Browning®

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F O R M
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Installation and Maintenance Manual For IntelliGear Plus™ Variable Speed Gearmotors and Motors

⚠WARNING

High voltage and rotating parts may cause serious or fatal injury.

Turn off power to install or service.

Operate with guards in place.

Read and follow all instructions in this manual.

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EMERSON™
Industrial Automation

Thank you for choosing an IntelliGear Plus Gearmotor.

Safety First

High voltage and rotating parts can cause serious or fatal injury. Safe installation, operation and maintenance must be performed by qualified personnel. Familiarization with and adherence to NEMA MG2, the National Electric Code and local codes is recommended. It is important to observe safety precautions to protect personnel from possible injury. Personnel should be instructed to:

1. Avoid contact with energized circuits or rotating parts.
2. Disconnect all power sources before initiating any maintenance or repair.
3. Act with care in accordance with prescribed procedures in handling and lifting this equipment.
4. Be sure unit is electrically grounded in accordance with code requirements.
5. Be sure equipment is properly enclosed to prevent access by children or other unauthorized personnel in order to prevent possible accidents.
6. Be sure shaft key is fully captive before unit is energized.
7. Avoid contact with capacitors until safe discharge procedures have been completed.
8. Most units are shipped with oil. Always be sure oil lubricated units are filled with correct oil to proper level before operating.
9. Provide proper safeguards for personnel against rotating parts and applications involving high inertia loads which can cause overspeed.
10. Avoid extended exposure to equipment with high noise levels.
11. Be familiar with the equipment and read all instructions thoroughly before installing or working on equipment.

⚠WARNING **Disconnect all power before adjusting units.**

Safety and Operating Instructions for Electrical Actuators
(In accordance with the low voltage directive 73/23/EEC modified by 93/68/EEC).

1 - General

Depending on their exposure after mounting, IntelliGear Plus motors may contain moving parts, as well as hot surfaces, during operation.

Unjustified removal of protection devices, incorrect use, faulty installation or inappropriate operation could represent a serious risk to personnel, animals and equipment.

For further information, consult the manual.

All work relating to transportation, installation and maintenance must be performed by experienced, qualified personnel (see IEC 364 or CENELEC HD 384, or DIN VDE 0100 and national specifications for installation, startup and accident prevention).

In these basic safety instructions, qualified personnel means persons competent to install, mount, startup, and operate the product and possessing the relevant qualifications.

2 - Use

IntelliGear Plus motors are components designed for integration in installations or electrical machines.

When integrated in a machine, commissioning must not take place in Europe until it has been verified that the machine conforms with directive 89/392/EEC (Machinery Directive).

It is also necessary in Europe to comply with standard EN 60204, which stipulates in particular that electrical actuators (which include IntelliGear Plus) cannot be regarded as circuit-breaking devices and certainly not as isolating switches.

Commissioning can take place only if the requirements of the Electromagnetic Compatibility Directive (89/336/EEC, modified by 92/31/EEC) and/or local codes are met.

IntelliGear Plus motors meet the requirements of the Low Voltage Directive 73/23/EEC, modified by 93/68/EEC. The harmonized standards of the DIN VDE 0160 series in connection with standard VDE 0660, part 500 and EN 60146/VDE 0558 are also applicable.

The technical characteristics and instructions concerning the connection conditions specified on the nameplate and in the documentation provided must be observed without fail.

3 - Transportation, Storage

All instructions concerning transportation, storage and correct handling must be observed.

The climatic conditions specified in the technical manual must be observed.

4 - Installation

The installation and cooling of equipment must comply with the specifications in the manual supplied with the product. IntelliGear Plus motors must be protected against excessive shock or vibration. In particular, there must be no damage to parts and/or modification of the clearance between components during transportation and handling. Avoid touching the electronic components and contact parts.

IntelliGear Plus motors contain parts which are sensitive to static electricity and may be easily damaged if handled incorrectly. Electrical components must not be exposed to mechanical damage or destruction (risks to health).

5 - Electrical Connection

When work is performed on IntelliGear Plus motors which are powered up, national accident prevention specifications must be respected.

The electrical installation must comply with the relevant specifications (for example conductor cross-sections, protection via fused circuit-breaker, connection of protective conductor). More detailed information is given in the manual. Instructions for an installation which meets the requirements for electromagnetic compatibility, such as screening, grounding, presence of filters and correct insertion of cables and conductors, are given in the documentation supplied with the IntelliGear Plus. These instructions must be followed in all cases, even if the IntelliGear Plus carries the CE mark.

Adherence to the limits given in the EMC legislation is the responsibility of the manufacturer of the installation or the machine.

6 - Operation

Installations incorporating IntelliGear Plus motors must be fitted with additional protection and monitoring devices as laid down in the current relevant safety regulations: law on technical equipment, accident prevention regulations, etc. Modifications to Intelligear Plus motors using control software are permitted.

Active parts of the device and live power connections must not be touched immediately after the IntelliGear Plus is powered down, as the capacitors may still be charged. In view of this, the warnings fixed to IntelliGear Plus motors must be observed.

During operation, all protective covers must remain in place.

7 - Servicing and Maintenance

Refer to the manufacturer's documentation.

⚠WARNING **Disconnect all power before adjusting units.**

Contents

⚠WARNING Disconnect all power before adjusting units.

General Information

1 - General Information

1.1 - General operating principle

The IntelliGear Plus is a combination of a 3-phase induction motor and an integrated open loop vector variable speed drive. The motor can be combined with many gear types from Emerson Power Transmission's range.

In the standard product version, the integrated drive does not require any connection other than the power supply. The options may be used to broaden the application range of the IntelliGear Plus. Based on the advanced technology of the IGBT power module, very high efficiency and reduced noise levels are achieved.

1.2 - Product name

IntelliGear Plus Range							
115V Single Phase Power Supply		230V Single Phase Power Supply		230V Three Phase Power Supply		460V Three Phase Power Supply	
Catalog Number	Motor HP	Catalog Number	Motor HP	Catalog Number	Motor HP	Catalog Number	Motor HP
310 M 033	0.33	31 M 033	0.33	31 TL 033	0.33	31 T 033	0.33
310 M 050	0.50	31 M 050	0.50	31 TL 050	0.50	31 T 050	0.50
32 M 075	0.75	31 M 075	0.75	31 TL 075	0.75	31 T 075	0.75
		31 M 100	1	31 TL 100	1	31 T 100	1
		32 M 150	1.5	32 TL 150	1.5	31 T 150	1.5
		32 M 200	2	32 TL 200	2	31 T 200	2
				33 TL 300	3	32 T 300	3
				33 TL 500	5	32 T 500	5
						33 T 750	7.5
						33 T 1000	10

IntelliGear Plus Speed Controlling Options	
Designation	Description
PD	Digital keypad on enclosure For./Rev./stop/speed-up/speed-down/speed display
P1	Run/Stop/Control knob mounted on enclosure
P2	For./Rev./Stop/Control knob mounted on enclosure
P3	Control knob (only) mounted on enclosure
P4	Control knob (only) mounted inside enclosure w/trim potentiometers
R	Remore signal following (either 0-10 vDC or 4-20 mA)
RP	Fieldbus controlled by customer's PROFIBUS DP

IntelliGear Plus Options	
Part ID	Description
KEYPAD LCD	Parameter setting console w/cable to locally reprogram to customized parameters
PX KEY	Drive parameter set-up key storage Fob
AEM904KA006	DC Braking resistors 100W
AEM904KA007	DC Braking resistors 200W
VMA30SOFT	CD w/cable and USB to locally reprogram to customized parameters

⚠WARNING **Disconnect all power before adjusting units.**

1.3 - Characteristics

1.3.1 - Electrical Data

Single Phase Design

Power supply	115 V ± 10%, 50 - 60 Hz	230 V ± 10%, 50 - 60 Hz
Output voltage	From input voltage down to (input voltage/speed range)	
Power range	0.33, 0.50, 0.75 HP	0.33, 0.50, 0.75. 1.0, 1.5, 2.0 HP
Maximum numbers of power-ups per hour	10	

Three Phase Design

Power supply	230 V ± 10%, 50 - 60 Hz	460 V ± 10%, 50 - 60 Hz
Output voltage	From input voltage down to (input voltage/speed range)	
Power range	0.33, 0.50, 0.75. 1.0, 1.5, 2.0, 3, 5 HP	0.33, 0.50, 0.75. 1.0, 1.5, 2.0, 3.0, 5.0, 7.5, 10 HP
Maximum numbers of power-ups per hour	100	

1.3.2 - Characteristics and Functions

Characteristic	**IntelliGear Plus**	
Overload	150 % of full load setting for 60 seconds, 10 times per hour	
Motor Frequency Variation Ranges	Standard	60 to 10 Hz 6:1 constant torque up through 3 HP
		74 to 12 Hz 6:1 constant torque for 5 through 10 HP
	Optional	60 to 6 Hz 10:1 constant torque up through 1.5 HP
		90 to 9 Hz 10:1 constant torque for 2 through 10 HP
	Special	120 to 2 Hz depending on thermal and mechanical limits
Efficiency	97.5 % x motor efficiency x gear efficiency (if applicable)	

Drive Control	**IntelliGear Plus**
Speed Reference	• Analog reference (0V or 4mA = minimum speed) (10V or 20mA = maximum speed) - 0 to 10V with integral potentiometer on enclosure (P1,P2 and P3) - 0 to 10V with integral potentiometer in enclosure (P4) - 4 to 20 mA, 20 to 4 mA, 0 to 20 mA, 20 to 0 mA or 0 to 10 VDC (R) • Digital references - PD Digital Keypad - Fieldbus using Profibus DP
Speed regulation	- Speed regulation with encoder feedback option (only size 33) - Regulation of a reference with integrated PI loop

⚠WARNING **Disconnect all power before adjusting units.**

1.3.2 - Characteristics and Functions (cont'd.)

Drive Control	IntelliGear Plus
Run/Stop	- With power supply - With remote volt-free contact - With fieldbus - With local run/stop control
Forward/Reverse	- With internal connection on the terminal block - With remote volt-free contact - With fieldbus - With local For./Rev. controls
Stop Mode	- On ramps (using volt-free contact of integrated control) - Freewheel - DC injection brake - With electromechanical brake
Ramps	- Ramps are adjustable from 0.1 to 600 seconds/1000 rpm
Fieldbus	- PROFIBUS DP

Protection	IntelliGear Plus
Power	- Input/output phase loss - Undervoltage - Overvoltage - Overloads • thermal of motor or drive • protection from locked rotor - Short-circuit • motor windings - Overspeed
Control	- Short circuit on 0 - 10V/24V inputs or outputs
Drive reset	- By switching off the IntelliGear Plus or by opening/closing the connection between the 24V and ENA (size 31 and 32) terminals, or SDI1 and SDI 2 (size 33)

1.4 - Environmental Characteristics

Characteristics	Level - IntelliGear Plus	
Degree of protection	TEFC Version	TEFC motor and NEMA 4/12 Controller
	Washdown* Version	Washdown Motor and NEMA 4/12/Controller
Storage temperature	-40°C to +70°C	
Transport temperature	-40°C to +70°C	
Ambient operating temperature	-20°C to +40°C (above 40°C requires derating 1% per °C	
Altitude	Up to 3000 feet above sea level without derating	
Ambient humidity	95% non-condensing	
Humidity during storage	93%, 40°C, 4 days	
Vibration	- Exposed product: 0.01 g2 /Hz 1 hr. in accordance with IEC 60068-2-34	
	- Sinusoidal vibration: 2-9 Hz 3.5 ms-2 - 9-200 Hz 10 ms-2 in accordance with IEC 60068-2-6	
Shocks	Packaged product: 15 g, 6 ms, 500 times/direction in all 6 directions in accordance with Standard IEC 600068-2-29	
Immunity	Conforming to EN61000-6-2	
Radiated and conducted emissions	Conforming to EN500081-2 with internal filters	
UL and cUL Standards	Conforming to UL 508 C (E211799)	

* C-Face motors

⚠WARNING Disconnect all power before adjusting units.

1.5 - Radio-frequency interference:

1.5.1 - General

Variable speed drives use high-speed switches (transistors, semi-conductors) which switch high voltages (around 660V for 3-phase drives) at high frequencies (several kHz). This provides better efficiency and a low level of motor noise. As a result, they generate radio-frequency signals which may disturb operation of other equipment or distort measurements taken by sensors:

- due to high frequency leakage currents which escape to ground via the stray capacity of the drive/motor cable and that of the motor via the metal structures which support the motor
- by conduction or feedback of R.F. signals on the power supply cable; conducted emissions
- by direct radiation near to the main supply power cable or the drive/motor cable: radiated emissions

These phenomena are of direct interest to the user. The frequency range concerned (radio-frequency) does not affect the energy distribution company.

1.5.2 - Standards (Emission)

The maximum emission level is set by the generic industrial (EN 50081-2) and domestic (EN 50081-1) standards. IntelliGear Plus conforms to the following standards:

- EN 50081-2 as standard
- EN 50081-1 with filter option

1.5.3 - Standards (Immunity)

The maximum immunity level is set by the generic industrial (EN 50082-2) and domestic (EN 50082-1) standards. IntelliGear Plus conforms to the following standards:

- EN 50082-2 and EN 50082-1 as standard

1.6 - Description of cables and protection devices (Customer Supplied)

⚠WARNING When using a circuit-breaker, it must be a motor circuit-breaker (D curve).

- Comply with the size of protection fuses.
- The cable size may vary according to legislation applicable in the country, which will take precedence over the values given in the table below without exception.
- These tables should never be used in place of current standards.

Motor hp Rating	115V Single Phase Power Supply				230V Single Phase Power Supply				Motor hp Rating
	IntelliGear Plus Number	Input Amps	Wire Gauge	Fuse Size	IntelliGear Plus Number	Input Amps	Wire Gauge	Fuse Size	
0.33	I 310 M 033	4	14AWG	8 A	I 31 M 033	2	14AWG	8 A	0.33
0.50	I 310 M 050	5	14AWG	10 A	I 31 M 050	2.5	14AWG	8 A	0.50
0.75	I 32 M 075	8.5	14AWG	14 A	I 31 M 075	4	14AWG	8 A	0.75
1	-	-	-	-	I 31 M 100	5	14AWG	12 A	1
1.5	-	-	-	-	I 32 M 150	8	14AWG	14 A	1.5
2	-	-	-	-	I 32 M 200	10	14AWG	16 A	2

⚠WARNING Disconnect all power before adjusting units.

1.6 - Description of cables and protection devices (Customer Supplied) cont'd.

Motor hp Rating	230V Three Phase Power Supply				460V Three Phase Power Supply				Motor hp Rating
	IntelliGear Plus Number	Input Amps	Wire Gauge	Fuse Size	IntelliGear Plus Number	Input Amps	Wire Gauge	Fuse Size	
0.33	I 31 TL 033	2.5	14AWG	4 A	I 31 T 033	1.5	14AWG	4 A	0.33
0.50	I 31 TL 050	3	14AWG	6 A	I 31 T 050	2	14AWG	4 A	0.50
0.75	I 31 TL 075	4.1	14AWG	8 A	I 31 T 075	2.5	14AWG	6 A	0.75
1	I 31 TL 100	5.3	14AWG	8 A	I 31 T 100	3	14AWG	6 A	1
1.5	I 32 TL 150	6.1	14AWG	10 A	I 31 T 150	4.1	14AWG	8 A	1.5
2	I 32 TL 200	8	14AWG	16 A	I 31 T 200	5.3	14AWG	10 A	2
3	I 33 TL 300	12	12AWG	16 A	I 32 T 300	8	14AWG	10 A	3
5	I 33 TL 500	15	12AWG	20 A	I 32 T 500	9	14AWG	16 A	5
7.5	-	-	-	-	I 33 T 750	12	12AWG	16 A	7.5
10	-	-	-	-	I 33 T 1100	16	12AWG	20 A	10

Note:

• The mains current value is a typical value which depends on the source impedance. The higher the impedance, the lower the current.

1.7 - UL conformity

1.7.1 - Special mains supply

The drive can be incorporated in an installation with short circuit capacity of 5000 A rms maximum at a voltage 264 VAC rms maximum for 230 V (TL) drives or 528 VAC rms maximum for 400 V (T) drives.

1.7.2 - Cables

Only class 1 copper cables 60/75° C (140/167° F) should be used.

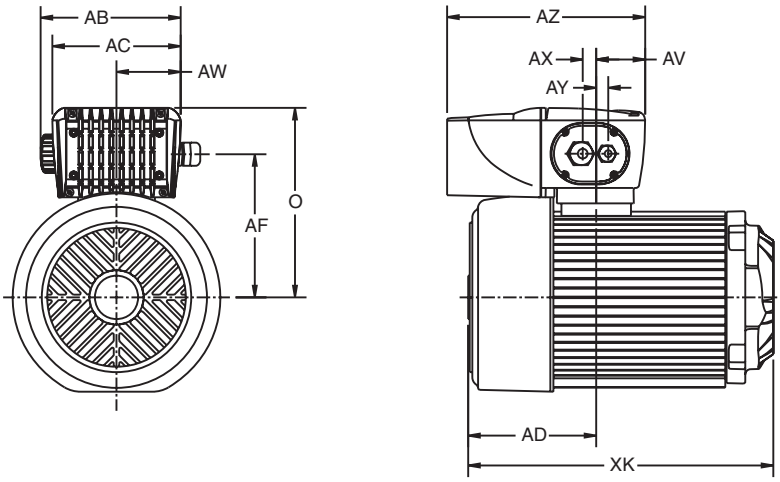
1.7.3 - Fuses

UL conformity is adhered to if the fuses used are UL-listed, fast-blow fuses (class CC up to 30 A) with a rating as indicated in the above table and if the short-circuit symmetrical current does not exceed 5 kA.

1.8 - Weights and dimensions - Gearmotors

Motor Frame	IntelliGear Plus Drive Size	Dimension (inches)											Drive Added Weight (lb.)
		0	AB	AC	AD	AF	AV	AW	AX	AY	AZ [3]	XK	
71*	31 or 31M	6.91	6.45	5.91	4.97 [2]	4.81	2.25	2.95	0.62	0.55	8.53	7.61 [2]	7
	32M	6.91	6.45	5.91	4.97 [2]	4.81	2.25	2.95	0.62	0.55	9.12	7.61 [2]	7.5
56	310M or 31M or 31	7.74	6.45	5.91	4.35	5.61	2.25	2.95	0.62	0.55	8.53	9.79 [1]	7
	32M	7.74	6.45	5.91	4.35	5.61	2.25	2.95	0.62	0.55	9.12	9.79 [1]	7.5
143T, 145T	31M or 31	7.74	6.45	5.91	4.35	5.61	2.25	2.95	0.62	0.55	8.53	11.04 [1]	7
145TY	31	7.74	6.45	5.91	4.35	5.61	2.25	2.95	0.62	0.55	8.53	12.04	7
143T, 145T	32 or 32M	7.74	6.45	5.91	4.35	5.61	2.25	2.95	0.62	0.55	9.12	11.04 [1]	7.5
145TY	32 or 32M	7.74	6.45	5.91	4.35	5.61	2.25	2.95	0.62	0.55	9.12	12.04	7.5
182T, 184T	32	8.72	6.45	5.91	5.89	6.58	2.25	2.95	0.62	0.55	9.12	14.05	7.5
	33	11.16	8.97	8.44	10.01	7.37	2.83	4.22	0.62	0.55	13.10	14.05	18
213T	33	11.99	8.97	8.44	11.73	8.11	2.83	4.22	0.62	0.55	13.10	16.15	18
215T	33	11.09	11.25	8.44	13.23	8.11	2.83	4.22	0.62	0.55	13.10	17.65	18

[1] There will be an additional .58 inches added for select small combined gearmotors.
[2] For less than .75 hp, reduce by .32 inches.
[3] Does not include mounting of brake resistor.



⚠WARNING **Disconnect all power before adjusting units.**

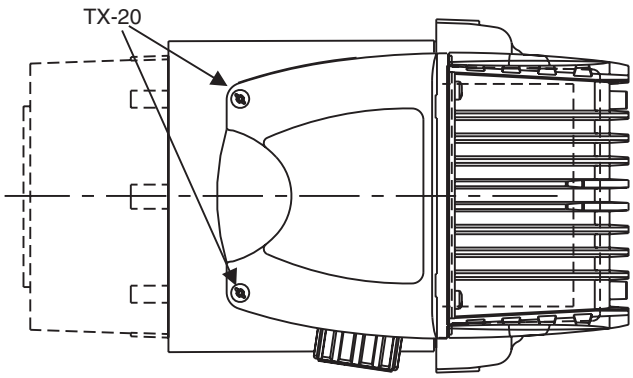
2 - Installation

⚠WARNING It is the responsibility of the owner or user to ensure that the installation, operation and maintenance of the inverter and its options comply with legislation relating to the safety of personnel, animals and equipment, and with the current regulations of the country of use.

- Before carrying out any work, disconnect and lock the drive power supply. For the single-phase range, wait two minutes to make sure that the capacitors have discharged.
- After connection, ensure that the seals are firmly in place, and that the screws and cable glands are watertight to ensure drive protection. Clear any condensation from the drain holes at the bottom of the motor.

2.1 - General

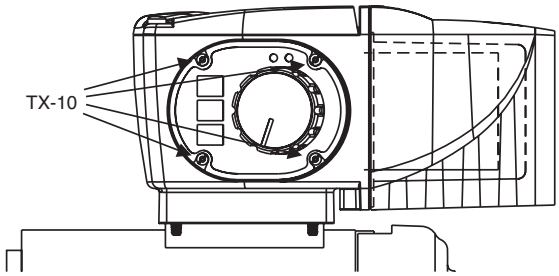
The IntelliGear Plus is usually fitted to the gear and mounted to the machine with flange or foot mounting.
The motor fan cools the whole assembly. Make sure that the ventilation air inlet is free of obstruction.
The positions of the potentiometer/cable gland supports are specified at the time of ordering. However they may be reversed if necessary.



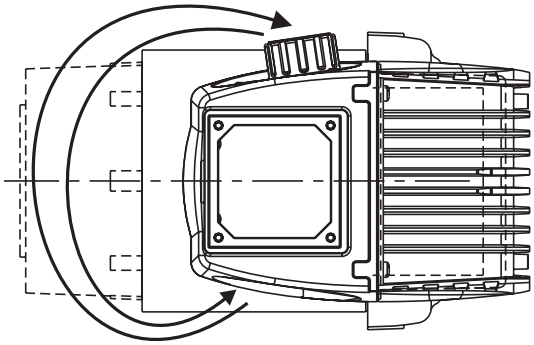
* If IntelliGear Plus unit is equipped with an FCR brake, reversing potentiometer is not permitted.

2.2 - Reversing the operators*

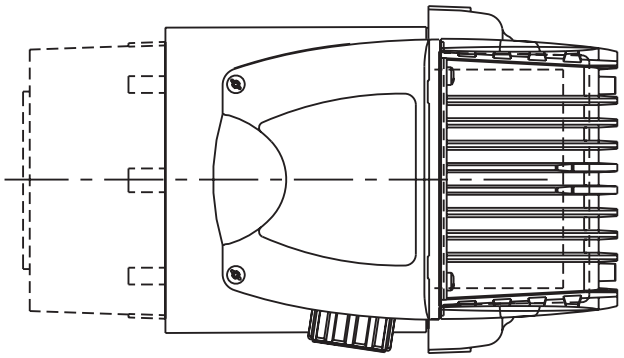
1. Undo the (2) TX 20 - slot type screws and remove the cover.
2. Remove the control knob and cable gland support attachment screws (TX10 - slot type screws).



3. Disconnect the plug connector from the P2 terminal if an option is connected.



4. Reverse the option and cable gland supports.
5. Reconnect the printed circuit plug connector on P2 and replace the TX 10 screws using .5 ft.-lbs. of torque.
6. Replace the cover using TX-20 slot type screws by applying 3 ft.-lbs. of torque.



⚠WARNING **Disconnect all power before adjusting units.**

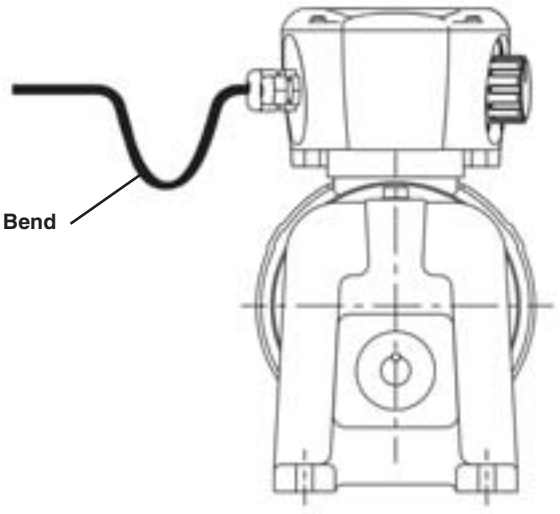
3 - Connections

⚠WARNING The voltages on the power terminal blocks and the cables connected to them may cause fatal electric shocks. The drive stop function does not protect against these high voltages.

- The drive contains capacitors which remain charged at a fatal voltage even after the power supply has been switched off.
- After switching off the drive, wait for two minutes so that the internal circuits can discharge the capacitors, before removing the protection (for the single-phase range).
- The drive power supply must be protected against overloads and short-circuits.
- It is vital to respect the rating of protection devices.
- Connection with copper conductor only.

3.1 - Wiring precautions

- When the IntelliGear Plus is controlled remotely, avoid parallel routing of power cables and control cables.
- All remote control cables must be shielded and have a cross-section between 24 AWG and 17 AWG. The shielding must be connected to control circuit common at one end only.
- Insure that control circuit commons being connected are at the same voltage relative to earth ground.
- Incorporate a bend where the cables enter the cable glands so that water cannot penetrate the terminal box.
- Tighten the cable glands firmly.



3.2 - Control Terminal Blocks

- Remove the terminal block from it's fixed holder (unplugged) before making any connections, to avoid putting pressure on the card.
- The IntelliGear Plus has a positive logic configuration. Using a drive with a control system which has a different control logic may cause unwanted starting of the motor.
- The control circuits in the drive are isolated from the power circuits by single insulation (IEC 664-1).

The installer must ensure that the external control circuits are isolated against any human contact.

- If the control circuits need to be connected to circuits conforming to SELV safety requirements, additional insulation must be inserted to maintain the SELV classification.

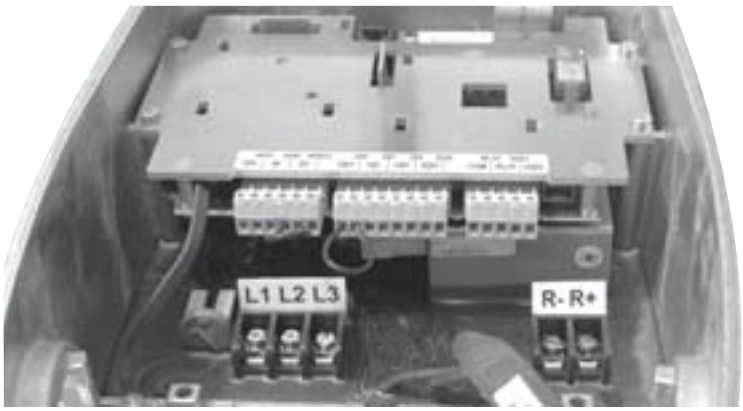
Removeable screws in terminal block:

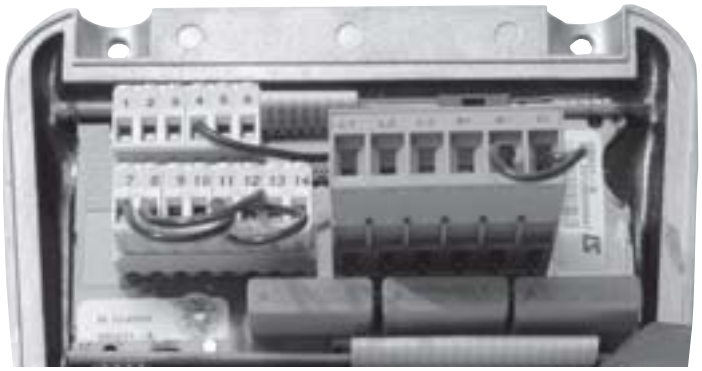
- Tightening torque = 2.62 in. lbs.
- Maximum cross section = 17 AWG

⚠WARNING **Disconnect all power before adjusting units.**

3.2 - Control Terminal Blocks (Continued)

Terminal Number		Designation	Function	Characteristics	
IntelliGear Frame					
31 or 32	33				
1	1	10V	+10V analog internal source	Accuracy	± 2%
				Maximum output current	30 mA
2	2	ADI1	Analog or logic Input 1 Assignment in standard configuration: 0-10V speed reference	**Voltage input**	
				Full scale voltage	10 V ± 2%
				Input Impedance	95 kΩ
				Current input	
				Current range	0 to 10 mA ± 5%
				Input impedance	500 Ω
				Resolution	10 bits
				Sampling	6 ms
				Logic input (if connected to the +24 V)	
				Threshholds	"0":<5V-"1"; >10V
				Voltage range	0 to +24V
				Load	95 kΩ
				Input threshold	7.5V
3	3	0V	Logic circuit common 0V		
4	4	ADI2	Analog or logic Input 2 Assignment in standard configuration: Analog Reference #2 for 4-20 mA	**Voltage input**	
				Full scale voltage	10 V ± 2%
				Input Impedance	95 kΩ
				Current input	
				Current range	0 to 20 mA ± 5%
				Input impedance	500 Ω
				Resolution	10 bits
				Sampling	6 ms
				Logic input (if connected to the +24 V)	
				Threshholds	"0":<5V-"1"; >10V
				Voltage range	0 to +24V
				Load	95 kΩ
				Input threshold	7.5V
				Input (PTC)	
				Trip	≤ 3300 Ω
				Voltage range	< 1800 Ω
N/A	5	0V	Logic circuit common 0V		





⚠WARNING **Disconnect all power before adjusting units.**

3.2 - Control Terminal Blocks (cont'd.)

Terminal Number		Designation	Function	Characteristics	
IntelliGear Frame					
31 or 32	33				
6	6	ADIO3	Analog or logic input or analog output 3 Assignment in standard configuration: analog output (LED control option for frame 33 and speed feedback for frames 31 and 32)	Characteristics	Analog voltage (common Mode) or uni-directional
				Voltage input	
				Full scale voltage	10 V ± 2%
				Input impedance	95 kΩ
				Current input	
				Current range	0 to 20 mA ± 5%
				Input impedance	500 Ω
				Resolution	10 bits
				Sampling	6 ms
				Logic input (if connected to the +24 V)	
				Threshholds	"0":<5V-"1"; >10V
				Voltage range	0 to +24V
				Load	95 kΩ
				Input threshold	7.5V
				Voltage output	
				Voltage range	0 to 10V
				Load resistance (min.)	2 kΩ
				Protection	Short-circuit (40mA max.)
				Current output (Frame 33 only)	
				Current range	0 to 20 mA + 5%
				Maximum voltage	10 V
				Load resistance	500 Ω
7	7	DIO1	Digital input or output 1 Assignment in standard configuration: digital input External fault interlock	Characteristics	Digital input or output 1
				Threshholds	"0":<5V-"1"; >10V
				Voltage range	0 to +24V
				Sampling/refreshment	2 ms
				Digital input	
				Absolute maximum voltage	0 to +35V
				Load	15 kΩ
				Input threshold	7.5V
				Logic input	
				Maximum output current	50 mA
				Overload current	50 mA
5	8	24V	+24V internal source	Output current	10 mA in total
				Overload current	33 = 150mA, 31/32 = 50mA
11	11			Accuracy	± 5%
				Protection	Current limiting and overload fault trip
8	9	DI2	Logic input 2 Assignment in standard configuration: Run forward	Characteristics	Logic input (positive logic)
				Threshold	"0":<5V-"1"; >10V
				Voltage range	0 to +24V
9	10	DI3	Logic input 3 Assignment in standard configuration: Run reverse	Sampling/refreshment	2 ms
				Absolute maximum voltage range	0 to +35V
10	12	DI4	Logic input 4 Assignment in standard configuration: Selection of analog ref. ADI1 or ADI2	Load	15 kΩ
				Input threshold	7.5V
N/A	13	SDI1	+24V dedicated to safety input	Characteristics	Logic input (positive logic)
				Thresholds	"0":<5V-"1"; >18V
12	14	SDI2/ENA	Safety/unlocking input	Voltage range	9 to + 35V
				Impedance	820 Ω
13	15	COM/RL1	Fault relay output	Characteristics	33: NO-NC single pole changeover contact
N/A	16	RL1C			31/32: NO single pole contact
14	17	RL1O/RL2		250VAC maximum contact current	-4 A, resistive load
					-2 A inductive load
N/A	18	SDO1	Safety contact	Characteristics	NO single-pole changeover contacts
N/A	19 N/A	SDO2		250VAC maximum contact current	-4 A, resistive load
					-2 A inductive load

⚠WARNING **Disconnect all power before adjusting units.**

3.3 Power terminal blocks

3.3.1 Terminal block for power supply PB1 (marked L1, L2, and L3)

This terminal block is used to connect the 3 phase power supply when the RFI filter is not used in an IntelliGear Plus. Otherwise, the RFI filter output is screwed onto this connector and the power supply should be attached to the terminals located on top of the filter.

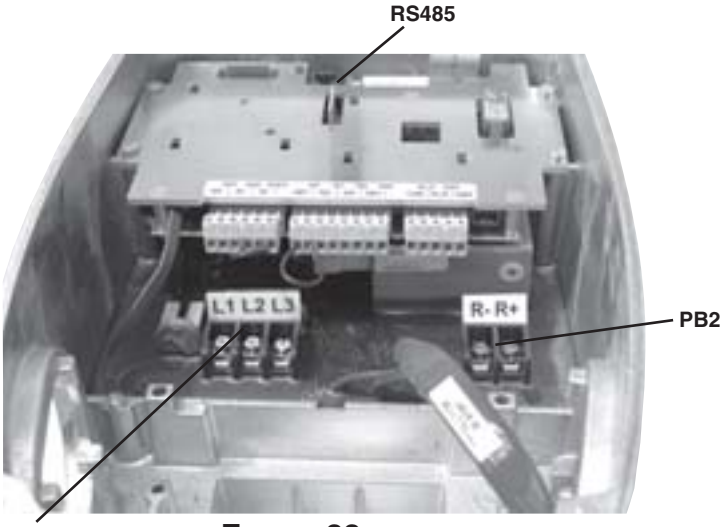
Screw terminal block	31 and 32	33
Tightening torque	7.1 in. lbs.	15.9 in. lbs.
Max. cross-section	AWG 14	AWG 8

3.3.2 Terminal block for braking resistor PB2 (marked R+ and R-)

This terminal block is used to connect a braking resistor when this option is required. The resistor is mounted outside and/or on the rear of the heat sink of the IntelliGear Plus.

Screw terminal block	31 and 32	33
Tightening torque	7.1 in. lbs.	15.9 in. lbs.
Max. cross-section	AWG 14	AWG 8

Note: For frames 31 and 32, PB1 and PB2 are both located on the same terminal block.
The terminal block on the 31 and 32 has a terminal marked FI connected to the R- terminal which enables use of the internal braking resistor. The jumper must be removed when an external braking resistor is connected or if the inertia is compatible with the rated deceleration ramp.



Frame 33

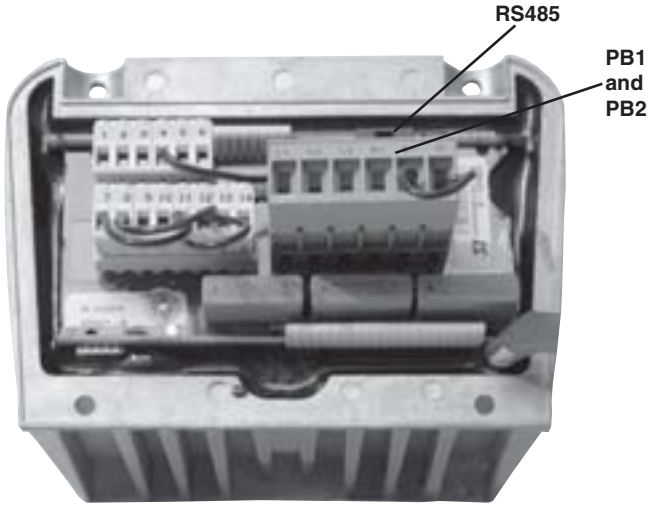
3.4 Terminal blocks for options

3.4.1 RS485 type serial link connector
This is an RJ 45 connector and is used to connect the PX LCD console or a PC in order to use the VMA30SOFT PC programming software.
For the 31 or 32, it is also used to connect a fieldbus or the PD digital pad option.

3.4.2 Description of Slot 1 (Frame 33 only)
This slot is used to connect an encoder feedback module when closed loop mode is selected

3.4.3 Description of Slot 2 (Frame 33 only)
This slot is used to connect a Profibus DP fieldbus option module

3.4.4 P2 connector (Frames 31 and 32 only)
This is used to connect one of the following option at a time (P1 , P2, P3, or ESFR brake control). When the ESFR option for FCR braking is required with one of the speed control options noted above, refer to Application Engineering due to limitations on the location that the speed control option can be mounted.

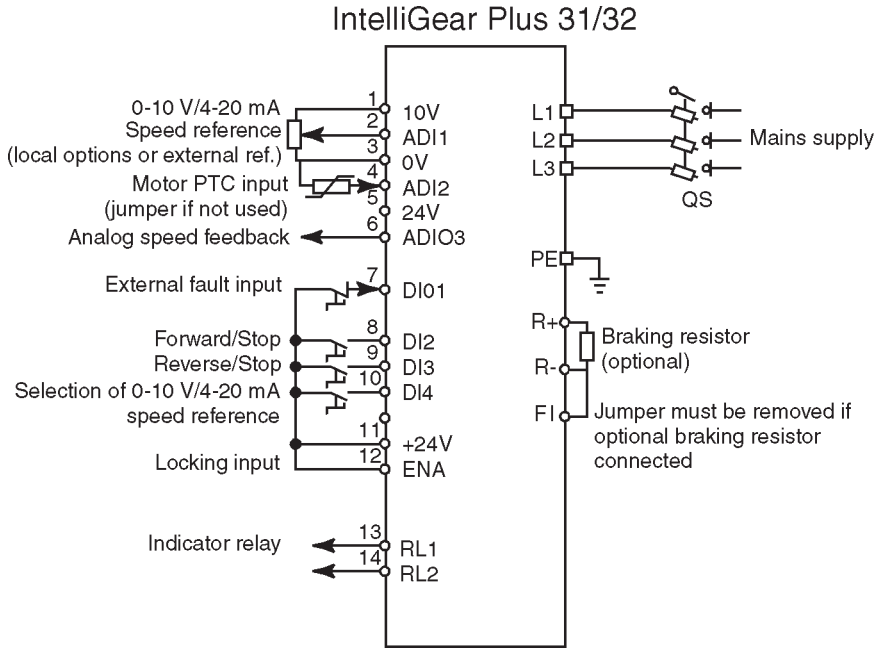


Frame 31/32

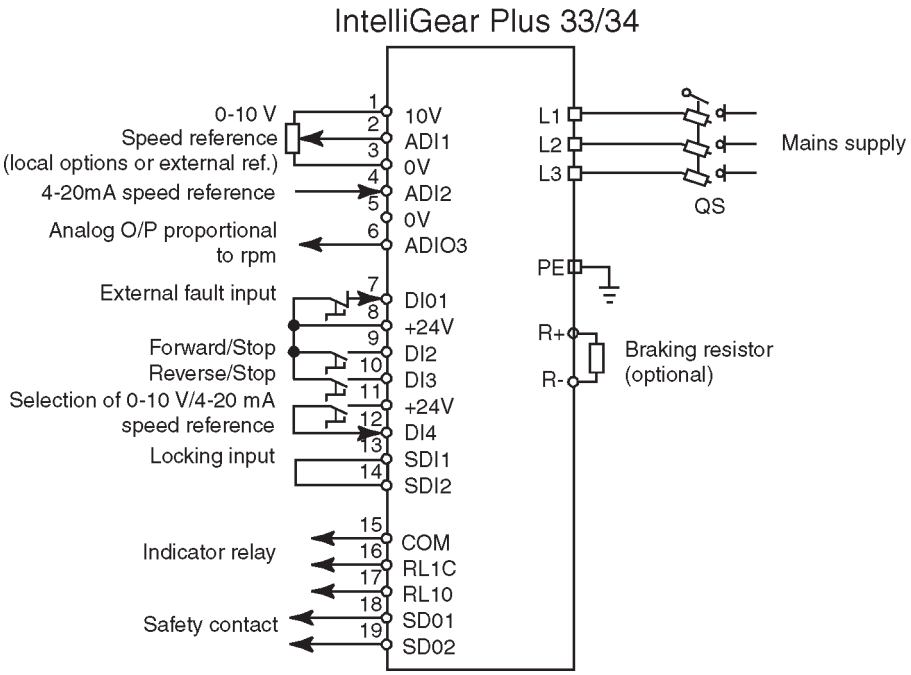
⚠WARNING **Disconnect all power before adjusting units.**

3.5 Wiring Diagrams

3.5.1 Standard configuration connection diagram



Note: For single-phase versions, the power supply is connected to terminals L and N.



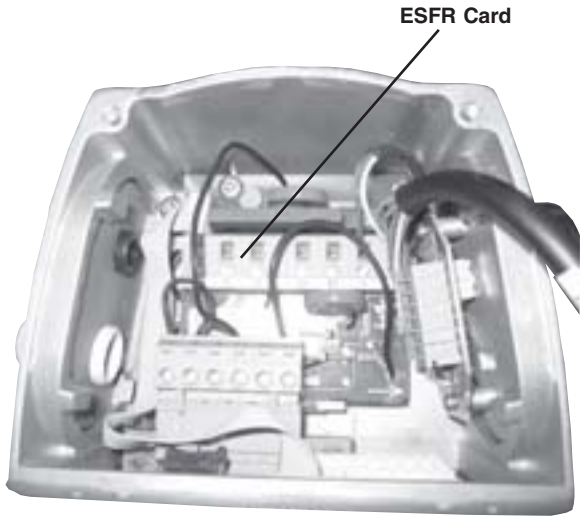
⚠WARNING Disconnect all power before adjusting units.

3.6 Power supply and control for FCR brake motors

3.6.1 Power supply for the built-in sequential control brake

ESFR option (31 and 32 only)

- the brake is supplied via the rectifier and a solid state relay fixed on the ESFR connection card. This connection is made at the factory.
- The rectifier is supplied by two mains phases.
- The brake is controlled according to the sequence which can be adjusted using the IntelliGear Plus parameters.



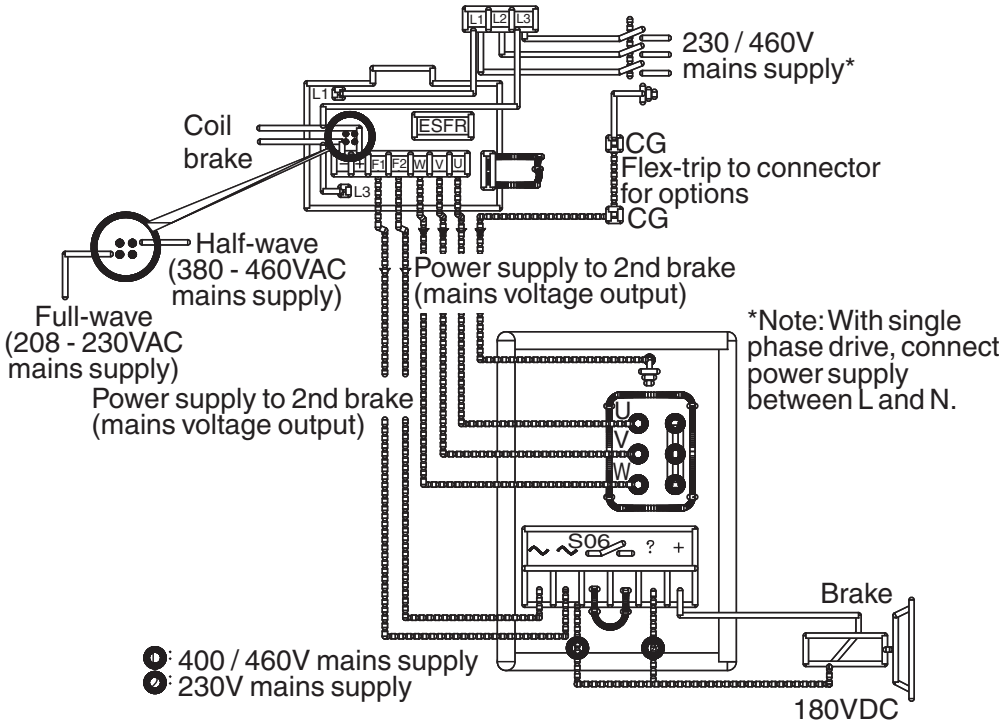
3.6.2 Separate power supply

The brake is supplied and controlled by an external source not supplied by Emerson Power Transmission.

3.7 Wiring diagrams for ESFR option

3.7.1 Connection of the ESFR option (31 and 32 only)

Use of this option to power a second motor and brake is a special and must be specified at order entry. The illustration for the wiring for the second motor in the diagram will not apply when this special feature is not specified.



⚠WARNING **Disconnect all power before adjusting units.**

4 Commissioning

⚠WARNING * Before switching on the IntelliGear Plus unit, check that the elctrical connections are correct, and that any moving parts are mechanically guarded.

⚠WARNING * For the safety of personnel, the IntelliGear Plus must not be switched on with any protective covering removed.

4.1 Starting with the power supply

This connection jumpers the run command so that the motor or gearmotor starts as soon as input power is switched on.

The speed is adjusted with the local control knob (P3 or P4 options) or a remote reference (0-10V or 4-20 mA).

Power-up: the green indicator lamp is lit continuously.

The control terminals SDI1 and SDI2 (size 33) or 11 and 12 (sizes 31 and 32) are linked (unlocking).

4.1.1 Automatic starting

By connecting a jumper between control terminals 8 and 11 (sizes 31 and 32) or 8 and 9 (size 33), the motor starts running forward. For reverse rotation connect terminals 9 and 11 (size 31 or 32) or 8 and 10 (size 33).

4.2 Starting with remote volt-free contact

Once it has been switched on, the motor starts in accordance with the run command given by the closing of the volt-free contact corresponding to the desired direction of rotation.

The speed is adjusted with the local control knob (P3 or P4 options) or a remote reference (0-10V or 4-20 mA).

4.3 Starting with the local run/stop control (PD, P1 or P2 options)

Once input power has been switched on, the motor starts after the button corresponding to the desired direction of rotation has been pressed for one second.

The speed is only adjusted with the local control knob or arrow buttons.

4.4 Setting the speed

4.1.1 External reference (R option)

Adjust the speed reference using the desired reference of either 0-10 V or 4-20 mA

4.2.2 Control knob options (P3) or remote potentiometer (supplied by customer)

Adjust the speed reference using a control know or a remote 10 KΩ potentiometer.

4.4.3 Internal speed control option (P4 option)

Adjust the speed reference using an internal speed potentiometer.

Adjust the max. speed or min. speed setting with independent potentiometers if it is not possible to reach the desired speed of operation.

⚠WARNING **Disconnect all power before adjusting units.**

5 Faults - Diagnostics

Information relating to the status of the IntelliGear Plus is provided by two indicator lamps located on the control options P1, P2 or P3 or by the internal LED in 31/32.

Color and state of indicator lamp	IntelliGear Plus	Checks to be performed
Steady green	No trip Mains present	
Flashing green	Current limiting	• Check that the motor is not overloaded or stalled.
Flashing red	IGBT temperature alarm Motor overload Braking resistor option overload	• Check that air is able to circulate around the motor fins and IntelliGear Plus casing. • The motor is overloaded: check the motor current using a clamp ammeter. • Check that the deceleration ramp is long enough for applications with high inertia.
Steady red	• Short-circuit of a motor winding • Locked motor rotor • Faulty insulation of a winding • (I^2T) overheating • Internal fault • Undervoltage • Overvoltage	• Check that no incident has occurred. • Switch off and then on again to clear the fault. • Check the main voltage. • Check that the deceleration ramp is long enough for applications with high inertia. • If the fault remains, consult Emerson Power Transmission Application Engineering.

The fault is cleared by switching off the IntelliGear Plus or by opening/closing the connection between terminals 12: ENA and 11: +24V (31/32) or SDI1 and SDI2 (33).

6 Operating Extensions

6.1 Digital Keypad on enclosure with For./Rev./Stop/ Speedup and down/Speed display/Fault Display

Ref.	Function
A	Display comprising 4 x 7 segment digits for indicating: - the drive operating status - certain operating data - the adjustment parameters (01 to 80) and their value
B	LED providing a sign for the data (the lit LED corresponds to the "-" sign)
C	Keys which can be used to scroll up and down through the parameters or their value. These keys can also be used to vary the speed.
D	Key which can be used to switch from standard mode to parameter-setting mode. In parameter-setting mode, the parameter number and value are displayed alternately on the display.
E F G	In keypad mode, these buttons are used for the following commands: - Reverse (standardly disabled) - Stop, clear fault - Forward

6.2 Control knob with integrated run/stop control option (P1)

In addition to speed control, a run button and a stop button make it possible to control the IntelliGear Plus locally, once it is has been powered. For a run command to be taken into account, the button must be held down for one second.

- It is connected on the P2 connector.
- Has two indicator lights.

6.3 Control knob with forward/reverse/stop control option (P2)

In addition to speed control, a forward button, a reverse button and a stop button make it possible to control the IntelliGear Plus locally, once it has been powered. For a run command to be taken into account, the button must be held down for one second.

- Connected on the P2 connector
- Has two indicator lights

⚠WARNING Disconnect all power before adjusting units.

6.4 Speed control knob option (P3)

The speed is set using a knob with graduations from 15 to 100 percent. Has two indicator lamps. It is connected on the P2 connector.

6.5 Internal speed control option (P4)

The speeds are set on potentiometers, which are accessible once the cover has been removed.
- a max. spd potentiometer: calibration of the maximum speed
- a min. spd potentiometer: calibration of the minimum speed
- an int. spd potentiometer: speed control, which replaces control via the control knob.

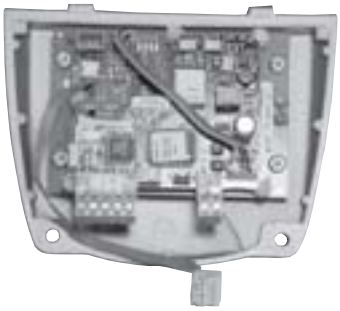
There are also two indicator lights.

6.6 Braking resistor option (RF100 - RF200)

For operation in four quadrants and energy dissipation, resistors are mounted directly onto the IntelliGear Plus.

6.7 Fieldbus options

The interface card is fixed inside the casing cover. Protocol: Profibus DP.



6.8 Parameter-setting console option (Keypad LCD)

The console option provides access to the drive internal settings (terminal block configuration, ramp, speed and PI settings, etc.).

See IntelliGear Plus parameter-setting manual included.

Description of the option:
1 Keypad LCD console
1 cable (3m long)

6.9 Programming CD (VMA30SOFT)

This CD with manual provides access to the drive internal settings (terminal block configuration, range, speed and PI settings, etc.).
Descriptions of the option:
1 CD in case
1 cable (3m long with USB on PC to RJ45 on IntelliGear Plus)

6.10 XPress Key (PX Key)

The XPress Key option is used to save a copy of all the IntelliGear Plus parameters so that they can be duplicated very simply in another drive.

IntelliGear Plus		Minimum Resistance (ohms)	RF100		RF200		
			Power (Watts)		Power (kW)		Resistor Connection
Frame	Input Voltage		Peak	Cont	Peak	Cont	
31 / 32	230 VAC	180 ohms	700	100	700	200	Series
	460 VAC		2800	100	2800	200	Series

External resistors with greater continuous power rating can be used, provided that the minimum ohmic value is maintained.

⚠WARNING Disconnect all power before adjusting units.