24	LI4 + LI4 -	Torque : torque enable if input is HIGH	Type 2 logic input under IEC 1131-2.5
6 18	LO1 0V Logic	Drive OK	24 V optocoupled PNP output max. 50 mA.
7 19	LO2 0V Logic	Speed detection OUT1	24 V optocoupled PNP output max. 50 mA
8 20	LO3 0V Logic	Speed detection OUT2	24 V optocoupled PNP output max. 50 mA
13 25	+24V logic 0V Logic	Supply available for logic inputs/outputs	max. 50 mA via R = 22 Ω

AI = Analogue Input, **LI =** Logic Input, **AO =** Analogue Output, **LO =** Logic Output





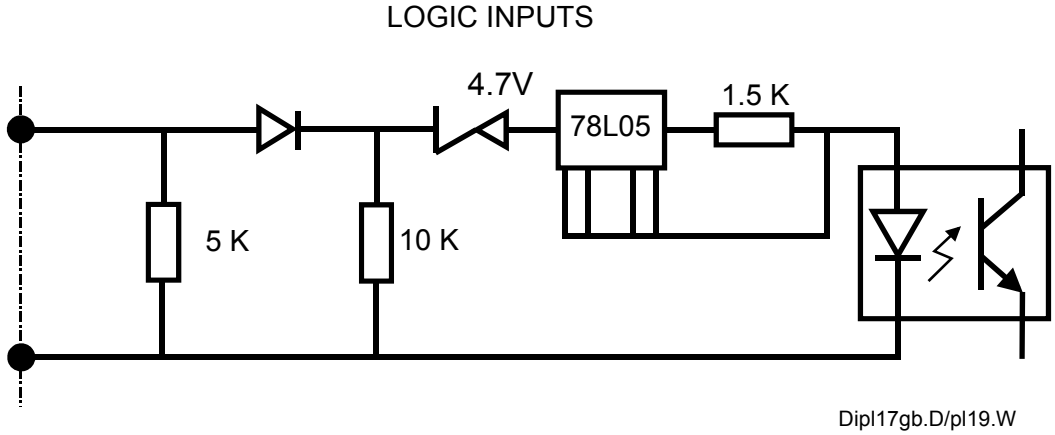
Dipl17gb.D/pl18.W



Dipl17gb.D/pl31.W

Logic Input Characteristics

- optocoupled 24 V dc inputs (insulation voltage 100 V)
- type 2 inputs to standard IEC 1131-2
- these inputs may be connected directly to PNP type outputs (external load resistor not necessary)



Dipl17gb.D/pl19.W

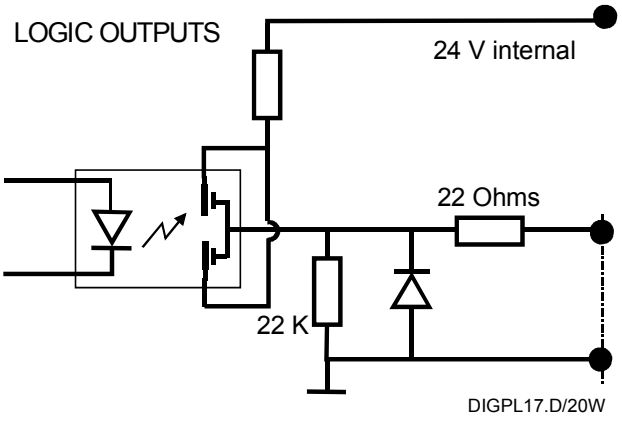
	MIN.	TYPICAL	MAX.
Level 0 input voltage	-	0V	5V
Level 1 input voltage	11V	24V	30V
Level 0 input current	-	0mA	2mA
Level 1 input current	7mA	13mA	15mA
Response time Ton (0 to 1)	-	1 ms	-
Response time Toff (1 to 0)	-	1 ms	-

Logic Output Characteristics

Outputs are supplied by a 24 V internal source (24 V and 0 V insulated and common to terminals 25 and 13). No external 24 V source is to be connected to the outputs. The 0V terminal of the three outputs and contact 25 are connected together.

- Max. output current (level 1) : 50 mA
- Residual current (level 0) : negligible
- Response time : 1 ms
- Voltage drop for I = 50 mA : 2 V

PNP opto-insulated (opto-mos) output, load to be connected to 0 V logic (between the two contacts assigned to this output).



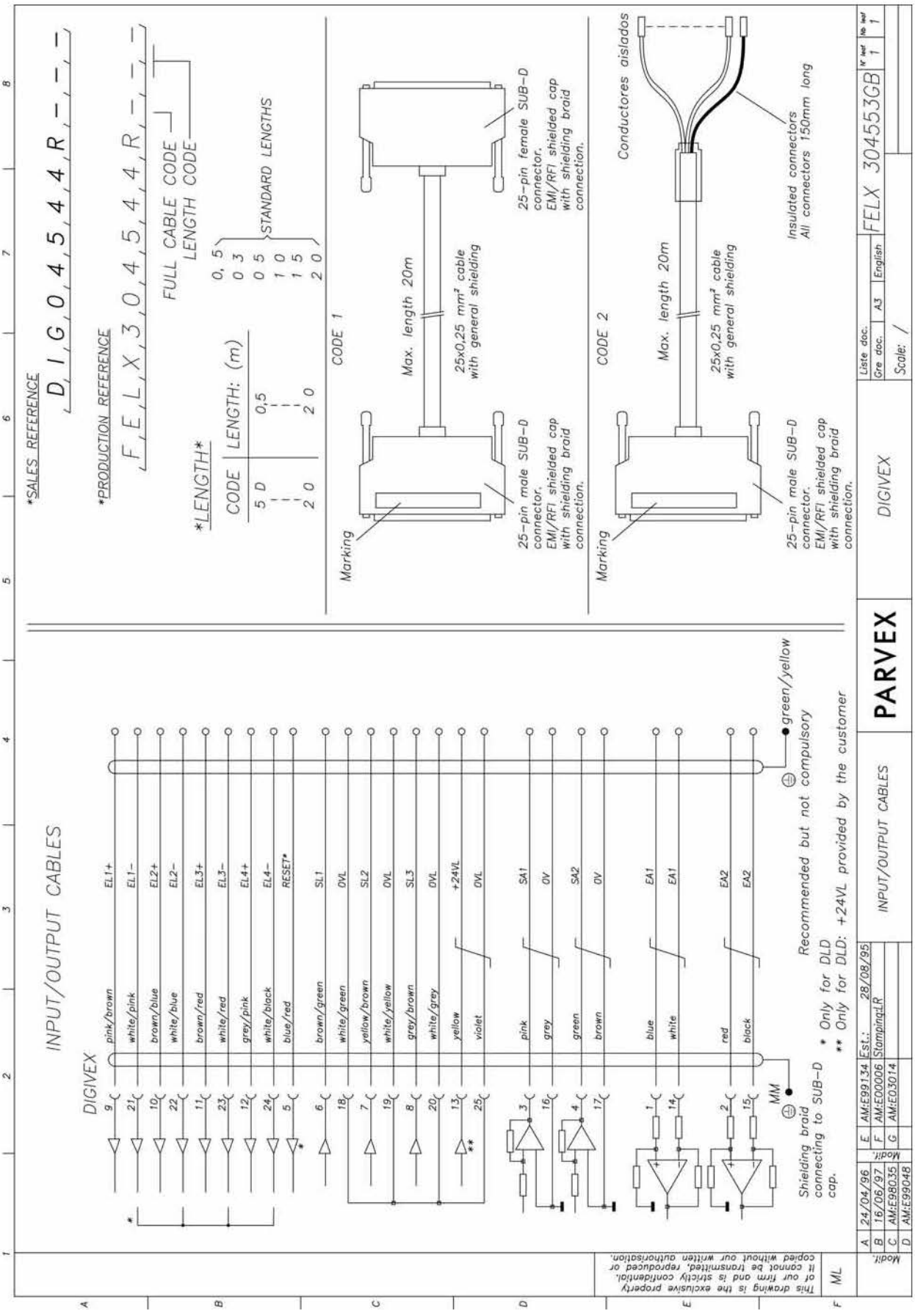
3.4.4.2 Input/Output Cable (Terminal Block X2 Inputs/Outputs)

Ensure continuous shielding at any intermediate terminal block separating the different functions.

Maximum advised distance between drive and terminal block : 10 m.

PARVEX SA recommended cable reference CB08304, 25 x 0.25 mm² conductors, including five twisted pairs with general shielding.

Cable may be supplied ready fitted with SUB-D plug, see drawing FELX 304553.


INPUT/OUTPUT CABLES
DIGIVEX
*SALES REFERENCE
DIG045444R---
*PRODUCTION REFERENCE
FELX3045444R---
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
Max. length 20m
25x0,25 mm² cable with general shielding
25-pin male SUB-D connector. EMI/RFI shielded cap with shielding braid connection.
25-pin female SUB-D connector. EMI/RFI shielded cap with shielding braid connection.
CODE 2
Conductores aislados
Insulated connectors All connectors 150mm long
pink/brown EL1+
white/pink EL1-
brown/blue EL2+
white/blue EL2-
brown/red EL3+
white/red EL3-
grey/pink EL4+
white/black EL4-
blue/red RESET*
brown/green SL1
white/green 0VL
yellow/brown SL2
white/yellow 0VL
grey/brown SL3
white/grey 0VL
yellow +24VL
violet 0VL
pink SA1
grey 0V
green SA2
brown 0V
blue EA1
white EA1
red EA2
black EA2
green/yellow
MM
Shielding braid connecting to SUB-D cap.
Recommended but not compulsory
* Only for DLD
** Only for DLD: +24VL provided by the customer
PARVEX
DIGIVEX
INPUT/OUTPUT CABLES
Liste doc.
Gre doc.
A3
English
FELX 304553GB
Scale: /
Modif.
A 24/04/96
B 16/06/97
C AM:E98035
D AM:E99048
E AM:E99134
F AM:E00006
G AM:E03014
Est.: 28/08/95
Stamping LR
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ML

3.4.5 SUB-D Plug

3.4.5.1 Definition

Maximum conductor cross-section : 0.5 mm²

- Serial link configuration :
  - 9600 bauds
  - 8 data bits
  - 1 start bit, 1 stop bit
  - No parity
  - No galvanic insulation
  - Use maximum 5 m extension cable.

DIGIVEX INTERNAL CONNECTIONS	DIGIVEX 9-PIN SUB-D	PC	PC 9-PIN SUB-D
	1	DCD	1
	2 TD (TXD)	RD (RXD)	2
	3 RD (RXD)	TD (TXD)	3
	4	DTR	4
	5 0V	0V	5
	6	DSR	6
	7	RTS	7
	8	CTS	8
	9 5V / 50mA	For programming terminal	9*

* May be connected without hazard to 9 of DIGIVEX.

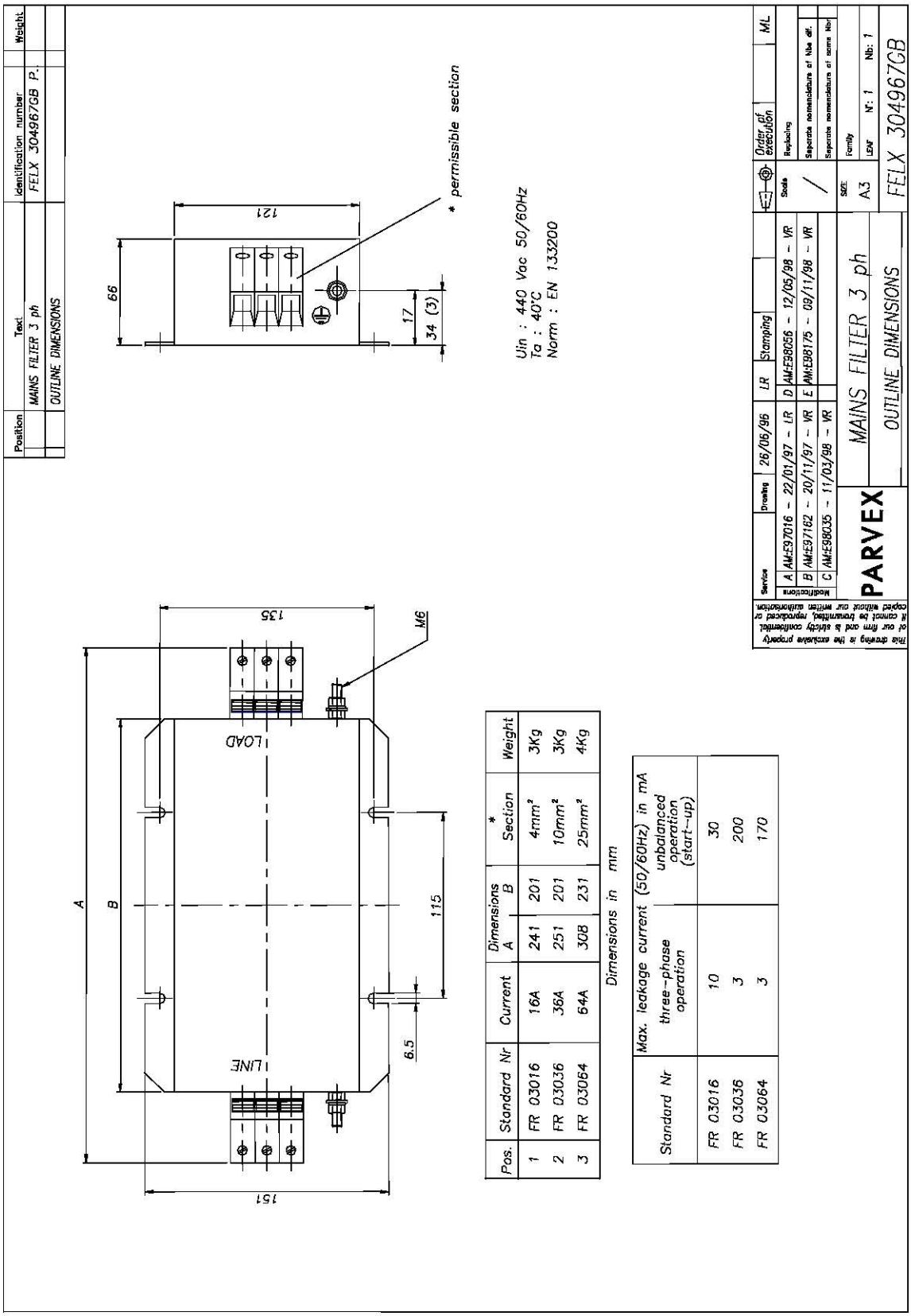
3.4.5.2 RS 232 cable

For the RS232 cable (SUB-D X3) see commercial cables (9-pin SUB-D extension)

3.5 Accessories

3.5.1 Mains filter

Mains filters: These filters are essential for compliance with protection currently required against interference (see especially the section on compliance with standards and wiring diagrams). Dimensions are shown on drawing FELX 304967 (see following pages).


Position
Text
Identification number
Weight
MAINS FILTER 3 ph
FELX 304967GB P.
OUTLINE DIMENSIONS
121
66
17
34 (3)
* permissible section
Uin : 440 Vac 50/60Hz
Ta : 40°C
Norm : EN 133200
135
M6
LOAD
LINE
A
B
115
6.5
151
Pos. | Standard Nr | Current | Dimensions A | Dimensions B | * Section | Weight
1 | FR 03016 | 16A | 241 | 201 | 4mm² | 3Kg
2 | FR 03036 | 36A | 251 | 201 | 10mm² | 3Kg
3 | FR 03064 | 64A | 308 | 231 | 25mm² | 4Kg
Dimensions in mm
Standard Nr | Max. leakage current (50/60Hz) in mA three-phase operation | unbalanced operation (start-up)
FR 03016 | 10 | 30
FR 03036 | 3 | 200
FR 03064 | 3 | 170
Modifications
Service
Drawing
Stamping
Order of execution
Scale
Replacing
Separate nomenclature of files diff.
Separate nomenclature of same files
Family
Sheet
A AM:E97016 - 22/01/97 - LR
B AM:E97162 - 20/11/97 - VR
C AM:E98035 - 11/03/98 - VR
26/06/96
LR
D AM:E98056 - 12/06/98 - VR
E AM:E98175 - 09/11/98 - VR
ML
A3
LENF
N°: 1
Nb: 1
PARVEX
MAINS FILTER 3 ph
OUTLINE DIMENSIONS
FELX 304967GB
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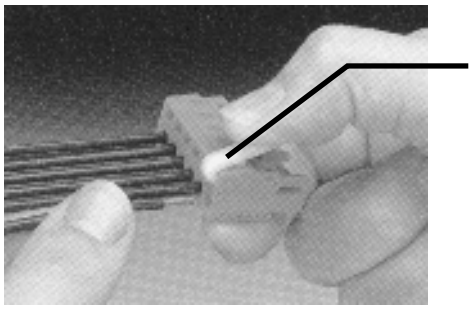
3.5.2 External energy dissipation resistors

- RE 91001 2 kW
- RE 91002 4.5 kW
- RE 90020 wall console

Dimensions : see following pages.

3.5.3 Tool

Tool for connecting leads to spring-action terminal blocks (X1, X2, X3). This tool is systematically supplied with the equipment. Extra ones may be ordered as catalogue number Parvex PD 01077.



(tool) lever
PD 01077

3.5.4 Cables

Bare cables :

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

Complete cables (fitted with connectors and/or SUB-D plugs) :

- Resolver cable: 220049R61-- (-- = lenght in meter) 5m/10m/15m/25m/50m.
- Input/output cable: FELX 304544R--Remember to indicate code 1 or 2 - see drawing - followed by the length (-- = length in metres) 3m/5m/10m/15m/20m.
- Encoder cable: FELX 304546R-- (-- = lenght in meter) 3m/5m/10m/15m/20m.

For RS 232 cable (SUB-D X3) see commercially available cables with 9-pin SUB-D extension.

Cable for power (delivered alone or with fitted connector).

MOTOR	CABLE REFERENCE	
	CABLE ALONE	FITTED CABLE
HX300	6537P0019 (0.5 mm²)	220049R49--
HX400/ HX600, HS600/ HD600, HS800 ($\hat{I}_0 < 14A$)	6537P0009 (1 mm²)	220049R42--
HS800 ($14 \leq \hat{I}_0 < 32A$)	6537P0010 (2.5 mm²)	220049R43--
HX800/ HD800 ($\hat{I}_0 < 32A$)	6537P0010 (2.5 mm²)	220049R48--
HS900 ($\hat{I}_0 < 32A$)	6537P0010 (2.5 mm²)	220049R48--
HX800/ HD800, HD900 ($32 \leq \hat{I}_0 < 60A$)	6537P0011 (6 mm²)	220049R45--
HD900 ($60 \leq \hat{I}_0 < 80A$)	6537P0012 (10 mm²)	220049R46--

Lenght 5m/10m/25m/50m. Add to hereabove reference the cable lenght in meter.

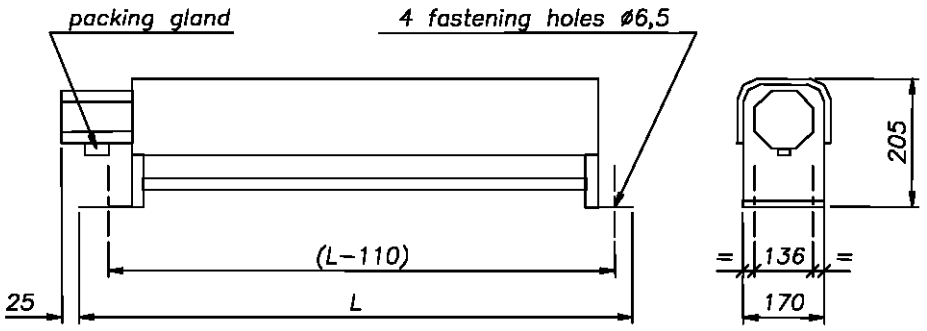
3.5.5 Inductors for long cable lengths with axis motor

Selection : see § 3.4.3.2.

Dimensions see drawing FELX 302983 (see following pages).

External energy dissipation resistor
(FOR 25 KW DIGIVEX POWER SUPPLY only)

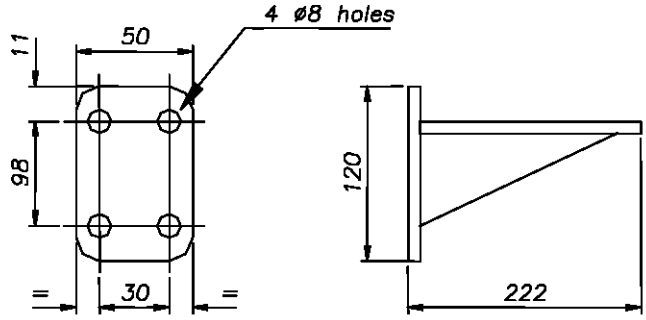
Position	Text	Identification number	Weight
	DIGIVEX	FELX 404537GB P1	
	EXTERNAL RESISTOR		



Standard N°	Power (W)	R (Ω)	L (mm)
RE 91001	2000	27	620
RE 91002	4500	12	1195

Connection in IP55 sealed terminal box with packing gland.
Weight (kg) : 1 + 9,2L(m)

RE 90020



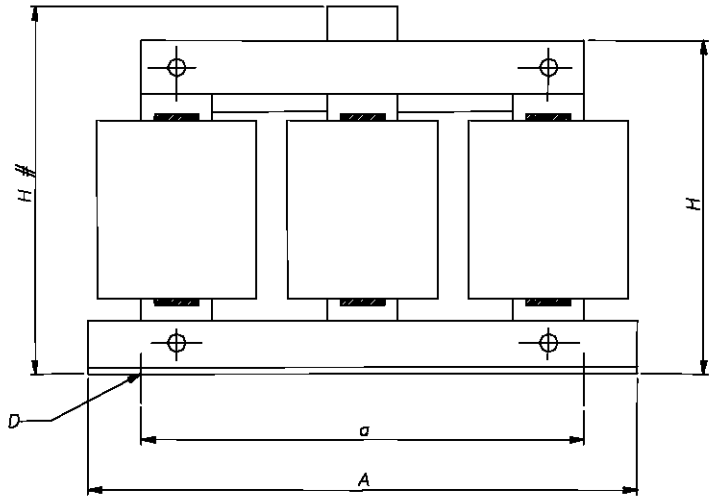
Pair of wall consoles
Weight : 0,9kG

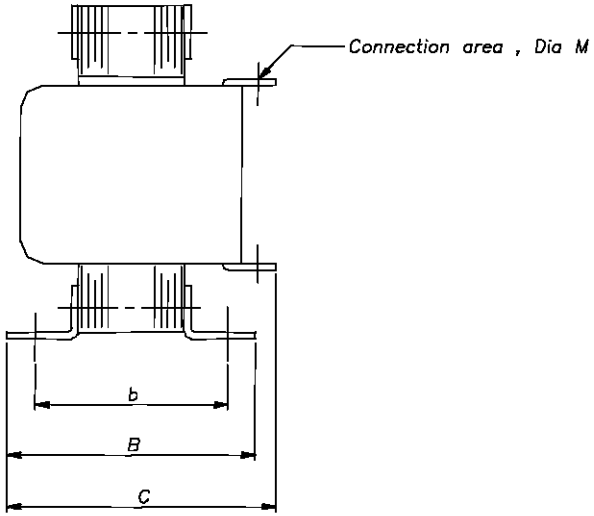
RECOMMENDATION:
These resistors must be used horizontally, fixed to the ground or to wall consoles, with nothing liable to impede natural convection.

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Service	Drawing	26/07/95	JP	Stamping		Order of execution	ML
Modifications	A	AM:E98026 – 20/02/98 – VR			Scale 1	Replacing	
						Separate nomenclature of Nbe dif.	
						Separate nomenclature of same Nbr	
PARVEX	DIGIVEX				SIZE A4	Family	
	EXTERNAL RESISTOR					LEAF N° 1 Nb 1	
					FELX 404537GB		

Position	Text	Identification number	Weight
	THREE PHASE CHOKE	FELX 302983GB	
	DIMENSIONS		





No Standard	Ct nom.	Choke nom.	Dimensions A	B	C	H	H#	Fixing axb	D	connection area	M	Weight
SF 02025	26A	850uH	150	95	110	/	135	112x80	6	# 6mm2	/	4,5kg
SF 02026	65A	340uH	175	95	95	165	180	53x68	6,5	16x16	6,5	9Kg
SF 02027	118A	190uH	290	116	135	210	/	230x100	8	20x20	9	13Kg
SF 02028	17A	1,3mH	160	95	/	/	115	112x71	6	# 6mm2	/	4,2Kg
SF 02029	91A	245uH	220	135	160	160	/	166x114	6	20x20	9	15Kg
SF 02030	170A	130uH	235	120	165	240	/	185x100	9	25x28	11	19Kg
SF 02032	7,5A	400uH	132	75	85	/	103	94x55	6x10	# 4mm2	/	1,9Kg

The dimensions are in mm

TERMINAL BLOCK CONNECTION

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Service	Drawing	05/02/91	FM	Stamping		Order of execution		ML
Modifications A	17/12/92 – AJOUT SF 02032					Scale	/	Replacing
B	24/02/97 – MISE A JOUR							Separate nomenclature of Nbe dif.
C	AM:E98035 – 11/03/98 – VR							Separate nomenclature of same Nbr
PARVEX	THREE PHASE CHOKE					SIZE A3		Family
	DIMENSIONS							LEAF N° 1 Nb 1
								FELX 302983GB

4. PARAMETER FUNCTION AND ADJUSTMENT

4.1 DIGIVEX Power Supply

4.1.1 Straps positions

ST1 : No phase detection.

- fitted, no phase detection.
- removed, no detect. Single-phase operation at 20% of maximum capacity.

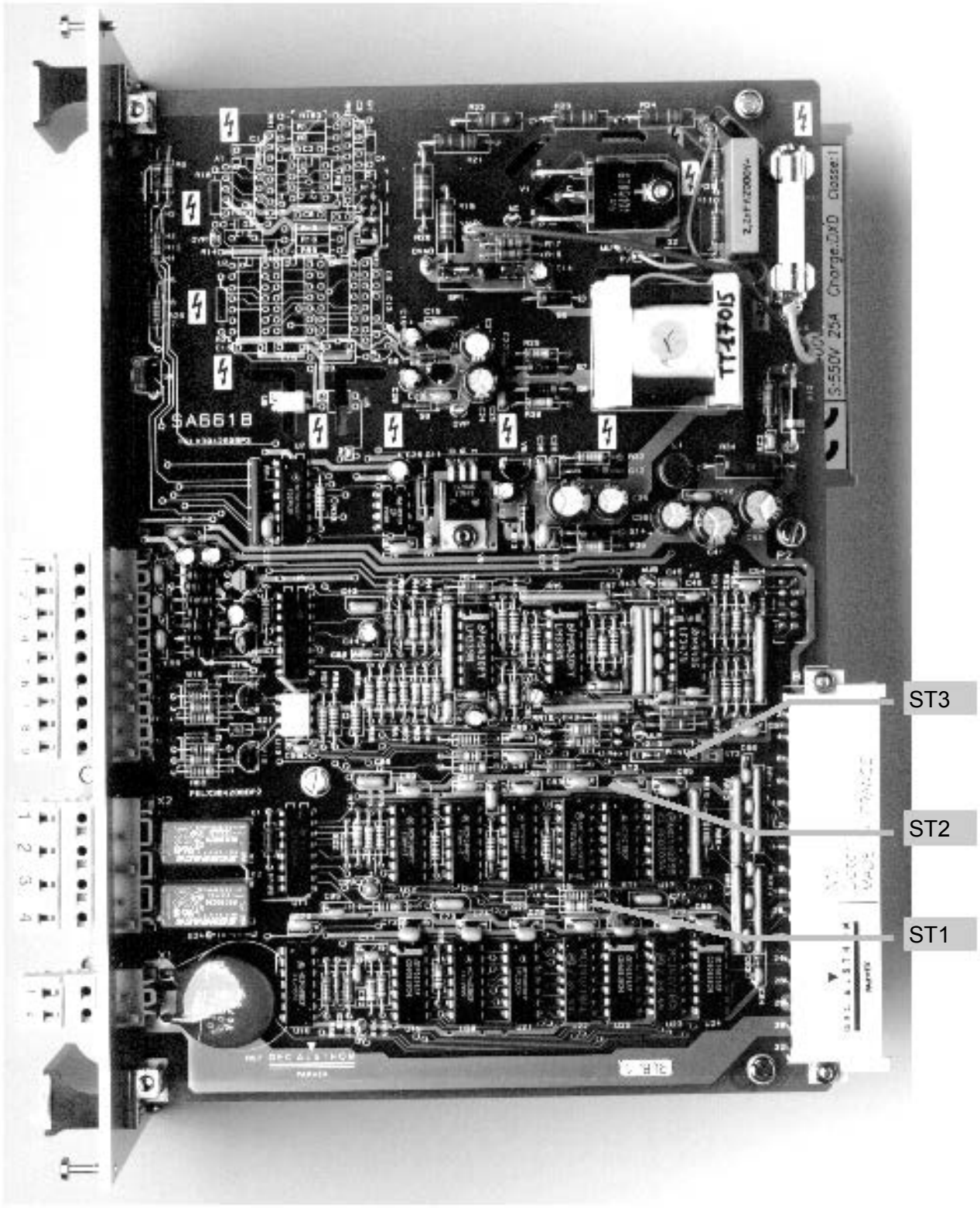
ST2 : Regeneration cycle. See §1.4.3. Strap ST2 is not fitted on 12 kW Power Supplies.

ST3 : Power bus discharge.

- between 1 & 2, bus discharged via regeneration resistor if bus voltage falls below 200V. With this option the bus discharging time can be higher than 5 seconds.
- between 2 & 3, bus discharged upon supply cut out (no mains supply detection). Approximately 100 ms after motors stop.

Standard configuration: ST1 and ST2 fitted, ST3 between 2 and 3.

Location : See next page.


ST3
ST2
ST1

4.1.2 Initialization Sequence

Upon energizing :

- T0 ← Mains present
- T0 + 100 ms → OK relay closed
- T0 + 700 ms → Main switch closed capacitors precharged
- T0 + 800 ms → Regeneration test OK
- T0 + 940 ms → INIT signal

The INIT. (initialization) signal enables the drives to be released.

4.2 DIGIVEX Drive

4.2.1 Functions

4.2.1.1 Block Diagram

See next pages
It groups the main drive functions and adjustment parameters.

- **On the right, the motor - resolver - power unit**

Parameters can be set for :

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

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

- **Ahead of current control**
  - ♦ Second order filter for reducing resonance effects at high frequencies
  - ♦ External reduction of current limitation.

- **Resolver digital processing** (non parametrable) and the optional encoder emulation function (number of points adjustable from 1 to 16,384).

- **Speed loop unit, where the following parameters can be set :**

  ⇒ maximum speed for the application (limited by the motor max. speed).
  ⇒ scaling (1 V = N rpm.).
  ⇒ choice of corrector type - proportional, proportional and integral, proportional and double integration, or simply choice of current regulation operation.

- **Predictive action related to speed control**

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

These predictive actions (or predictors) are :

⇒ Gravity : compensation of vertical masses.

⇒ Dry friction : a friction value is set a priori, the corresponding torque reference is applied, its sign being that of the speed reference.

⇒ Viscous friction: compensation of friction proportional to speed (hydraulic or electrical system drive).

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

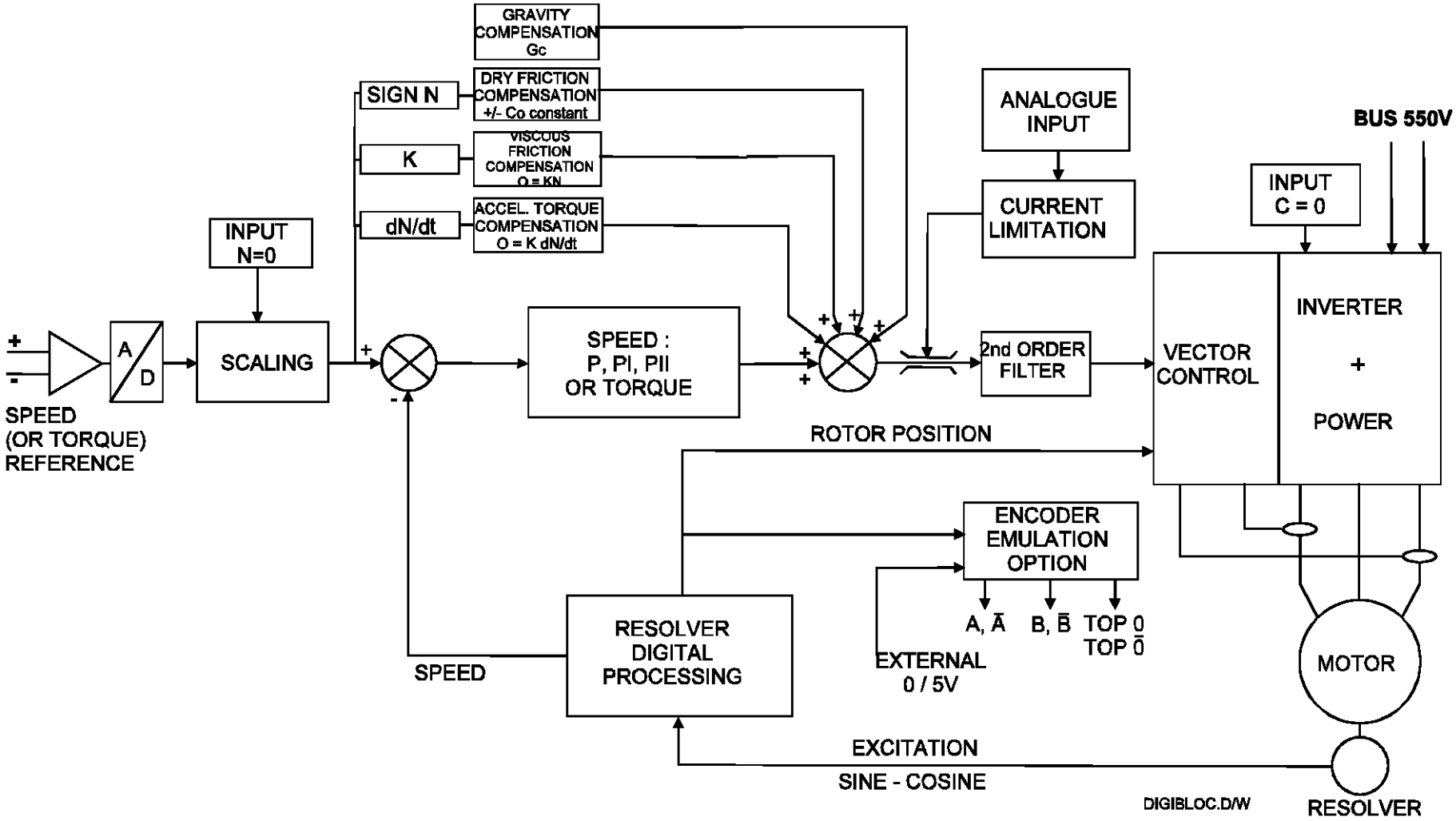
- **Analogue input** speed reference (16 bits), non assignable.

- **On the left of the block diagram,** the logic and analogue inputs/outputs.

The parameter setting software is used for :

⇒ assigning certain of these inputs/outputs
⇒ forcing them to a logic state. The inputs are then disconnected from the outside.

DIGIVEX DRIVE BLOCK DIAGRAM



4.2.1.2 Logic Input Forcing

The software (or.through handed terminal) can be used to force a logic input to a particular value. Using the software, the CW (zero speed clockwise), CCW (counter clockwise) and T (zero torque) inputs may be

- disconnected from the physical input
- forced by software to 0 or 1 (HIGH or LOW).

4.2.1.3 Stimulus/Oscilloscope Function

Functions integrated in the drive can be used to excite the speed or torque reference: dc voltage, square (response to scale), sine, noise.

These stimuli may be activated by a PC (or by the terminal). The result, stored in the drive, may be displayed on the PC screen by using the oscilloscope function (or sent to the 2 analog outputs).

4.2.1.4 Logic outputs

1) Speed detection

The two outputs assigned OUT1 and OUT2 are used to detect four speed ranges depending on the logic state.

OUT1	OUT2	SPEED
1	1	Speed ≤ 48 rpm
0	1	Speed ≤ N1
1	0	Speed ≤ N2
0	0	Speed > N2

N1 and N2 are speeds that are programmed in the parameters.
N2 > N1
and N1 > 48 rpm.

2) Speed reached and anchored

Selection and assignment with PME DIGIVEX PC software (PVD 3483) or terminal DTP001 (PVD 3491)

4.2.1.5 Brake Action

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

The 24 V brake supply to the DIGIVEX Power Supply (terminal block X1) is monitored by the drive.

CAUTION: cutting this supply releases brakes on **all axes**.

- 24 V present: Axis under torque. Removal of limitation to 90% of rated motor current.
- 24 V absent: Axis at 90% reduced torque of rated motor current.

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

4.2.1.6 Emergency Stop (speed loop mode only)

This signal is applied to theDIGIVEX Power Supply, terminal block X3 between terminals 8 and 9. During normal operation, it should be at logic state 1 (24 V on terminal X3-8).

If the signal goes LOW, this causes :

- All drives set to zero speed without ramps;
- Holding under torque after stoppage.

4.2.2 Servocontrol and Adjustment Parameters

4.2.2.1 List of Parameters

Choice of type of regulation :

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

In all cases :	Minimum Value	Maximum Value
• Filtering frequency	20 Hz	800 Hz
• Offset	- 1 % V max.	+ 1 % V max.
• Current limitation	0 A	Drive I pulse

In speed regulation (P, PI, PI²)

• Max. Speed	100 rpm	100,000 rpm
• Speed for 1 Volt	10 rpm	20,000 rpm
• Proportional gain	Drive Ipulse/156	Drive Ipulse x 210
• Integration frequency stop	0,1 Hz	150 Hz
• Speed 1 and speed 2	48 rpm < speed 1 < speed 2 < max speed	
• Predictors (gravity, static or dynamic friction, acceleration)		

4.2.2.2 Regulation Selection: Current, Proportional, PI, PI≤

Current regulation

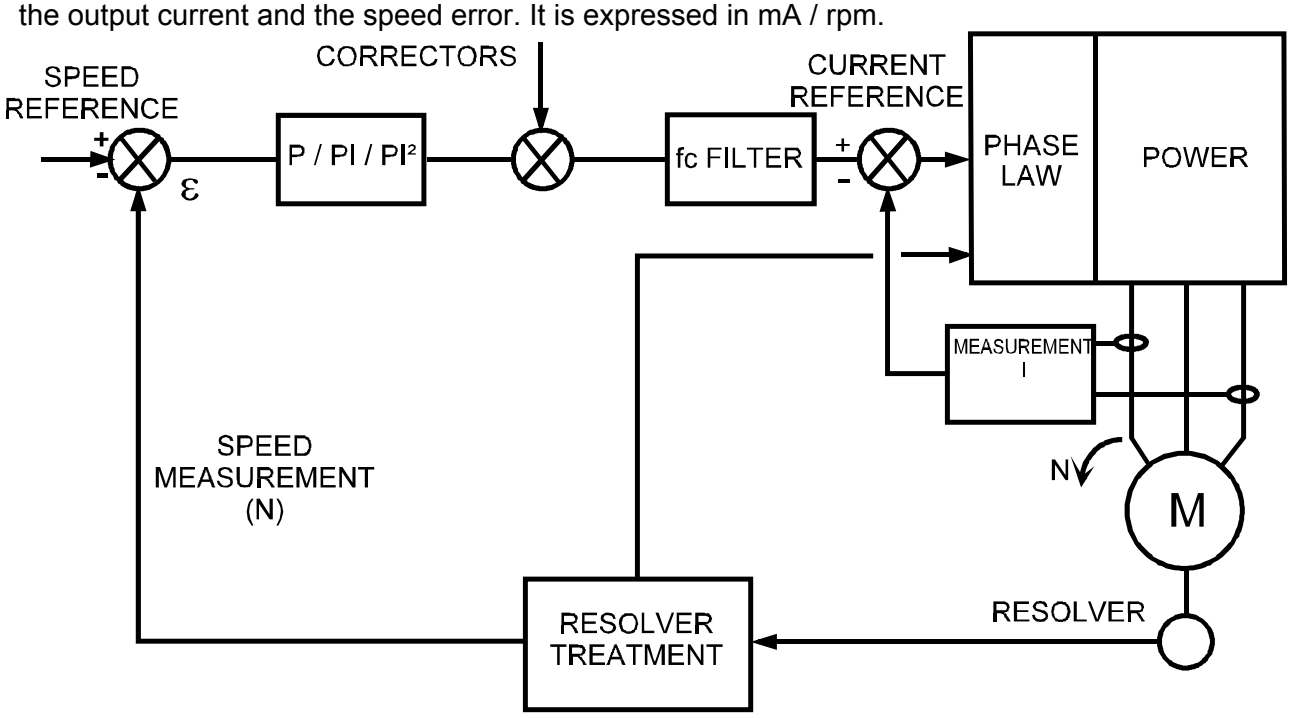
Selecting "current" means current can be controlled directly (therefore motor torque through the torque coefficient Kt). This the gives 10 V = peak pulse current of the drive selected.

In this mode, PI/PI^2 adjustment and predictors are neutralised. The only operative features are :

- Current limitation (often adjusted below permanent drive current so as not to trip in mean and rms values)
- The second order low pass filter (filtering frequency) for reducing possible resonance effects.

Selection of P

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

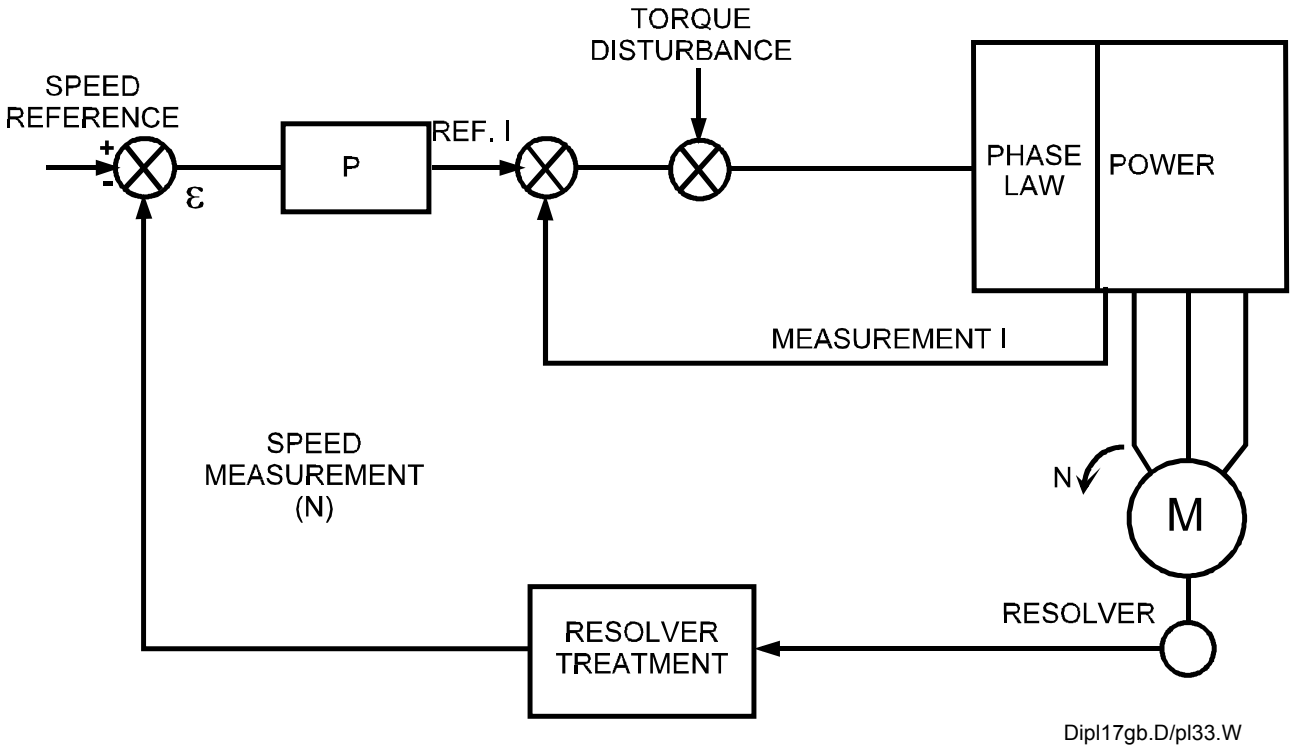


Dipl17gb.D/pl32.W

At speed N equal if the gain increases, the error e decreases, the system speed increases and its bandwidth.

Increased gain may lead to instability because of other components in the loop (resonance, second order filter).

The use of proportional action P alone has the drawback of providing zero stiffness, because there is no integration ahead of the current part.



Thus, if a torque jog is introduced when stopped there will be a permanent speed error (related in particular to gain P) and the system will run as long as the torque is present.

Notice that in modes P, PI and PI^2 all of the predictors are validated.

PI Selection (proportional and integral action)

By comparison with P alone, PI provides the following two changes :

- Gain (open loop) at zero frequency is infinite; if there is a torque jog there will be an angular discrepancy of the motor shaft relative to the rest state. This angle will be proportional to the torque applied and there will be no permanent speed drift. It is then possible to speak of "rigidity" of the system. This rigidity is strictly proportional to the integration stop frequency.

- Proportional gain P fixes the bandwidth f_0 (system speed). Integral action entails a -90° phase shift, which generates instability. This phase shift is not troublesome at low frequencies but may make the system unstable at higher frequencies. The "integral stop frequency" should therefore be correctly adjusted (0.2 - 0.3 times the bandwidth f_0).

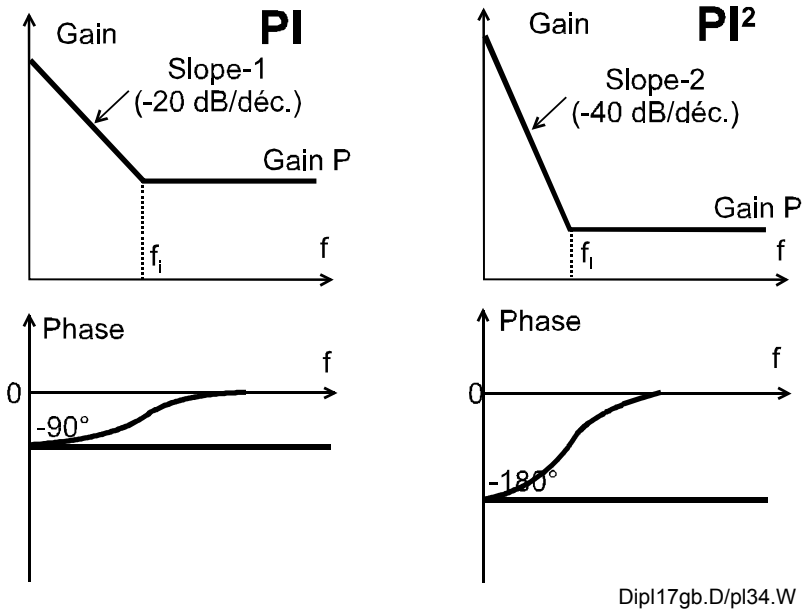
PI^2 Selection (proportional and double integration action)

By comparison with P alone, PI^2 brings about the following two changes :

- Rigidity at rest is infinite. Upon a motor torque jog and after a transient period, the motor shaft returns to its rest position (there is no permanent position discrepancy).
- The double integral action entails a - 180° phase shift at low frequencies. Poor integral stop frequency setting may make the system unstable. It should be limited to 0.1 - 0.2 times the bandwidth f_0.

4.2.2.3 Integration Stop

See the previous paragraph for the role of this parameter. The definition from Bode curves only is given below (gain / frequency and phase / frequency)



Dipl17gb.D/pl34.W

4.2.2.4 Speed Scaling

The choice of motor-drive unit fixes a 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 changing it does not alter the gain.

The "speed for 1 Volt" parameter fixes the speed "gradient" (e.g. the maximum speed can be obtained for 10V, 9V or 7V depending on the positioning control).

4.2.2.5 Filtering Frequency

Resonance
Many system have one or more resonance frequencies related usually to mechanical phenomena: inertia or masses, related to the stiffness of the mechanical components (belts, screws, gears, frames, etc.).

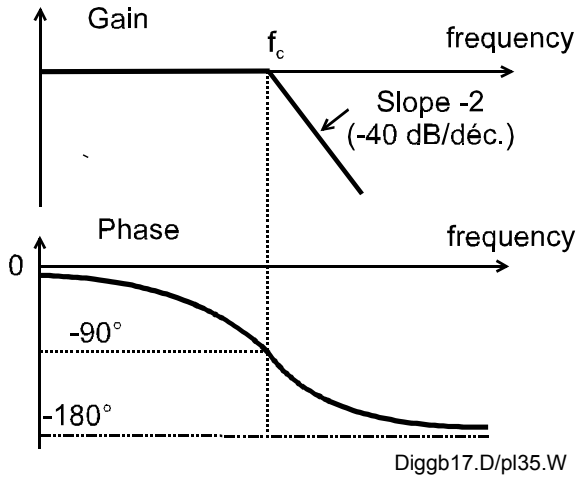
In reduced frequency areas around the resonance frequency there are :

- large variations in loop gain
- large variations in phase in closed loop mode

This leads to instability or "squealing", more-or-less violent oscillations.

Second Order Filter

This phenomenon cannot be treated by adjusting P/PI/PI^2. If the resonance cannot be dealt with mechanically, the frequencies concerned must be eliminated. This is the job of the 2nd order low pass filter.



Diggb17.D/pl35.W

Resonance frequencies are usually higher than 50 or 60 Hz (whereas oscillations from incorrect PI or PI^2 settings are generally lower than 50 Hz).

4.2.2.6 Predictors

Purpose of Predictors
Four physical phenomena :

- vertical mass
- dry friction
- friction proportional to speed
- acceleration

are direct and calculable cause of changes in motor torque.

Predictors are intended, by calculation, to act directly on the current reference without going through the speed loop and without waiting for the speed error caused by these phenomena (see block diagram).

The principle for adjusting and working on the predictors is to minimise the part of the current reference from the P, PI, PI² branch and therefore to reduce the speed error.

As these predictors are outside the speed loop (which must be set first) they do not affect stability. They considerably improve response time.

The acceleration predictor improves stability and can be used to increase the gain of any position loop superimposed on the speed loop.

However, it should be noted that a number of speed servo controls do not require the use of these predictors.

General characteristics of each predictor

- **Mass or gravity compensation (vertical axis)**

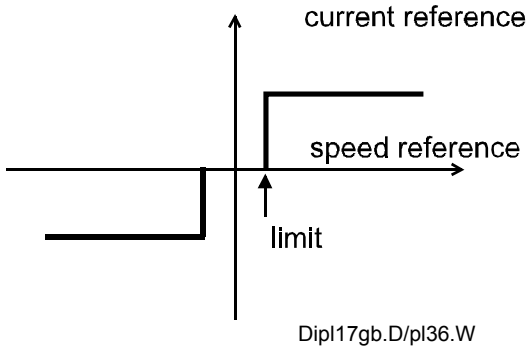
The current value in Amps required by the motor to move the mass at constant speed (mean between rise and fall) is introduced directly in the parameter.

- **Dry or "static" friction**

The friction force is fixed whatever the speed. The direction is opposed to movement, the sign depends therefore on the speed reference sign.

In this case too the value of the current in amps required for the motor to overcome friction is entered directly.

The limit expressed in revolutions per minute defines the speed range in which compensation is zero.



The limit is in the order of 1/1000th of maximum speed. This zone is used to reduce torque oscillation during rapid and repeated changes of the speed sign. This is particularly the case at rest when there is a position loop.

- **Dynamic" Friction Compensation**

This is friction proportional to speed encountered on certain mechanical items using fluids.

Value to enter : coefficient in amps (rpm)

- **Acceleration Prediction**

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

The change in the reference speed is monitored to send a reference proportional to inertia (fixed) and acceleration to the current control. This illustrates a limitation of the system; there is no point in having a speed reference that changes more than maximum possible motor acceleration given by dw/dt = peak torque /ΣJ. Acceleration prediction is only worthwhile if the reference speed features a ramp.

The parameter used is tpr, prediction time in milliseconds; tpr ranges from :

⇒ 0 ms (no prediction)

⇒ t = td, starting time from 0 to maximum speed, with full drive current. There is then 100% correction.

4.2.3 Entering Parameters / personnalization board/change

Customisation parameters for the motor-drive unit are introduced at start up using a PC under Windows via the DIGIVEX PC software (see brochure PVD 3483 DIGIVEX P.C SOFTWARE).

They may be read and in part altered via the display/parameter setting terminal. (see DIGIVEX PC SOFTWARE instructions PVD 3483 F).

The characterization is safeguarded in an EEPROM store mounted on a plug-in sub-print. This store can therefore be transferred from one drive to another of the same calibre.

Transfer of data from this EEPROM to a servoamplifier of different rating generates a fault. The parameters stored in the EEPROM are retained.

Access to parameters may be restricted by an access code also stored in the EEPROM store (see DIGIVEX PC SOFTWARE instructions PVD 3483 F).

Customization unit reference : SZ6608B

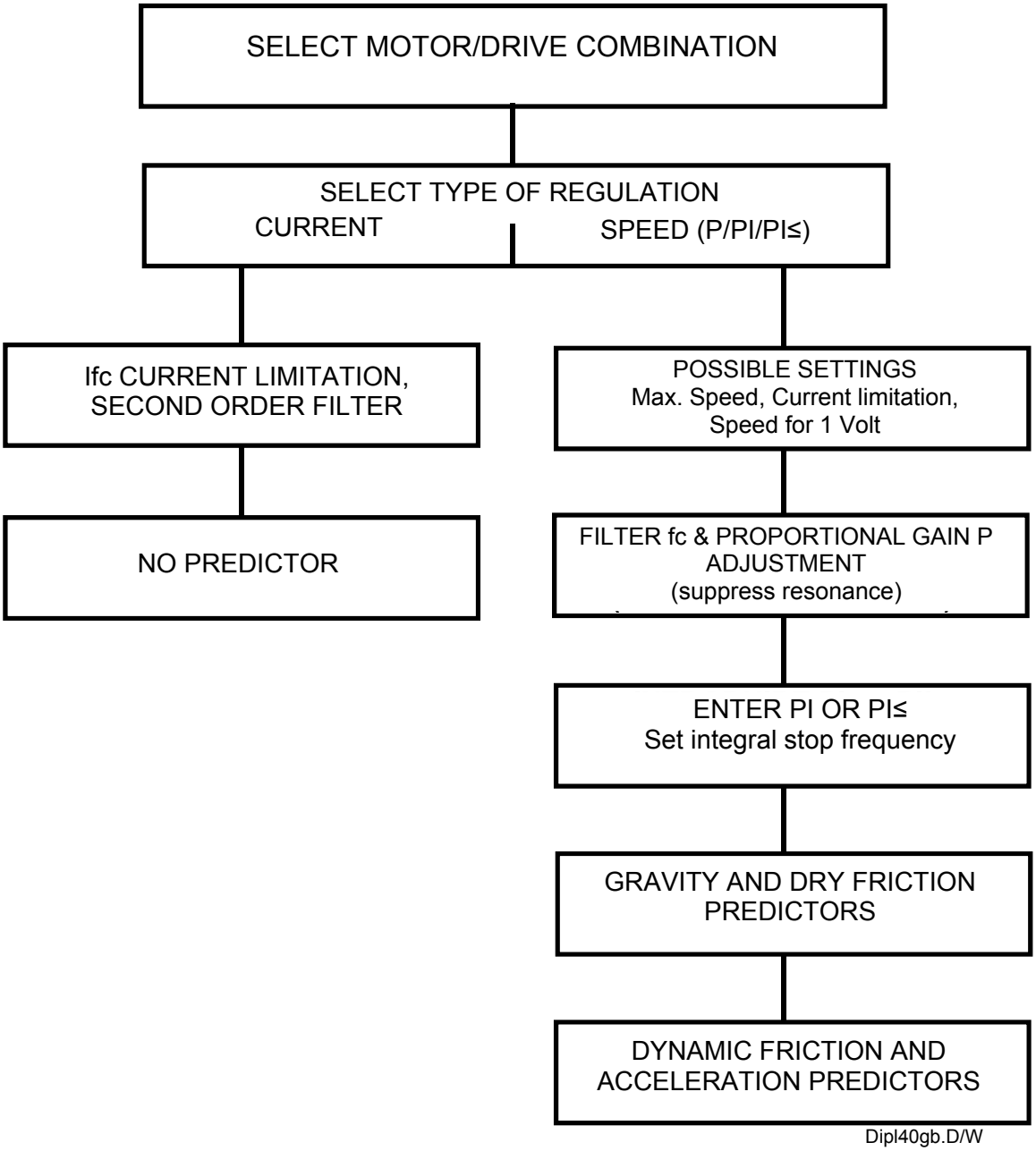
- With a short circuit on J_O for spindle motors
- With an open circuit on J_O for axis motors

Label :

- Motor name
- Speed reference value
- Adjustment number.

4.2.4 Servocontrol Parameter Setting

4.2.4.1 Overview of Settings



4.2.4.2 Parameters setting Tools

- **Without PC software or terminal**

There is no access to setting changes. It is possible only to display the two variables assigned to the two analogue outputs on a standard oscilloscope. These are usually :

- ♦ Output 1 : speed measurement,
- ♦ Output 2 : current set point.

- **With the terminal, without PC software**

If the system allows complete access (level 2), the terminal provides access to the servo-control parameters (regulation type, gain, etc.). Two types of display are available :

- ♦ either by direct read-out on the LCD display of :
  - input set point
  - current set point
  - bus voltage
  - temperature
  - speed measurement
- ♦ or by assigning two of the 5 internal variables :
  - input set point in rpm
  - speed reading in rpm
  - current set point in A
  - bus voltage in V
  - position in degrees

to the two analog outputs and using an external oscilloscope.

If at level 1, it is possible only to modify the gain already in place (ratio 0.7 to 1.4), speed for a set point of 10V (±10% unless already at maximum speed) and offset (±1%).

- **With the DIGIVEX PC Software**

Three tools can be accessed :

- ♦ Generation of speed set point (fixed, scale, sine) of which the amplitude, frequency, and mean value are adjustable.
- ♦ Oscilloscope function, for displaying and recording the response curves of any two of the internal variables available.
- ♦ Adjustment procedure, using the above two functions, ("parameters" window open) and using a wave to make the adjustment (except for predictors) from the single scale response.

Accessible internal variables (using DIGIVEX PC software or the terminal).

The choice of internal variables is as follows :

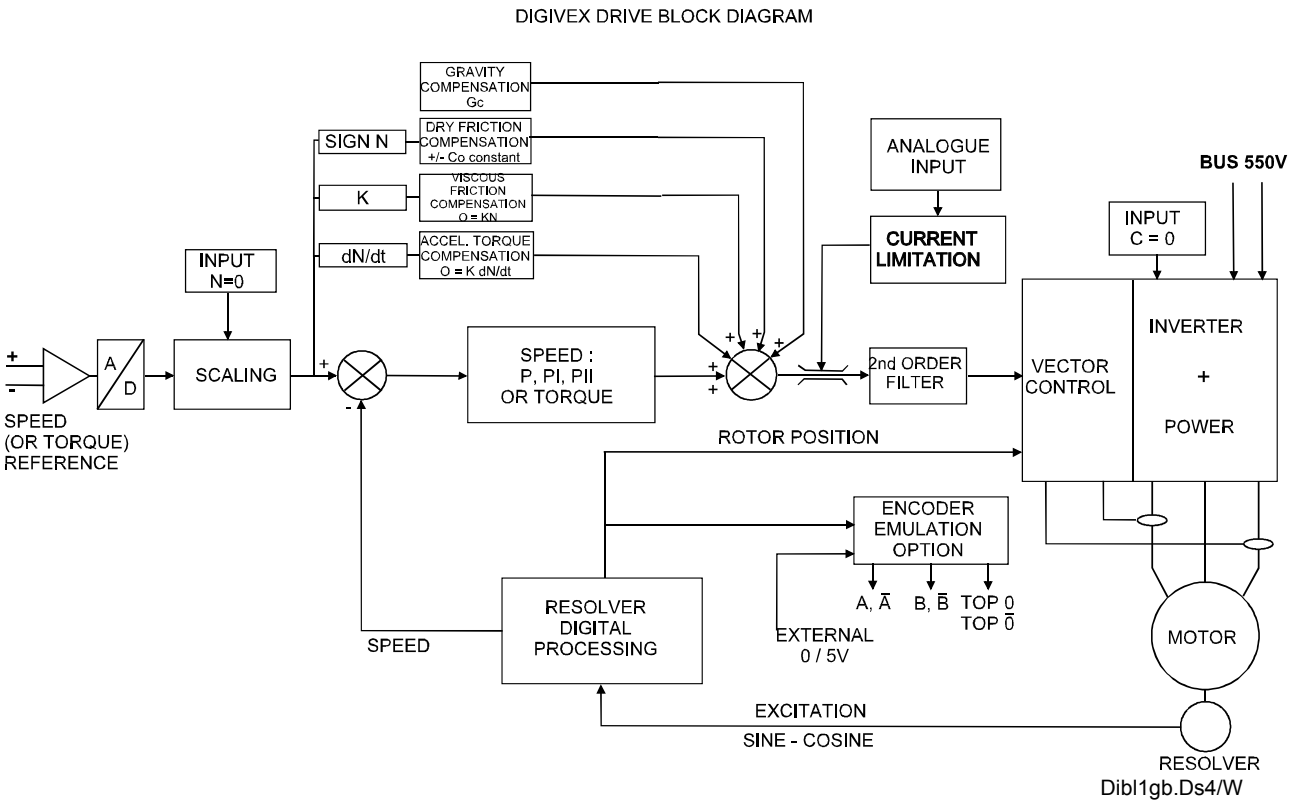


Figure reference

- ♦ 1 Input set point in rpm
- ♦ 2 Speed reading in rpm
- ♦ 3 P, PI, PI≤ output in amps
- ♦ 4 Sum in amps
- ♦ 5 Current set point in amps
- ♦ 6 Acceleration in ms
- ♦ 7 Dynamic friction in amps
- ♦ 8 Static friction in amps
- ♦ 9 Position in degrees
- ♦ Iu Phase U current in amps
- ♦ Iw Phase W current in amps

The two variables can be selected :

- either in interactive mode by positioning the two probe tips on the diagram (for the eleven variables above only)
- or from the list in the TOOLS - OSCILLOSCOPE table. Access via the variable name. This is valid for all twenty variables, the eleven above plus the following :

- Low frequency generator (stimuli)
- Temperature in degrees C
- Bus voltage in volts
- Id set point in amps
- Iq set point in amps
- Id measurement in amps
- Iq measurement in amps
- Voltage Ud in Volts
- Voltage Uq in Volts
- Auxiliary input in Volts

Notice that these twenty variables can be assigned to the two analogue outputs, that allows eventually to use an external oscilloscope.

4.2.4.3 Parameter Access Condition

Access levels

- Level 1 is permanently accessible and can be used to modify :
  - proportional gain within bounds (0.7 - 1,4)
  - speed for 1 V reference (±10%) and maximum speed (unless already at max. speed).
  - offset.

It can also be used for reading all parameters.

- Level 2 is accessible by entering a password and is used for altering all the parameters as required for the application.

This level can be used on line or off line with the PC software or the terminal.

The access code is stored in EEPROM, as a parameter.

Off Line Mode

If working at level 2 and with the PC software, off line mode can be used for preparing complete parameter files: motor selection, servocontrol parameters, inputs and outputs, etc. This is data processing work on files (File, Open, Save as …).

On Line Mode (with level 2 access)

In this mode the RS 232 link connects the PC with its software and the DIGIVEX DRIVE (see DIGIVEX PC software instructions).

When going on line all the parameters in the drive are copied to the PC. Any parameter altered by the PC will be copied back to the drive.

On line mode has the following features :

- resolver parameters cannot be modified
- loop parameters can only be modified by the + or - keys, as numerical values cannot be keyed in directly
- if a complete parameter file is to be sent via the serial link (first time loading, copying from one drive to another) :
- the torque set to 0 (T = 0) by software during the transfer. After transfet the torque must be reset to 1 by forcing the input T = 0. (see DIGIVEX PC software instructions PVD 3483 F).
- the drive checks compatibility with the drive calibre. It may reject the file if incompatible.

4.2.4.4 Motor Selection and Parameter Entry via DIGIVEX PC Software

See DIGIVEX PC software instructions PVD 3483 F

- Calibre selection
- Motor selection (standard or special)
- Resolver selection
- Entering servocontrol parameters (global transfer)
- Assigning inputs/outputs and variables
- Using the oscilloscope function
- Two parameters set : "Extended parameter set" option

4.2.4.5 Loop Parameter Adjustment Speed Regulation Mode

Speed for 1 V and maximum speed

Maximum possible speed is fixed by the choice of motor/drive combination. It can be reduced only.

To check the result :

- select a "continuous" set point of say 1 V
- Use "Drive Status" (COMMANDS menu) to check the value obtained for the "speed measurement in rpm" variable.

Proportional Gain Setting

Initial status :

- Change to proportional gain P only
- Filtering frequency fc to maximum (800 Hz) and low gain
- System able to run, no predictor.

The P gain and filter frequency adjustments are simultaneous. If, when increasing P gain, the system starts to resonate, this can be suppressed by reducing the filter frequency and then increasing P, etc. until a compromise is reached.

Maximum advised value for P

There is a maximum recommended proportional gain depending on drive gain and corresponding to maximum current ripple.

CALIBRE	P in mA / rpm
2 / 4	35
4 / 8	75
8 /16	150
16 / 32	300
32 / 64	600

NB: this value may be exceeded under certain conditions. Please ask for details.

Generate a speed set point step (for instance, 5% of maximum speed)

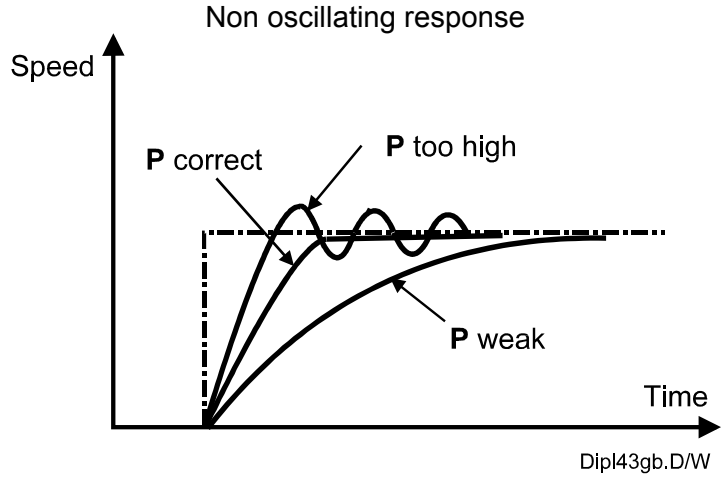
Display the oscilloscope function

- Channel 1 ⇒ input reference.
- Channel 2 ⇒ speed reading.
- Trigger on the set point (channel 1), rising flank, 1 to 2% of maximum speed.

Increase gain P

Excite the stimulus in on line mode. The response at one speed reference scale is obtained.

Three cases may arise :



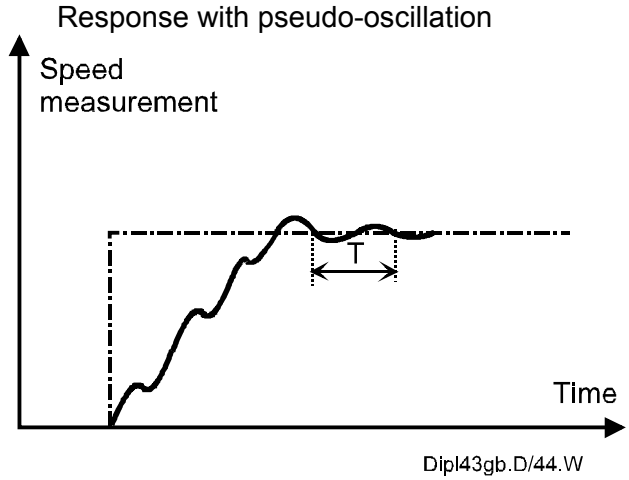
A response must be achieved without overshoot and oscillation. For example, increase gain until oscillations appear progressively; then reduce it again by 20 - 30%.

If the maximum value shown in the table is reached with P gain without having reduced filter frequency, then :

- stop increasing P,
- reduce the filter frequency to the oscillation limit.

Filter frequency adjustment

Oscillations may arise on the response achieved above (even during the increase in speed).



Resonance occurs here (probably of mechanical origin) of frequency fr = 1/T, more than 100 Hz.

Reduce the filtering frequency until the oscillation almost vanishes. If impossible maximum gain is attained

If possible gain may be increased again until a response with no oscillation is obtained.

Oscillation may appear again, if so reduce the filtering frequency slightly.

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

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

PI/PI^2 - Integral Stop Frequency Setting

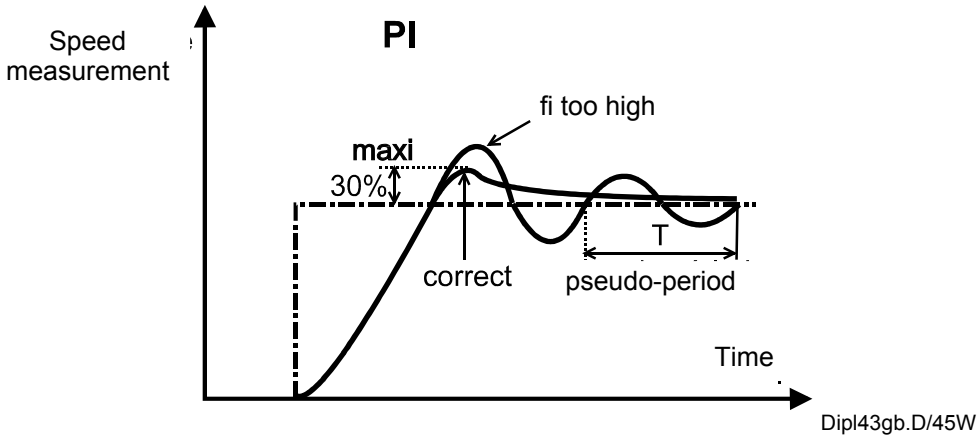
Initial status :

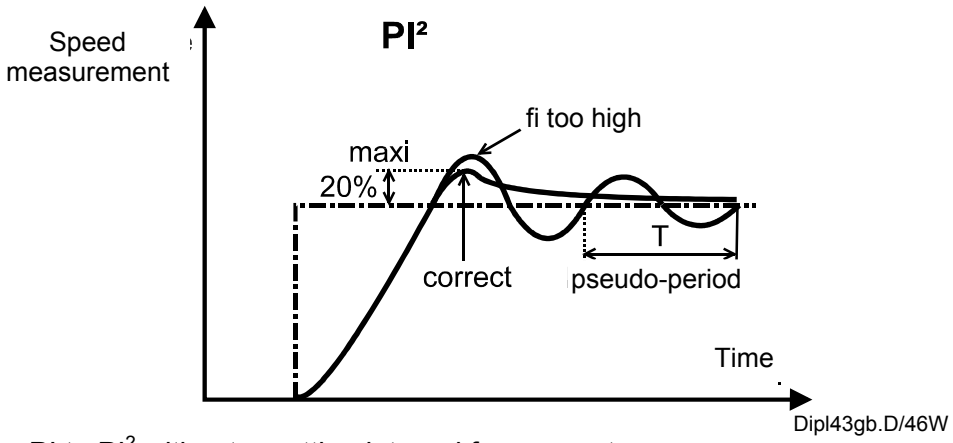
- P gain alone. P setting and filtering frequency completed.
- Integration stop frequency = 0.

- Still no integration.
- System able to run.
  - ♦ Select PI or PI≤.
  - ♦ Use the same stimulus as before (set point step).
  - ♦ On line, increase the integration stop frequency until overshoot of about :
    - 25 - 30% in PI
    - 15 - 20% in PI≤

With no ripple.

If the frequency is too high ripples appear at fairly low frequency (< 50 Hz). Frequency must then be reduced (never readjust gain P).





Do not change PI to PI^2 without resetting integral frequency to zero.

4.2.4.6 Predictor Adjustment

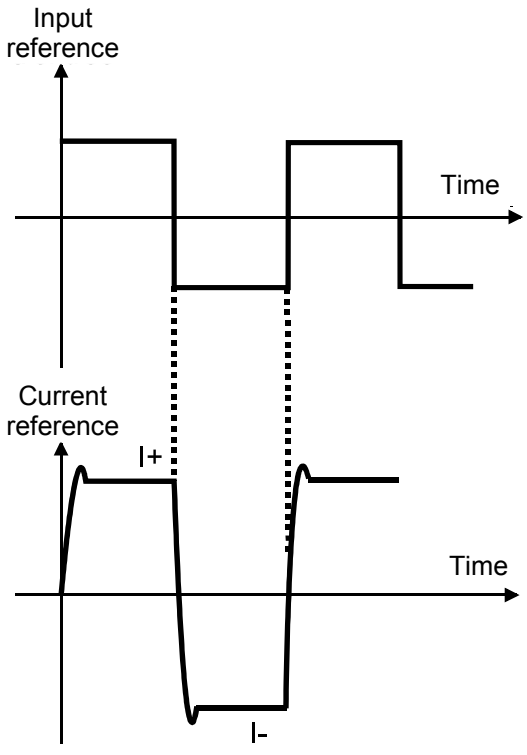
Initial Conditions

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

Adjusting Gravity and Static Friction Predictors

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

- Take a square stimulus, offset = 0, peak-to-peak value = 3 - 5% max. speed in rpm, frequency 0.2 - 1 Hz.
- Display with the oscilloscope function :
  - input reference
  - current reference

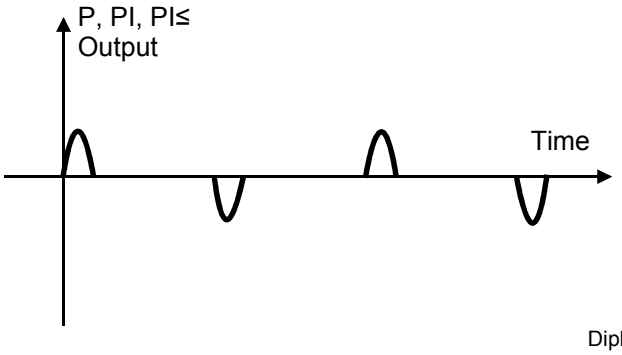


Diggb43.D/47W

Nota : I+ and I- must be taken with their sign, generally I- is negative.

In principle :

- Gravity = $\frac{I_+ + I_-}{2}$ in amps (horizontal movement, gravity = 0).
- Static friction = $\frac{I_+ - I_-}{2}$ in amps.
- Enter these values in the parameters.
- Enter the threshold value (e.g. threshold = max. speed / 1000).
- After entering the values, the same stimulus can be used for checking the result obtained.
- Display the input reference on one channel and the P, PI, PI^2 output on the other channel. The result should be similar to that shown below:

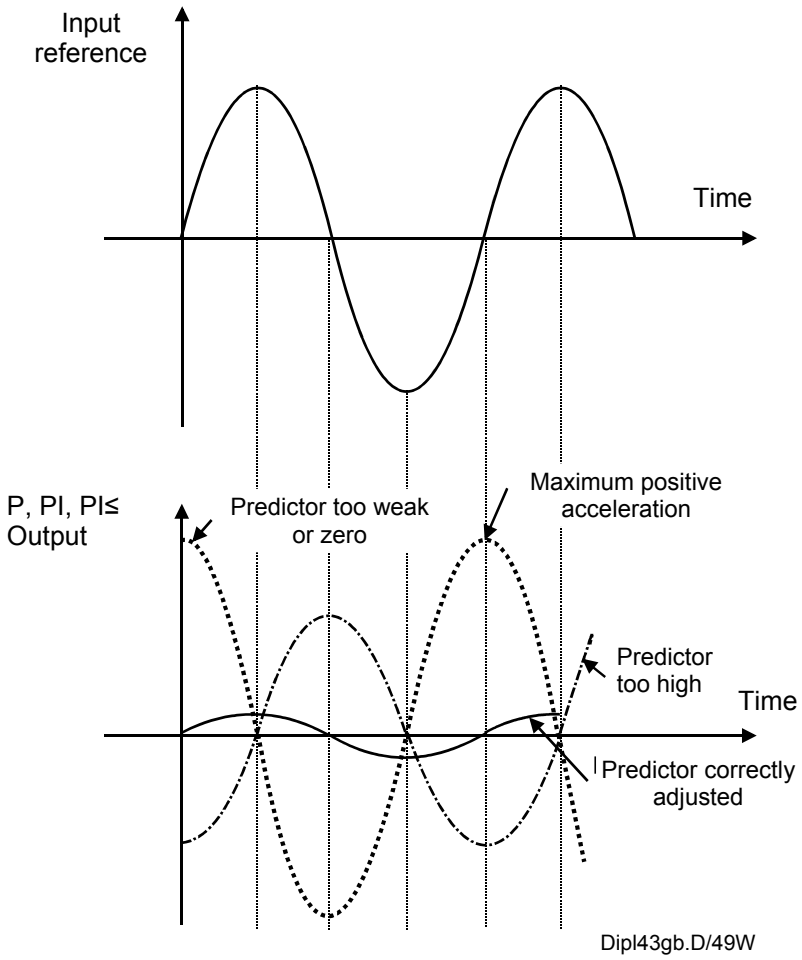


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Dynamic Friction and Acceleration Predictor Adjustment (Assuming the dry friction and gravity parameters are set)

- Use a sine stimulus, offset 0, peak-to-peak value 10 - 20% of max. speed, frequency 0.2 - 1 Hz.
- With the oscilloscope function display :
  - ♦ the input reference on one channel
  - ♦ the P, PI, PI² output on the other channel.

- Acceleration predictor adjustment. Increase the predictor to minimise P, PI, PI² output. Too high a value increase P, PI, PI≤ with a phase shift.



Very marked difference between optimum setting and no predictor.

Correct setting gives minimum amplitude to P, PI, PI² output. The predictor should reduce P, PI, PI² output by a ratio of at least 5 to 10.

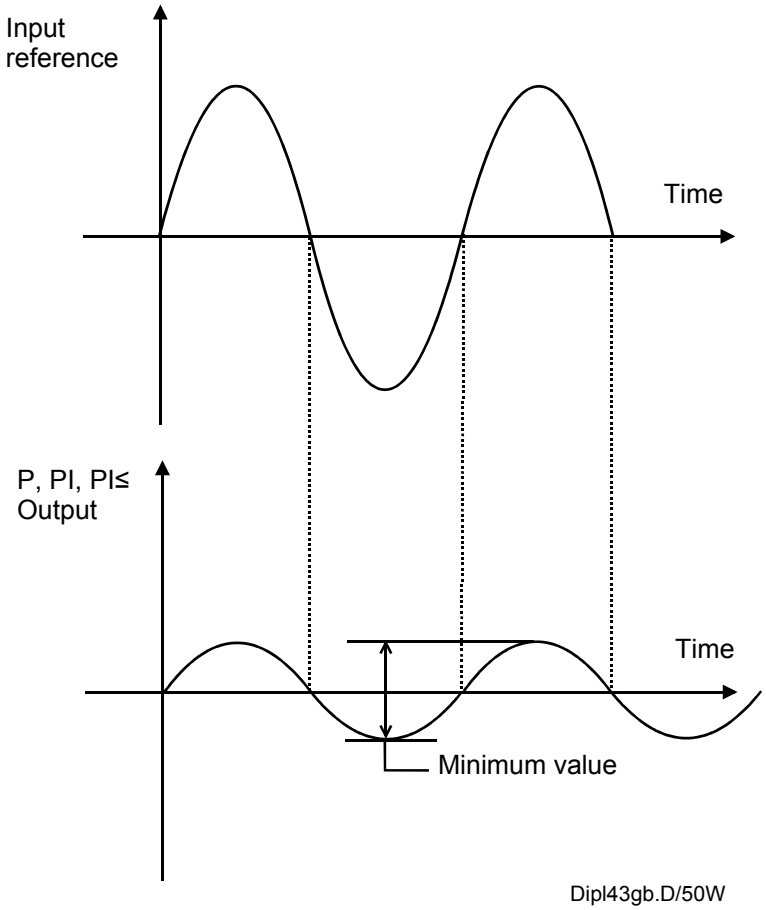
Remember that the value (in ms) of tpr (prediction time) is close to td (start up time) with :

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

td is acceleration time from 0 to max. speed with maximum torque
td in seconds, inertia in kgm^2, wmax. in rd/s, torque in Nm

- Dynamic friction predictor adjustment. After setting all the other predictors increase the dynamic predictor to minimise the P, PI, PI^2 output signal.

When correctly set the minimum output should be obtained and in phase with the input reference.



4.2.4.7 Parameter Adjustment in Current Regulation Mode

If the "current" option is selected, the following items only are to be adjusted :

- current limitation. Take care with this type of application not to trigger upon monitoring of mean current and rms current. Often current limitation = permanent current.
- Second order filter frequency. This can only be done with the "upper" regulation loop providing the current reference.

4.2.4.8 Other Parameters

Logic and Analogue Inputs/Outputs

Access either via the menus (COMMANDS + INPUT ASSIGNMENT) or (COMMAND + OUTPUTS ASSIGNMENT) or in interactive mode by clicking on the I/O at the left of the block diagram. This makes it possible to :

- Assign one of the twenty internal variables to each of the two analogue outputs one of the internal variables.
- Force the logic inputs to 0 or 1 (HIGH or LOW).

The logic inputs/outputs are assigned on a permanent basis.

Encoder Emulation Option

- Choice of number of marks from 1 to 16,384 per revolution (off line.
- Validation of zero signal in teach mode (on line).

Miscellaneous Choices

- Choice of processing strategy for monitoring in mean and rms currents: current reduction or power cut-out (see § 3 and DIGIVEX PC software instructions).
- Choice of brake use strategy : current reduction or not when brake is applied (see DIGIVEX PC software instructions).
- Choice of motor thermal protection strategy (with or without thermal protection).

5. STARTING UP - DETECTING CAUSES OF STOPPAGE

5.1 Start Up Sequence

5.1.1 Prior Checks

Wiring Check

- Power and auxiliary connections to DIGIVEX POWER SUPPLY. See wiring diagram (see § 3.2, 3.3).
- Connection of any external energy recovery resistor and presence or absence of strap on terminal block B3 (see § 4.1).
- Wiring of Reset and Emergency Stop to DIGIVEX POWER SUPPLY (see § 3.3).
- External arrival of 24 V source for motor brake on DIGIVEX POWER SUPPLY terminal block X1.
- Check resolver connections (see § 3.3.3.4) :
  - ♦ at motor end
  - ♦ at DIGIVEX DRIVE end.
- Check the power, brake and thermal sensor connections (see § 3.4.3.3) :
  - ♦ at motor end
  - ♦ at DIGIVEX DRIVE end.

Power Supply Type Check

- Power : 50/60 Hz, three-phase 400 V ± 10%.
- Auxiliaries : single-phase, 50/60 Hz, 400 V ± 10%.
- Brake supply : 24 V dc ± 10% (ripple included).

Check the position of the DIGIVEX POWER SUPPLY straps (ST1 / ST2 / ST3, see § 4.1.1).

Warning: Before any work make sure that the power bus is at 0 V. Wait at least three minutes after the motors have come to a complete stop before carrying out any work. **The power and auxiliary buses must be at zero Volts when removing the drives from the rack, all the LEDs are switched off.**

5.1.2 First Time Starting with DIGIVEX PC Software or the terminal

This is done drive by drive. First remove (or disconnect) drives that have not yet been set.

- So as not to supply power, remove terminal block X2 from the DIGIVEX POWER SUPPLY module. This prevents the main switch from closing.
- Connect the PC via the RS 232 serial link.
- Supply the (low level) auxiliary part only. This can only be done by drawing the 400 V single phase auxiliary supply from ahead of the main switch. The « Power Off » led of the DIGIVEX POWER SUPPLY lights up.
- Check that the rack fans work (airflow).
- Use the PC (Connection menu) to come on line, If the system does not come on line :
  - ♦ Check the serial link configuration is compatible.
  - ♦ Check the cable.

When the system is on line all the parameters in the DIGIVEX DRIVE can be read.

- The DRIVE FAULT LED is on (no power). Use the PC (or the terminal) to check if there is no fault (COMMANDS + FAULTS menu). See possible diagnostics.
- If access to modification is prohibited (level 1), read the parameters in the drive and check they comply with the problem: motor type, maximum speed, etc.
- If access to modification is allowed (level 2) the configure the drive. This may be done off line in a file which is then transferred or modified ON LINE.
  - ♦ Motor selection.
  - ♦ Speed or torque loop parameters selection (note that without power, it is not possible to check if these parameters are correct).
  - ♦ Auxiliary selections: validate brakes, analogue outputs, safety strategies, etc.
- Cut off the auxiliary supply. Replace the DIGIVEX POWER SUPPLY terminal block X2 (OK and READY relays).

Restore the low-level supply. Use the software to force the drive to zero torque.

- Power up. Normally the POWER ON LED of the DIGIVEX POWER SUPPLY lights. If there is a drive fault the DRIVE FAULT light comes on. Read the diagnostic and correct the fault.

If all is in order, check the brake (if fitted) works properly.

- Remove the "zero torque" lock with the software or by the hardware contact (set "T=0" input to 24V), open any brake.
- Adjust the system using the stimuli (PC software or terminal)
  - ♦ "Direct current" stimuli (square with peak-to-peak = 0). Check Nmax.
  - ♦ "Square" stimuli or adjustment procedure to set the servo-control parameters.
  - ♦ DIGIVEX PC software to set the predictors, if necessary.

For all these manipulations, make sure that the driven mechanism can run freely.

5.1.3 Start up or Modification with the Display / Parameter Setting Terminal / Parameters transfer

The general process is the same as above.

The display / parameter setting terminal is for systems that have already been programmed :

- either by PC software
- or by transfer of parameters from one drive to another using the PC software or the terminal
- or by physically transferring the EEPROM containing the customised application. See § 4.2.3.

5.2 Detecting causes of stoppage

5.2.1 DIGIVEX Power Supply

The following LEDs are located on the front panel :

LED	COLOUR	PURPOSE
POWER ON	Green	Main and auxiliary power present, no supply or drive faults
POWER OFF	Red	No power or supply fault
RECOVERY	Red	- Either lights temporarily for normal use of regeneration resistor - Or if permanently on, regeneration fault . No resistor or short circuit . Internal resistor thermal sensor tripped
DRIVE FAULT	Red	- Fault with drive
DC OVERVOLT.	Red	Excess bus voltage (>750 V)
AC OVERVOLT.	Red	Mains overvoltage (Urms > 470 V)
PHASE	Red	Mains phase absent
OVER TEMP	Red	Dissipater temperature > 85°C

5.2.2 DIGIVEX Drive

5.2.2.1 Display

Problems that arise may be displayed in three ways :

- On the front panel of the DIGIVEX POWER SUPPLY module, a DRIVE FAULT LED indicates problems with any of the drives.

- On the front panel of each DIGIVEX DRIVE module, two RUN and FAULT LEDs indicate the overall status of the drive.
  - « RUN » is green, everything is in order.
  - « RUN » off and « FAULT » on, no CPU activity (incorrect).
  - « FAULT » flashes, decreased drive performance without cutting the rack out.
  - « FAULT » is permanently on, major fault opening the power supply OK relay and therefore the main switch.
  - « RUN » and FAULT off, low-level supply to drive failure

- To identify the exact nature of the problem or the drive status, requires :
  - either the DIGIVEX PC software, which specifies the problem and hints for correction in plain language
  - or the display/parameter terminal which displays in plain language a code for each problem encountered.

5.2.2.2 Drive Fault Processing

Four cases may arise :

Fault

These faults entail :

- DIGIVEX Drive FAULT LED comes on.
- power supply DRIVE FAULT LED lights and consequently the main switch opens and the power is switched off.
- The fault origin code is stored in the drive.

Systematic reduction in performances (with no choice of strategy)

This is the case with dissipater temperature monitoring. In this case :

- Internal alteration of maximum permissible mean current, the FAULT LED flashes. Storage of the condition in the drive.
- No action on the DIGIVEX Power Supply module.

Choice of strategy

For current monitoring, when customising the drive, there is a choice between :

- Strategy 1: Fault.
- Strategy 2: Performance reduction without storage in drive as a fault condition.

Central Processing Unit Fault

This fault causes the green RUN LED to go out (and the red FAULT LED to light).

5.2.2.3 Current Monitoring

Drive mean current

To prevent excessive overheating of the drive the mean current [I = f(t)] is compared after about two seconds filtering with the permanent permissible current (rating).
There is then a choice between two strategies:

- Strategy 1: Fault with opening of the power supply OK relay and the main switch
- Strategy 2: Reduction of the permanent drive current to 90% of the permanent permissible current. The FAULT LED flashes.

Motor rms current

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

The rms current is compared with the permanent permissible current under slow rotation by the motor $\hat{I}_0$ (after first order filtering with 20 sec time constant). This data is characteristic of the motor and is known to the drive when the motor-drive selection is made.
As before, there is a choice of two strategies :

- Strategy 1: fault
- Strategy 2: reduction of drive pulse current to 0.9 $\hat{I}_0$ motor. The FAULT LED flashes.

Drive output current

Two features are monitored :

- Protection against short circuits: Current derivative monitoring.
- Excessive output current (max. I): checks whether the measured current exceeds the drive pulse current by 30%.

In both cases the fault is tripped.

Drive input current

Fuse protection in the event of an internal short circuit. Blowing the fuse (bus voltage present, zero voltage in drive) produces a fault.

5.2.2.4 Temperature Monitoring

DIGIVEX Drive dissipator temperature

- If the dissipater temperature is less than 60°C nothing happens.
- From 60° to 85°C the pulse current that the drive can deliver is reduced (the FAULT LED flashes slowly).
- At 95°C fault tripped.

Servomotor winding temperature

Each HX, HS and HD motor has a thermal sensor. When customizing the drive, this sensor must be taken into consideration. In this case, excessive motor temperature causes a fault condition.

Ambient temperature

Measured between electronic boards. It stops operation at more than 60°C.

5.2.2.5 Miscellaneous Monitoring

No resolver
Resolver fault or wiring fault.

Overspeed

Speed > 1.15 times the maximum motor/drive speed setting.

These two cases produce a fault with :

- red FAULT LED lights.

Zero bus voltage

This situation may be produced by simply switching off the power (with no fault) or by a power supply fault.

If the loss of power is not caused by a drive fault :

- the RUN LED remains on;
- the FAULT LED remains off.

5.2.2.6 Fault and Diagnostic Summary Chart

☼ : LED on, **E**=LED off, **RF**=rapid flashing, **SF**=slow flashing

RUN LED (Green)	FAULT LED (Red)	PC SOFTWARE FAULT-FINDING	PROGRAMMING CONSOLE FAULT-FINDING	COMMENTS
☼	☼	Max. drive current reached	Overcurrent	
☼	☼	dI/dT fault	Short circuit	Output or earth short circuit
☼	☼	Excessive mean current	I average fault	Too much current asked of drive
☼	☼	Excessive rms current	I RMS fault	Too much current asked of drive. Cycle too demanding.
☼	☼	Excessive motor temperature	Motor overtemp.	Cycle too demanding or no motor fan cooling
☼	☼	Excessive dissipater temperature	Fin overtemp.	
☼	☼	Excessive ambient temperature	Ambient overtemp.	Fan cooling stopped or excessive cabinet temperature
☼	☼	Resolver fault	Resolver fault	Problem with resolver or wiring
☼	☼	Excessive speed	Overspeed	Speed reference > 10 V or speed parameter setting error
E	☼	CPU fault	CPU fault	
☼	☼	Bus overvoltage	Bus overvoltage	Regenerative braking impossible. Disconnected from mains supply.
☼	☼	Customization card fault	EEPROM fault	Customization card incompatible with drive rating or drive type
☼	☼	Drive-spindle definition	SPINDLE BIT DEF.	Control type (drive-spindle) incompatible with customization cardSZ6608B
☼	☼	Motor not connected	MOTOR Disconnect	Motor wrongly connected
E	E	Liaison impossible		No power supply

RUN LED (Green)	FAULT LED (Red)	PC SOFTWARE FAULT-FINDING	PROGRAMMING CONSOLE FAULT-FINDING	COMMENTS
☼	**RF**	Excessive mean current OR		Current reduction. I mean > drive rating
☼	**RF**	Excessive rms Current		Current reduction. Drive RMS current > Îo motor
☼	**SF**	Excessive dissipater temperature		Max. current reduced depending on temperature

5.2.2.7 Corrective actions

During a start up, the main possible incidents (due to a wrong wiring or to wrong manipulations) are as follows :

- Resolver fault
  - ♦ Check the resolver connection.
- Overcurrent
  - ♦ Wrong motor connection (incorrect pases U - V - W).
  - ♦ The motor introduced by software is not in accordance with the motor really connected.
- Overspeed
  - ♦ Wrong maximum speed adjustment.
  - ♦ Software validation of torque loop instead of speed loop.
- Motor is not running and remains without torque
  - ♦ The system is at zero torque (« Hard » or « Soft » input T = 0). The torque has been assigned at 0 during a global transfer. Activate the torque (see DIGIVEX PC SOFTWARE instructions or terminal instructions).
  - ♦ The motor is not connected.
- Motor is not running but torque is available
  - ♦ The system is at zero speed, the DIGIVEX Power Supply emergency stop (EMERGENCY) has no 24V supply.
  - ♦ The CW and CCW inputs are at zero (Hard or Soft) Check with software or terminal.

5.2.2.8 7-segment display (SS 6611 mounted)

Function: to provide information on DIGIVEX status discriminating between faults. Format: placed in the upper part of the DIGIVEX.
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
5	Maximum supply current
6	Maximum drive current reached or di/dt fault
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
A	Drive/spindle definition fault
F	Drive rating incompatible with CUSTOMIZATION
C	Motor not connected
. (dot)	CPU fault
- (dash)	Unlisted fault

6. OPTIONS

6.1 Possible associations

Maximum of two options possible		Integrated encoder SC6631	7-segment display SS6611	Indexing function SH6601	Speed output card SV6601	SSI SC6637	SERCOS SP6605
Integrated encoder	SC6631		X	X			
7-segment display	SS6611	X			X		
Indexing function	SH6601	X					
Speed output card	SV6601		X				
SSI	SC6637						
SERCOS	SP6605						

Association examples: Integrated encoder + 7-segment display
OR
Integrated encoder + Indexing function

6.2 Encoder Emulation Card Option (SC 6631)

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

An optional card placed in the upper part of the DIGIVEX Drive regulation card can be used to convert the signal from the resolver into a string of pulses identical to those from an incremental encoder: A, B, 0, and their complements.

6.2.1 Resolution and Zero Signal Position Programming

This can be programmed using the DIGIVEX PC software or via the terminal.

The parameter is called up :

- either in graphic mode (click twice in the encoder emulation).
- or via the menus: Parameters + options.
- or by the terminal keyboard.

Resolution

Adjustable from 1 to 16,384 either by the +/- keys or by entering a number directly (OFF LINE only).

Precision

This is provided by the resolver and the conversion electronics.
There is no direct link between precision and resolution, the programmed resolution may be higher than sensor precision.

Zero Signal Adjustment (not possible with present software)

Adjustment by teach mode, with the PC running "on line".
When the operator judges the position is suitable he confirms it by acknowledging the zero signal.

6.2.2 Electrical Characteristics

The electrical output interface meets standard RS 422 for differential serial links. The circuit used is a Line Drive type MC 26 LS 31 D. The electrical characteristics are therefore closely related to the use of this component.

Voltage Supply

The encoder emulation cards are galvanically isolated between the output stage via three opto-couplers and need to be powered from a +5 V, ±10%, 100 mA external source, as do the incremental encoders.

In no event can this supply, used only for galvanic insulation, be used to save position information from the resolver in the event of a break in the drive low levels.

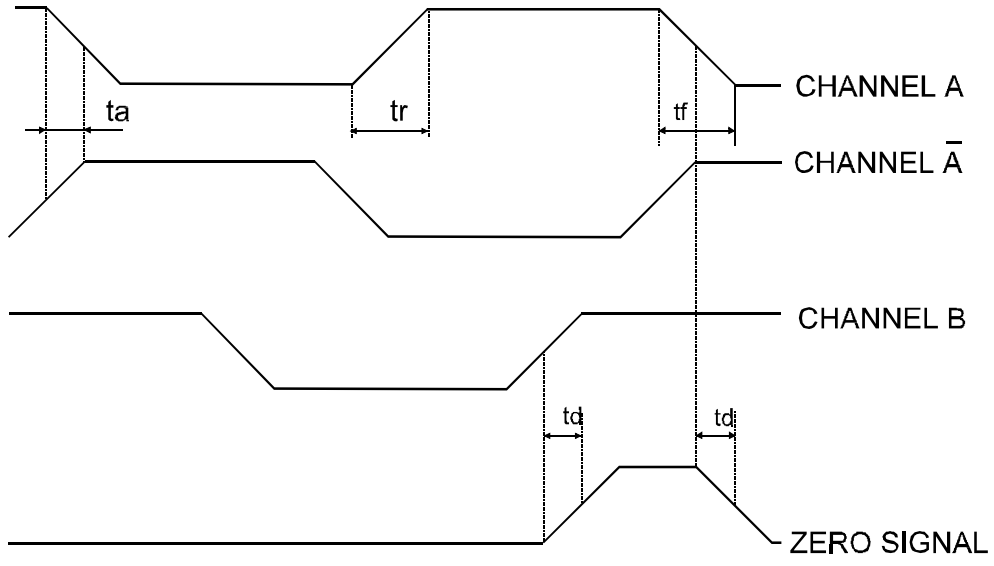
Short Circuit Whitstanding

A single output can be short circuited to 0 V at a given time.

Signal Pattern

Signal levels :

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



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Switching Time

Rise or fall time defined from 10% to 90% of the magnitude in question without cable and without load.
tr = tf = 45 ns (typical value)

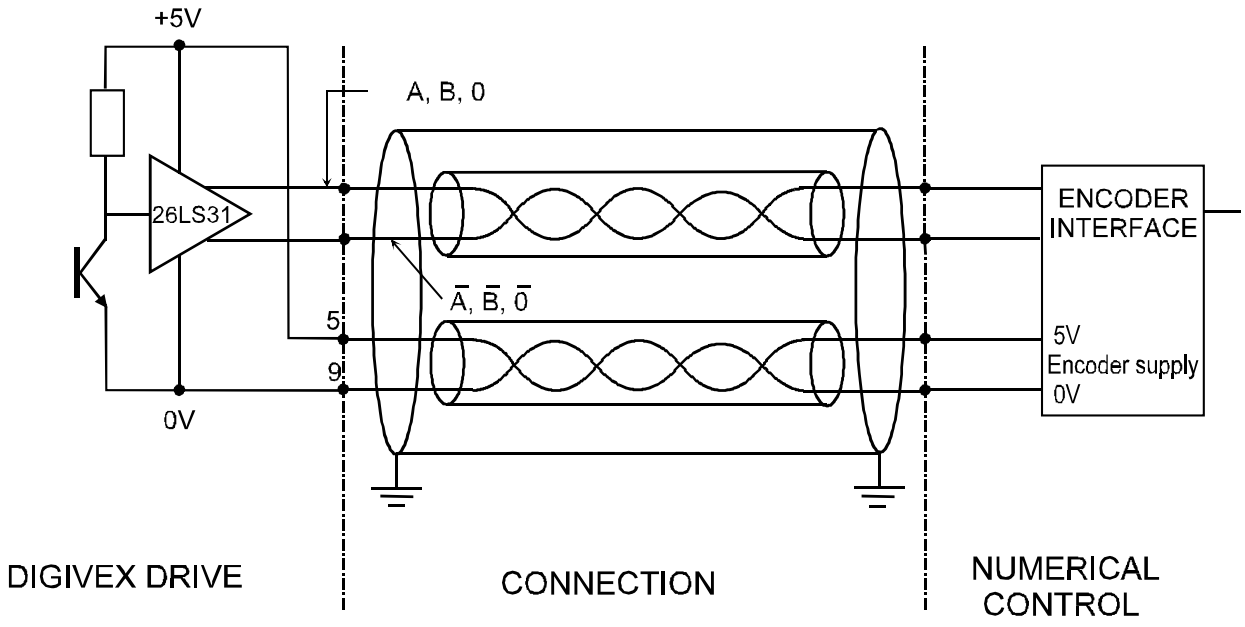
Time Lag between Direct and Complemented Channels

Time lag defined as 50% of magnitudes considered without cable and without load.
-6 ns ≤ ta ≤ 6 ns (maximum)

Time Lag between Channels A, B and Zero Signal

Time lag defined as 50% of magnitudes considered without cable and without load.

-6 ns ≤ td ≤ 6 ns (maximum)



Dipl44gb.D/52W

6.2.3 SUB-D Plug

Nine-pin "encoder" Sub-D Plug . Maximum conductor cross-section: 0.5 mm².

PIN	TYPICAL	TASK
1	.	
2	Output	$\overline{\text{Zero signal}}$
3	Output	$\overline{\text{A}}$
4	Output	$\overline{\text{B}}$
5	Input	5V
6	Output	Zero signal
7	Output	A
8	Output	B
9	Input	0V

6.2.4 Encoder Emulation Cable (ENCODER terminal block X3)

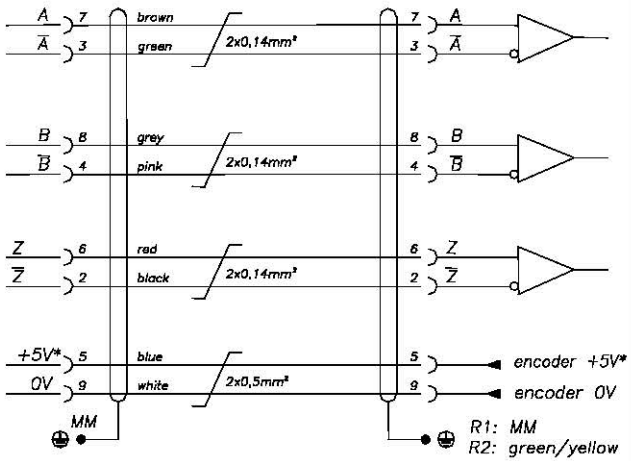
Cable composed of three 0.14 mm2 twisted pairs, one 0.5 mm2 twisted pair for 5 V supply and general shielding.

PARVEX SA recommended cable reference CB08307.

Cable may be supplied ready fitted with SUB-D plug, see drawing FELX 304554 (cable compatible with our CYBER 2000 AND CYBER 4000 NCs).

ENCODER EMULATOR CABLE

DIGIVEX



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,–,–,–,

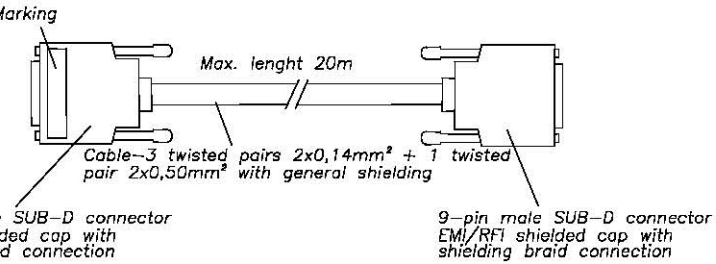
FULL CABLE CODE
LENGHT CODE

LENGHT

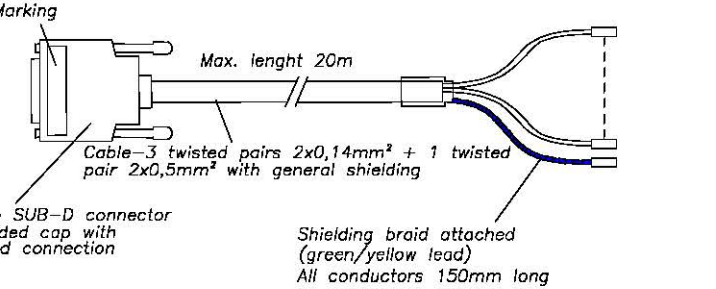
CODE	LENGHT: (m)
0 3	0 3
⋮	⋮
2 0	2 0

0 3
0 5
1 0
1 5
2 0
} STANDARD LENGHTS

CODE 1



CODE 2



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ML

Modif.							
A	12/06/97	E	AM:E00006	Est.: 29/08/95	ENCODER EMULATOR CABLE	PARVEX	DIGIVEX
B	AM:E98035			Stamping:LR			
C	AM:E98132						
D	AM:E99024						

Liste doc. | Gre doc. | A3 | English | FELX 304554GB | N° leaf 1 | Nb leaf 1
Scale: /

DIGIVEX SERVO-AMPLIFIER

Reference	Description
DPS0612	12 kW power supply
DPS0625	25 kW power supply
DPS0615	15 kW power supply with return to mains
SF_02040	Three-phase choke for 15 kW mains supply
DRA3165V23	+6U rack 3 slots, fan, reduced (4/8)
DRA3165V43	+6U rack 3 slots
DRA3165R23	+ 6U rack 3 slots, with external recovery
DRA3168V23	+ 6U rack 19" 6 slots, fan, reduced (4/8)
DRA3168V63	+ 6U rack 19" 6 slots
DRA3168R43	+ 6U rack 6 slots with external recovery
RE_91001	2000 W 27 ohm external resistor
RE_91002	4500 W 12 ohm external resistor
RE_91020	Pair or wall consoles for resistors
TL_83085	6U 11E stopper
DXD06001	DIGIVEX 1/2 single module
DXD06002	DIGIVEX 4/4 single module
DXD06004	DIGIVEX 4/8 single module
DXD06008	DIGIVEX 8/16 single module
DXD06016	DIGIVEX 16/32 double module
DXD06032	DIGIVEX 32/64 single module
DSD13004	DIGIVEX Single Drive 230V 4/8
DSD13007	DIGIVEX Single Drive 230V 7.5/15
DSD13015	DIGIVEX Single Drive 230V 15/30
DSD16002	DIGIVEX Single Drive 400V 2/4
DSD16004	DIGIVEX Single Drive 400V 4/8
DSD16008	DIGIVEX Single Drive 400V 8/16
DPD16050	DIGIVEX Power Drive 50/80
DPD16100	DIGIVEX Power Drive 100/120
DPD16150	DIGIVEX Power Drive 150
SC_6631	Encoder emulation
SC_6637-1	Simplified SSI encoder card
SC_6637-2	SSI encoder card
DTP001	Programming and parameter setting console
FR_03016	16 A filter (DIGIVEX 12 kW)
FR_03036	36 A filter (DIGIVEX 25 kW and 50/80)
FR_03064	64 A filter (DIGIVEX 100/120)
PVD3464x	DIGIVEX Multiple Drive manual D, E, F, GB
	DIGIVEX Single Drive manual
PVD3484x	DIGIVEX Power Drive manual D, E, F, GB
PVD3488x	SSI D, F board manual
x = D German, E Spanish, F French, GB English	

PLUGS AND CABLES FOR DIGIVEX AND HX, HS, HD

Reference	Description
DXDK1	Set of 3 Sub-D connectors for DIGIVEX
DXDK2	Set of 4 Sub-D connectors for DIGIVEX + encoder emulation
CB_08304	I/O cable by metre for DIGIVEX drive
FELX304544R205	Equipped I/O cable (1 Sub-D) for DIGIVEX drive length 5 m (1)
FELX304544R105	Equipped I/O cable (2 Sub-D) for DIGIVEX drive length 5 m (1)
6537P0016	Encoder emulation cable for DIGIVEX drive
FELX304546R105	Equipped encoder emulation cable (2 Sub-D) for DIGIVEX length 5 m (1)
220065R4621	Motor end resolver cable
6537P0001	Resolver cable by metre
220049R6105	Equipped resolver cable (motor plugs & Sub-D) length 5m (1)
For motors HX3	
220065R1610	Size 1 power plug
6537P0019	0.5 mm^2 power cable by metre
220049R4905	Equipped power cable - length 5m (1)
For motors HX4, HX6, HS6, HD6, HD6, HS8 and Io < 14 A.	
220065R1610	Size 1 power plug
6537P0009	1 mm^2 power cable by metre
220049R4205	Equipped power cable - length 5m (1)
For motors HS820EQ (Io > 14 A)	
220065R1611	Size 1 power plug
6537P0010	2.5 mm^2 power cable by metre
220049R4305	Equipped power cable - length 5m (1)
For motors HD8, HS9	
220065R3611	Size 3 power plug
6537P0010	2.5 mm^2 power cable by metre
220049R4805	Equipped power cable - length 5m (1)
For motors HD9 and Io < 60 A	
220065R3610	Size 3 power plug
6537P0011	6 mm^2 power cable by metre
220049R4505	Equipped power cable - length 5m (1)
For motors H....and Io > 60 A	
220065R3610	Size 3 power plug
6537P0012	10 mm^2 power cable by metre
220049R4605	Equipped power cable - length 5m (1)