AMTECH

AXPERT Eazy

High Frequency Drive

INSTRUCTION MANUAL

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PREFACE

THANK YOU for purchasing the “AMTECH ***AXPERT Eazy*** Series High Frequency Drive”.

AXPERT Eazy Series High Frequency Drive is a modern Digital Signal Processor based highly functional AC Drive for high-speed application and that is easy to use. It employs latest generation IGBT as a switching device and pwm control technique to apply commanded output to the Spindle to control the Spindle speed.

PLEASE READ THIS MANUAL THOROUGHLY before use, and keep the manual at hand for later reference. Also make sure that this manual is delivered to the final users.

The purpose of this Instruction Manual is to provide basic information on Installation, Start-up, Operational and Troubleshooting for the ***AXPERT Eazy*** Series High Frequency Drive.

WARNING

ALWAYS READ THIS MANUAL THOROUGHLY BEFORE USING THE AC Drive.

THIS AC Drive CONTAINS HIGH VOLTAGE CIRCUITS THAT MAY BE FATAL TO HUMANS. USE EXTREME CAUTION DURING INSTALLATION. MAINTENANCE MUST BE PERFORMED BY QUALIFIED TECHNICIANS, AND ALL POWER SOURCES MUST BE DISCONNECTED BEFORE ANY MAINTENANCE. SUFFICIENT NOTICE MUST BE GIVEN TO THE GENERAL OPERATORS AND WORKERS BEFORE STARTING.

• ***ELECTRIC SHOCK MAY OCCUR IF THE FOLLOWING POINTS ARE NOT OBSERVED***.

(1) DO NOT OPEN THE FRONT COVER WHILE THE POWER IS ON.

(2) A CHARGE STILL REMAINS IN THE AC DRIVE WHILE THE INDICATOR IS LIT EVEN IF THE POWER HAS BEEN TURNED OFF. DO NOT OPEN THE FRONT COVER IN THIS CASE. WAIT AT LEAST 20 MINUTES AFTER THE INDICATOR GOES OUT.

(3) DO NOT CONTACT THE ELECTRICAL CIRCUIT WHILE THE "CHARGE" LED ON THE UNIT IS LIT. PERFORM SERVICING, ETC., AFTER WAITING AT LEAST 20 MINUTES AFTER THE LAMP GOES OUT.

(4) ALWAYS GROUND THE AC Drive CASE. THE GROUNDING METHOD MUST COMPLY WITH THE LAWS OF THE COUNTRY WHERE THE AC Drive IS BEING INSTALLED.

• THE AC Drive MAY BE DESTROYED BEYOND REPAIR IF THE FOLLOWING POINTS ARE NOT OBSERVED.

(1) OPERATION WITHIN THE AC DRIVE SPECIFICATIONS.

(2) PROPER CABLE CONNECTIONS TO INPUT/OUTPUT TERMINALS.

(3) CLEANING AND ENOUGH VENTILATION TO THE AC DRIVE INTAKE/OUTTAKE PORTS.

(4) OBSERVATION OF CAUTIONS LISTED IN THIS INSTRUCTION MANUAL.

• THERE MAY BE SOURCES OF NOISE AROUND THIS AC DRIVE AND SPINDLE DRIVEN BY THIS AC DRIVE. CONSIDER THE POWER SUPPLY SYSTEM, INSTALLATION PLACE AND WIRING METHOD BEFORE INSTALLATION.

INSTALL THIS AC DRIVE AWAY FROM DEVICES THAT HANDLE MINUTE SIGNALS, SUCH AS MEDICAL EQUIPMENT IN PARTICULAR. ALSO SEPARATE THE DEVICES ELECTRICALLY, AND TAKE SUFFICIENT NOISE MEASURES.

• TAKE SUFFICIENT SAFETY MEASURES WHEN USING THIS AC Drive FOR PASSENGER TRANSPORTATION, SUCH AS IN ELEVATORS (LIFTS).

Precautions For Safety

Items to be observed to prevent physical damage or property damage and to ensure safe use of this product are noted on the product and in this instruction manual.

- Please read this instruction manual and enclosed documents before starting operation to ensure correct usage. Thoroughly understand the device, safety information and precautions before starting operation. After reading, always store this manual where it can be accessed easily.

- The safety precautions are ranked as "**DANGER**" and "**CAUTION**" in this instruction manual.

: When a dangerous situation may occur if handling is mistaken, leading to fatal or major injuries.

: When a dangerous situation may occur if handling is mistaken, leading to medium or minor injuries, or physical damage.

Note that some items described as 

may lead to major problems depending on the situation. In any case, important information that must be observed is described.

This instruction manual is written on the presumption that the user has an understanding of the AC Drive. A qualified person must do installation, operation, maintenance and inspection of this product. Even qualified persons must undergo periodic training.

Qualified refers to satisfying the following conditions.

- ✓ The person has thoroughly read and understood this instruction manual.
- ✓ The person is well versed in the installation, operation, maintenance and inspection of this product, and understands the possible dangers.
- ✓ The person is informed on matters related to starting, stopping, installation, locks and tag displays, and has been trained in the operation and remedies.
- ✓ The person has been trained on the maintenance, inspection and repairs of this product.
- ✓ The person has been trained on protective tools used to ensure safety.

KEEP SAFETY FIRST IN YOUR SYSTEM

AMTECH puts the maximum effort into making products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with AC Drive may lead to personal injury, fire or property damage. Remember to give due consideration to safety when making your system, with appropriate measures such as isolating devices, mechanical brakes, prevention against any malfunction or mishap.

CHAPTER- 1: DELIVERY, INSPECTION AND STORAGE

⚠ CAUTION

- ✓ Always transport the product with an appropriate method according to the products weight.
  Failure to observe this could lead to injuries.
- ✓ Do not place the product near inflammable items.
  Failure to observe this could lead to fires.
- ✓ Do not hold the product with front cover while transporting the product.
  Failure to observe this could lead to injuries from dropping.
- ✓ Do not let conductive materials such as screws or metal pieces and inflammable materials such as oil enter the product.
  Failure to observe this could lead to fires.
- ✓ Install the product in a place that can withstand the weight of the product, and follow the instruction manual.
  Failure to do so could lead to injuries from dropping.
- ✓ Do not install and operate an AC Drive that is damaged or that has missing parts.
  Failure to observe this could lead to injuries.
- ✓ Always observe the conditions described in the instruction manual for the installation environment.
  Failure to observe this could lead to faults.

1-1 Delivery, Inspection And Storage

AXPERT Eazy Series High Frequency Drive has gone through rigorous quality control tests at the factory before shipment. After receiving the AC drive, check for the following.

(1) Check to make sure that the package includes a High Frequency Drive and User Manual

(2) Remove the unit from packaging, and check the details on the rating nameplate to confirm that the AC Drive is as ordered.

(3) Confirm that the product has not been damaged during shipment.

The *AXPERT Eazy* Series High Frequency Drive should be kept in the shipping carton before installation. In order to retain the warranty coverage, the AC Drive should be stored properly when it is not to be used for an extended period of time. Some storage suggestions are:

(1) Store in a clean, dry location.

(2) Store within an ambient temperature range of -20°C (-4°F) to +70°C (158°F).

(3) If possible, store in an air-conditioned environment where the relative humidity is less than 95%, non-condensing.

(4) Do not store the High Frequency Drive in places where it could be exposed to corrosive gases.

(5) Do not store the High Frequency Drive on a shelf or on an unstable surface.

(6) If the High Frequency Drive is not to be used for a while (more than 2 months) after purchasing, store it in a place with no humidity or vibration in the packaged state.

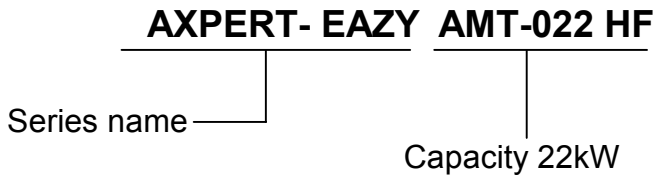
(7) Always inspect the High Frequency Drive before using after storing for a long period.

1-2 Details Of Rating Nameplate And Type Display Method

The following details are listed on the rating nameplate.

MODEL AXPERT-EAZY HF	: AMT022HF	KW: 22
INPUT AC 3-PHASE	: 380 - 460VAC,	50 / 60Hz
OUTPUT AC 3-PHASE	: 380 / 460VAC,	0.1 ~ 1800.0Hz
OUTPUT CURRENT	: 44A	
SERIAL NO	: XXXXX	
S/W VERSION	:	

Using the above type as an example, the type is displayed as follows:



CHAPTER- 2: INSTALLATION AND WIRING

This chapter provides the information needed to properly **install** and **wire** the AC Drive. Make sure that the AC Drive is wired according to the instructions contained in this chapter. The instructions should be read and understood before the actual installation begins.

⚠ CAUTION

- ✓ Install the AC Drive, dynamic braking unit and resistor, and other peripheral devices on noncombustible material such as metal.
  Failure to observe this could lead to fires.
- ✓ Do not place the product near inflammable items.
  Failure to observe this could lead to fires.
- ✓ Do not let conductive materials such as screws or metal pieces and inflammable materials such as oil enter the product.
  Failure to observe this could lead to fires.
- ✓ Install the product in a place that can withstand the weight of the product.
  Failure to do so could lead to injuries from dropping.
- ✓ Do not install and operate AC Drive that is damaged or that is missing parts.
  Failure to observe this could lead to injuries.
- ✓ Always observe the conditions described in the instruction manual for the installation environment.
  Failure to observe this could lead to faults.
- ✓ Install an overheating protection device on the dynamic braking resistor, and shut off the power with this fault signal.
  Failure to do so could lead to fires in the event of abnormal overheating.

2-1 Installation Environment

Observe the following points when installing the AC Drive.

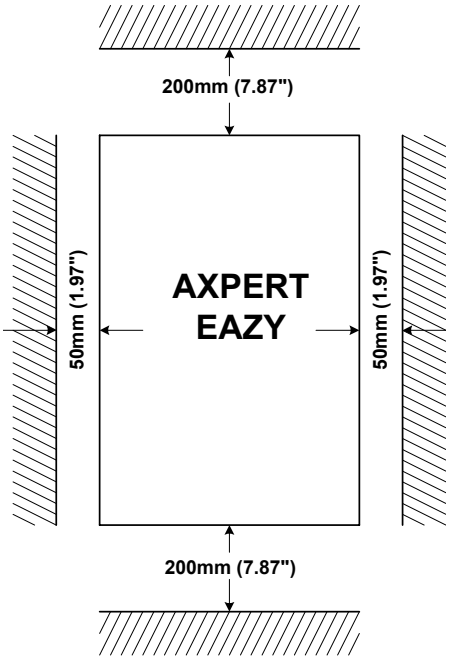
(1) Install the AC Drive vertically to provide proper ventilation.

(2) Make sure that the ambient temperature is –10°C (14°F) to 50°C (122°F).

(3) Avoid installation in the following environment.

- Places subject to direct sunlight
- Places with oil mist, dust or cotton lint, or subject to salty winds
- Places with corrosive gas, explosive gas or high humidity levels
- Places near vibration sources such as dollies or press machines
- Places made of in-flammable materials such as wood, or places that are not heat resistant

(4) Ensure ventilation space around the AC Drive as shown in the below figure.



2-2 Precautions For Power Supply And Spindle Wiring

DANGER

- Always turn the device's input power OFF before starting wiring.
  Failure to do so could lead to electric shocks or fires.
- Carry out grounding that complies with the standards of the country where the AC Drive is being installed.
  Failure to do so could lead to electric shocks or fires.
- Wiring must always be done by a qualified electrician
  Failure to observe this could lead to electric shocks or fires.
- Always install the device before starting wiring.
  Failure to do so could lead to electric shocks or injuries.
- Use circuit breaker or fuses that match with the capacity of AC Drive power supply.
  Failure to do so could lead to fires.

CAUTION

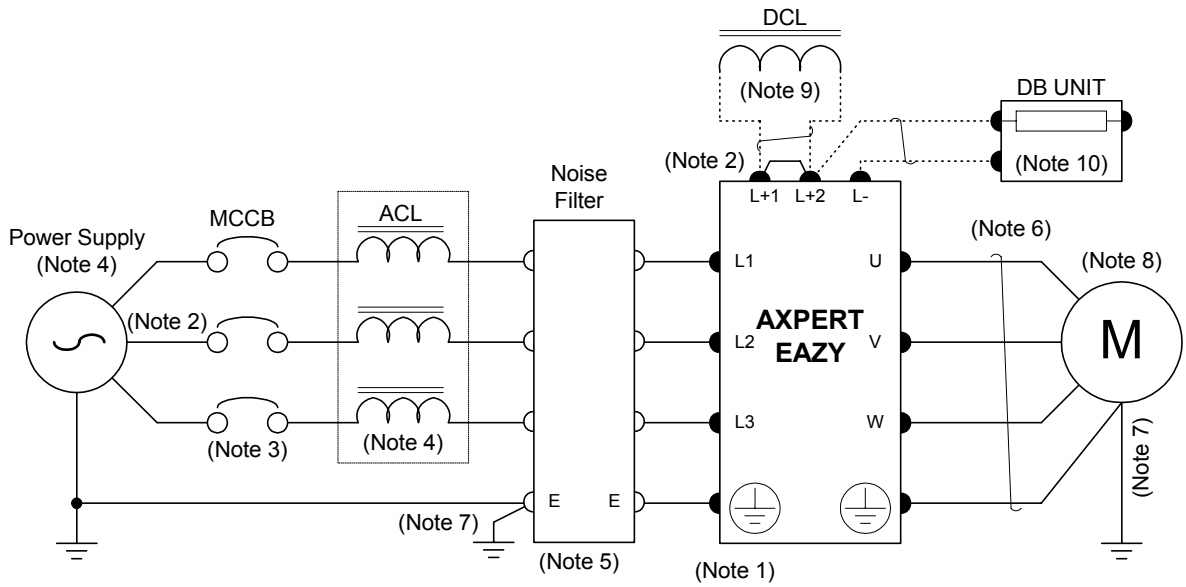
- ✓ Do not connect an AC power supply to the output terminals (U, V, W) and DC terminals (L+1, L+2, and L–).
  Failure to observe this could lead to injuries or fires.
- ✓ Confirm that the product's rated input voltage and frequency match the power supply voltage and frequency.
  Failure to do so could lead to injuries or fires.
- ✓ Install an overheating protection device on the dynamic braking resistor, and shut off the power with this fault signal.
  Failure to do so could lead to fires in the event of abnormal overheating.
- ✓ Do not directly connect a resistor to the DC terminals (L+1, L+2, and L–).
  Failure to observe this could lead to fires.
- ✓ Tighten the terminal screws with the designated tightening torque.
  Failure to do so could lead to fires.
- ✓ Correctly connect the output (U, V, W) to Spindle terminals to ensure proper phase sequence.
  Failure to do so could cause the Spindle to rotate in reverse and the machine to be damaged.

Refer to below figure and wire the main circuits for the power supply and Spindle, etc.
Always observe the following precautions for wiring.

CAUTION

There is a risk of electric shocks.
The AC Drive has a built-in electrolytic capacitor, so a charge will remain even when the AC Drive power is turned off. Always observe the following items before carrying out the wiring work.

- ✓ Wait at least 20 minutes after turning the power off before starting work. Make sure that the displays on the Digital Operation Panel have gone out before removing the cover.
- ✓ After removing the cover, confirm that the “DC BUS CHARGE LED“ in the unit on bleeder board has gone out. Also check that the voltage between terminals L+1 or L+2 and L- is 15V or less before starting the inspections.



EXAMPLE OF MAIN CIRCUIT WIRING

(Note 1) AC Drive input / output terminals

The AC Drive input terminals are L1, L2 & L3. The output terminals to the Spindle are U, V & W. Connect the power supply to input terminals L1, L2 & L3 only. Never connect the power supply to the U, V, and W terminals. Incorrect wiring will lead to AC Drive damage or fires.

(Note 2) Wire size

Use wires having the size (or larger) shown in the below table for the main circuit wiring shown in the above figure. The applicable wire size range, applicable ring terminal and tightening torque for the main circuit terminals are shown in the table.

AXPERT Eazy AMT-□□□HF		**1P5**	**2P2**	**4P0**	**5P5**	**7P5**	**011**	**015**	**018**	**022**	**030**	**037**
Rated Capacity	**kW**	1.5	2.2	4.0	5.5	7.5	11	15	18	22	30	37
	Hp	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50
Rated Current (A)		3.6	5.5	8.6	13	17	23	31	37	44	60	73
Applicable Spindle kW		1.5	2.2	4.0	5.5	7.5	11	15	18	22	30	37
Applicable wire for Input / Output	mm^2	0.8	0.8	2	3.5	5.5	5.5	8	14	14	35	35
	AWG	18	18	14	12	10	10	8	6	6	2	2

(Note 3) Breaker for wiring

Install circuit breaker or fuse on the power supply side of the AC Drive. Refer to table and select the Circuit Breaker or Fuses.

(Note 4) Power supply capacity

Make sure that the capacity of the transformer used as the AC Drive's power supply is 10 times (or less) AC Drive capacity (for 4% impedance transformer). If the above value is exceeded or multiple drives are being fed from the same line with only the wiring impedance between them, install an ACL on the AC Drive's input side.

If improperly sized, the voltage drop on a line reactor can reduce the voltage on drive terminals especially at high load. In that case the Spindle current will also increase and DC Bus under voltage fault may occur.

(Note 5) Noise filter

The AC Drive will generate high harmonic electromagnetic noise, so using the following noise measures is recommended.

- Insert a noise filter on the input side of the AC Drive. Contact Amtech to select the proper noise filter.
- Keep the wiring length between the noise filter and AC Drive to 500 mm (19.69") or less.
- Use a shield cable for the AC Drive and Spindle wiring and connect the screen to the AC Drive's ⏚ terminal.
- When using the control circuit wiring and power circuit wiring in parallel, separate the wiring by 300mm (11.8") or more or pass each of the wiring through separate metal conduits. If the control circuit wiring and main circuit wiring intersect, make sure that they intersect at a right angle.

(Note 6) AC Drive output

Do not insert a power factor improvement capacitor on the output side of the AC Drive. When inserting a magnetic contactor on the output side of the AC Drive, prepare a sequence control circuit so that the magnetic contactor will not open and close when the AC Drive is running.

(Note 7) Grounding

Always ground the AC Drive unit according to the regulations of the country where the AC Drive is being used.

(Note 8) AC Drive output surge voltage

As the AC Drive output cable is lengthened, the surge voltage applied on the Spindle also increases. If the wiring between the AC Drive and Spindle exceeds 20 meters (65.6"), connect a surge absorber dedicated for the AC Drive output.

(Note 9) DCL

Always short across L+1 and L+2 when not using the DCL (factory setting state). When connecting the optional DCL, connect it to L+1 and L+2. Twist the wiring to the DCL, and keep the wiring length to 5 meters (16.4") or less.

(Note 10) DB Unit

When connecting an optional DB unit, make the connections as shown in the main circuit wiring. The DB unit and AC Drive unit will damage if the connections are incorrect. Twist the wiring to the DB unit, and keep length to 3 meters (9.8") or less.

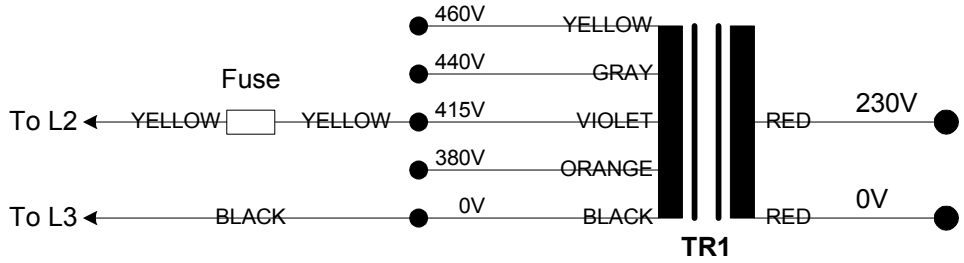
When using the external DB unit, use the overload detection relay or thermal relay to protect the DB resistor and AC Drive.

(Note 11) Surge absorber

Install a surge absorber on the magnetic contactor and relay coils installed near the AC Drive.

(Note 12) Voltage Selection for the auxiliary equipment Power Supply (Applicable to models above 22kW)

Ensure appropriate tapping for the control transformer, which provides the power supply to the auxiliary equipments like fan/blower, soft charge contactor etc. Note that this not applicable to the models up to 22kW.



(Note 13) Output Transformer

Output transformer must be custom designed for each drive and required voltage frequency of Spindle. If the output transformer is not properly sized, drive and/or spindle may damage.

- In high frequency application when spindle voltage is significantly lower (360V) than the line voltage available.
- For increasing the output current without increasing the drive current rating (output voltage reduction).

2-3 Precautions For Wiring To Control Signals

- ✓ When wiring (control circuit wiring) to the control terminal block, separate the main circuit wiring (terminals L1, L2, L3, L+1, L+2, L-, U, V, W) and the other drive wires and power wires.
- ✓ Use a 0.13mm^2 (AWG 26) to 0.8mm² (AWG 18) wire for wiring to the control circuit. The tightening torque must be 0.6N.m (5.3lb-inch).
- ✓ Use a twisted pair wire or twisted pair shield wire for wiring to the analog signal circuit such as the analog references and meters. Connect the shield wire to the 0V terminal of the unit. The wire length must be 30 meters (98.4”) or less.
- ✓ The length of the sequence input/output contact wire must be 50 meters (164”) or less.
- ✓ The sequence input can be changed between sink logic and source logic by changing the jumper position JP1 in PCA-2014A between “SINK” and “SOURCE” position respectively. Open cover designated as “Control Unit” to access this jumper.
- ✓ Observe the precautions listed in “**5. Control Input/Output Terminals**”
- ✓ After wiring, always check the mutual wiring.
- ✓ At this time do not carry out a megger check or buzzer check on the control circuit.

  • Are there any wire scraps or foreign matter left around the terminals?
  • Are any screws loose?
  • Is the wiring correct?
  • Is any terminal contacting any other terminal?

If so, take the necessary corrective measures before proceeding further.

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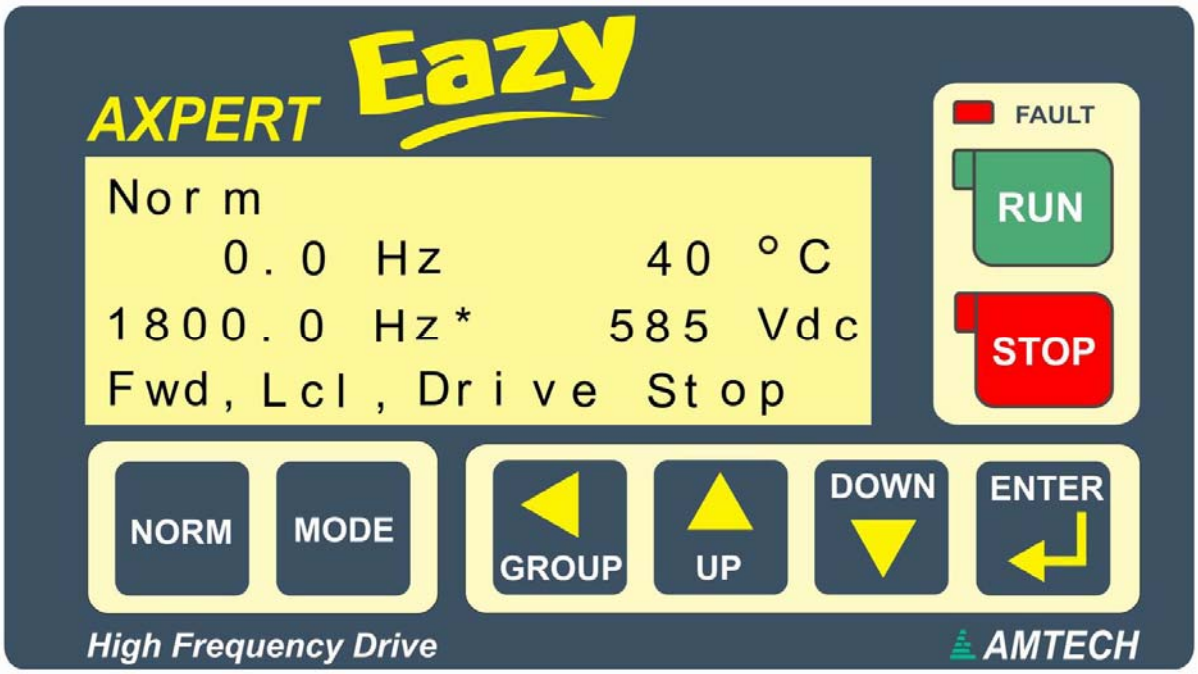
CHAPTER- 3: DIGITAL OPERATION PANEL (LCD KEYPAD MODULE)



The configuration of the Digital Operation Panel is shown in the below figure. The structure of it is as shown below.

The Digital Operation Panel is equipped with 8-keys as shown in the above figure. The function of each key is described below.

This key is utilized to reach to the normal screen of digital operator panel from any parameter, group or mode. The normal screen displays different parameters and status. This is the screen displayed at power on.

This key when pressed, passes the control to next successive modes i.e. NORM (Normal), MODE-M (Monitor), MODE-A, MODE-B, MODE-C, MODE-D & Meter mode. After the end of all modes, it will carry the control again to first mode. When changing the mode, the last accessed parameter of last accessed group of successive mode will be displayed.

This key passes the control to next group in the same mode. The groups can be accessed only in the incremental direction. At last it will again come to the first group.

These keys are used to change parameter numbers & parameter value. When ENTER key is pressed, these keys are used to change the parameter value, otherwise it is used to navigate the parameters in upward / downward direction in the group.

This key is used to change and save the parameter value. When pressed first time, it will allow the user to change the parameter value using up and down keys. Once the desired value is set, it is pressed again to save the change value. Press NORM key instead of ENTER, to discard the change.

This key is used to start the AC Drive when the start control is through Digital Operation Panel. The key is equipped with the status indicating LED. It will glow, when the AC Drive is running.

This key is used to stop the AC Drive irrespective of the start control source. It is also used to reset the fault. The stop key is equipped with status indicating LED. It will glow when the AC Drive is off.

The Digital Operation Panel is also equipped with the fault indicating LED. It will flash in the fault condition. It is also equipped with four lines, 20-character LCD display for the user-friendly parameter navigation, monitoring and setting.

In the normal condition the screen will be as below.

User Selectable four parameters

	N	o	r	m															
Norm 1 →			0	.	0		H	z						0	.	0		A	m	p
Norm 2 →		5	0	.	0		H	z	*					0	0			%	L	
	F	w	d	,	L	c	l	,	D	r	i	v	e		S	t	o	p		

← Norm 3

← Norm 4

Spindle Direction

F	w	d
R	e	v

Start Select

L	c	l
T	m	l
S	r	l

Drive Status

*	*		F	a	u	l	t		*	*	
E	m	r	g	n	c	y		S	t	o	p
G	a	p		E	l	i	m	i		O	n
S	t	a	r	t		D	e	l	a	y	
J	o	g	g	i	n	g					
A	u	t	o		R	e	s	t	a	r	t
C	u	r	r	e	n	t		L	m	t	
V	o	l	t	a	g	e		L	m	t	
S	p	e	e	d		S	e	a	r	c	h
P	L	C	T		A	c	t	i	v	e	
N	o	r	m	a	l		R	u	n		
A	c	c	e	l	e	r	a	t	i	o	n
D	e	c	e	l	e	r	a	t	i	o	n
D	C		B	r	e	a	k	i	n	g	
D	r	i	v	e		S	t	o	p		
M	a	i	n	s		O	n				

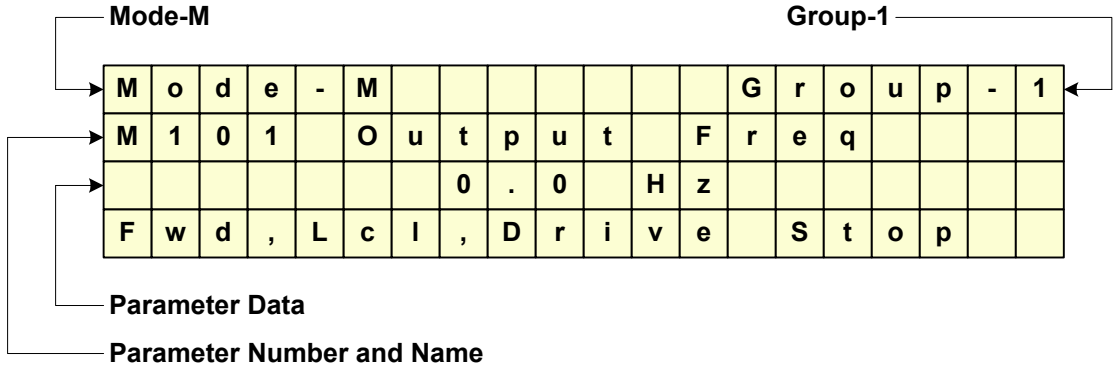
The above figure also indicates the selected direction of rotation, start selection and drive status. The four user selectable parameters can be configured using A601 ~ A604.

3- 1 Drive Status

The fourth line of the Digital Operation Panel (LCD Keypad Module) is used to display different status of the unit as shown above**.** More than one status can exist at one time. In this case, the status having higher priority will be displayed. The priority is as shown in the figure. Fault has the highest priority and mains on have least priority.

NO	NAME	DESCRIPTION
1	*Fault*	It indicates that some fault has occurred in the unit.
2	*Emergency Stop*	It shows that the unit is stopped due to emergency stop command.
3	*Gap Elimi On*	It shows gap eliminator output is on.
4	*Start Delay*	It shows that the start is delayed by the programmed start delay.
5	*Jogging*	It shows that the jog select input is active and present operation is jogging.
6	*Auto Restart*	It shows that auto restart function is in operation.
7	*Current Limit*	It shows that the current limit function is active.
8	*Voltage Limit*	It shows that the dc bus voltage control function is active.
9	*Speed Search*	It shows that the speed search operation is in progress.
10	*PLCT Active*	It shows that the Power-Loss-Carry-Through function is in progress.
11	*Normal Run*	It shows that ramp up / down action is over and unit is running in normal condition.
12	*Acceleration*	It shows that the unit is accelerating to the set speed.
13	*Deceleration*	It shows that the unit is decelerating.
14	*DC Breaking*	It shows that the dc breaking is active.
15	*Drive Stop*	It shows that the AC Drive is in stop condition.
16	*Mains On*	It shows that the mains power supply is on.

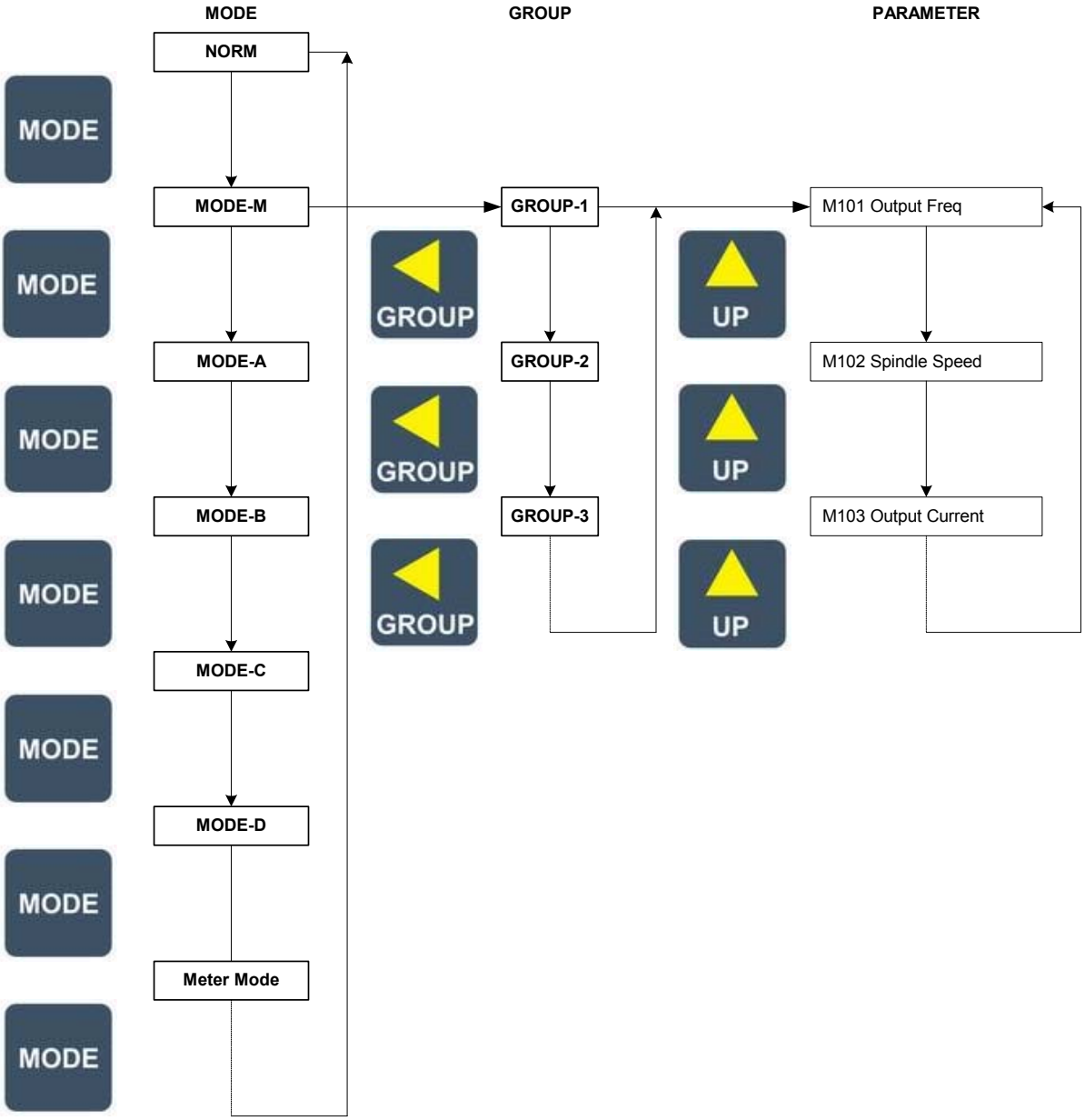
When first time MODE key is pressed, lastly accessed parameter of lastly accessed group of Mode-M will appear with its data. Below figure shows the parameter M101 of Group-1 of Mode-M.



The first line indicates the present mode and group. The second line indicates the parameter number with its name and the third line shows its value. The fourth line shows the present status and remains all the time except fault condition, contact information and fault history.

3-2 Modes & Parameters

The parameters are grouped into Modes and Groups according to their functions.
The configuration of the parameters is as under.



CAUTION

✓ Do not remove or insert the display cable between PCA-2014A (Main Control Card) and PCA-2012 (Display Card) in power-energized condition.
Failure to observe this could lead to component failure and tripping of the unit.

CHAPTER- 4: TEST OPERATION AND ADJUSTMENT

DANGER

- Always install the front cover before turning the input power ON. Never remove the cover while the power is ON. There are sections in the front PCB that are charged with high voltages.
  Failure to observe this could lead to electric shocks.
- Never touch the switches with wet hands.
  Failure to observe this could lead to electric shocks.
- Never touch the AC Drive's terminals while the AC Drive power is ON even if the operation is stopped.
  Failure to observe this could lead to electric shocks.
- Selection of the restart function could lead to unexpected restarting when a fault occurs. The machine may start suddenly if the power is turned ON, if the run command is present. Do not go near the machine.
  (Design the machine so that physical safety can be ensured even if the machine restarts.)
  Failure to do so could lead to injuries.
- The machine may not stop according to the set deceleration time when a stop command is issued if the ramp down to stop function is selected and the voltage / current limit function is activated. Prepare a separate emergency stop switch in such cases.
  Failure to do so could lead to injuries.
- Resetting of a fault while the run signal is input could lead to restarting. Always confirm that the run signal is OFF before resetting the fault.
  Failure to do so could lead to injuries.

CAUTION

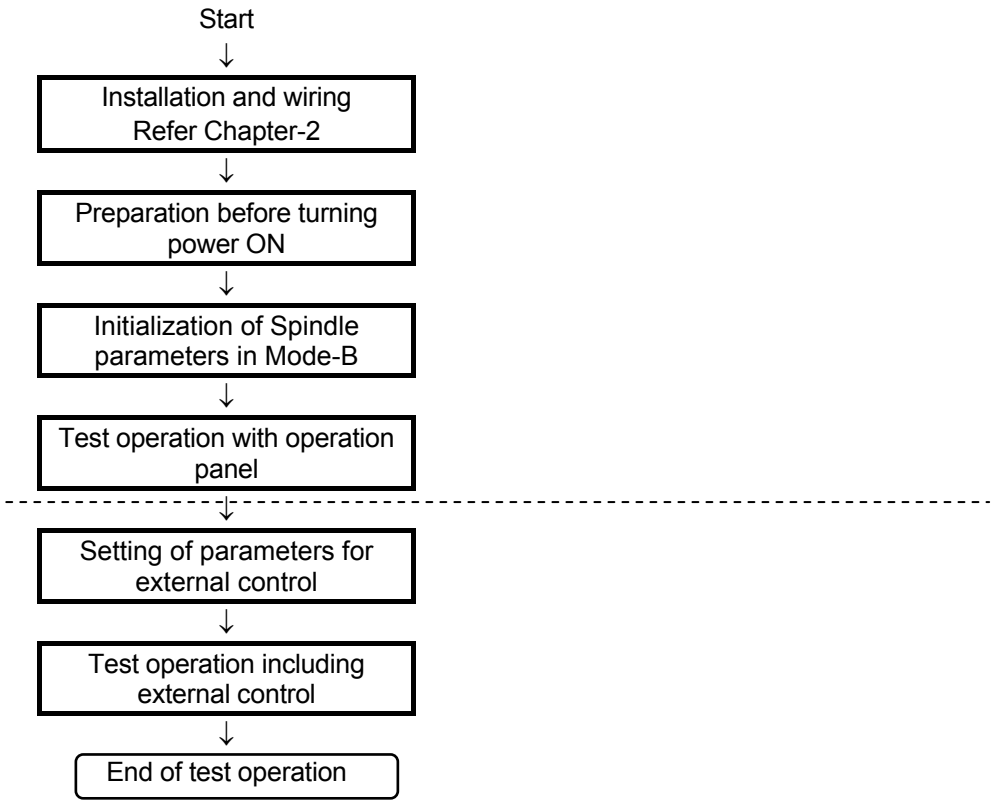
- ✓ The heat sink, chokes and dynamic braking resistor are heated to high temperatures, so never touch them.
  Failure to observe this could lead to burns.
- ✓ Do not block the AC Drive's ventilation holes.
  Failure to observe this could lead to fires.
- ✓ The AC Drive operation can easily be set from low speeds to high speeds, so confirm that the operation is within the tolerable range for the Spindle or machine before making settings.
  Failure to do so could lead to injuries.
- ✓ Prepare holding brakes when necessary. Holding is not possible with the AC Drive's brake functions.
  Failure to do so could lead to injuries.
- ✓ Confirm the operation of the Spindle as a single unit before operating the machine.
  Failure to do so could lead to injuries or machine damage due to unforeseen movements.
- ✓ Always prepare a safety backup device so that the machine is not placed in a hazardous situation when an error occurs in the AC Drive.
  Failure to do so could lead to injuries or machine damage or fires.

The Axpert Eazy HF Series AC Drive has various setting items. Some of these include settings that must be made according to the power supply and Spindle before actually starting the operation.

The method of the basic operation is explained in this section.

Carry out test operation according to the flow shown below

The procedures above the dotted line in the below fig are explained in this section.



4-1 Preparation before turning power ON

Always confirm the following points before turning ON the power after completing wire.

(1) Remove the coupling and belt coupling the Spindle and machine, so that the machine can be run as a single unit.

(2) Confirm that the power supply cables are correctly connected to the input terminals (L1, L2, and L3).

(3) There are some sections in the inverter, which operate with an AC power supply, such as fan/blower and magnetic contactor. In this case, select the appropriate tapping of the control transformer on the control terminal block inside the unit. Remove the front cover to access the control terminal block.

(4) Make sure that the power voltage and frequency is within the tolerable range.

(5) Refer to Chapter-2: Installation & Wiring and correctly connect the main circuit wiring.

(6) Securely fix the Spindle with the specified method.

(7) Make sure that none of the terminal section screws are loose.

(8) Make sure that there is no short circuit state in the terminals caused by wire scraps, etc.

(9) Always correctly install the front cover and outer cover before turning the power ON.

(10) Assign an operator, and make sure that the operator operates the switches.

Make sure that there is no abnormal noise, smoke or odors at this time. If any abnormality is found, turn the power OFF immediately.

4-1-1 Selection of Start Control

The Axpert Eazy HF Drive can be controlled from various places like Digital Operation Panel (Local), Terminal or from PC. Select appropriate start control in A301. Use Digital Operation Panel (Local) during the test operation.

A301: Start Control
- =1: Local
- =2: Terminal
- =3: Serial

4-1-2 Selection of Frequency Reference Input

The Axpert Eazy AC Drive accepts frequency reference from various places like Digital Operation Panel (Local), Terminal or from PC. Select appropriate frequency reference input in A106. Use Digital Operation Panel (Local) during the test operation.

A106: Frequency Reference Input
- =1: Local (Digital Operation Panel)
- =2: FSV 0-10V
- =3: FSI 4-20mA
- =4: FSV 0-5V
- =5: FSI 0-20mA
- =6: FSV 10-0V
- =7: FSI 20-4mA
- =8: FSV 5-0V
- =9: FSI 20-0mA
- =10: Static pot
- =11: Serial
- =12: PID Output
- =13: IIN 4-20mA

Refer the diagram of selection process of frequency reference diagram for the better understanding of the flow frequency reference signal priorities.

4-1-3 Output Transformer Selections

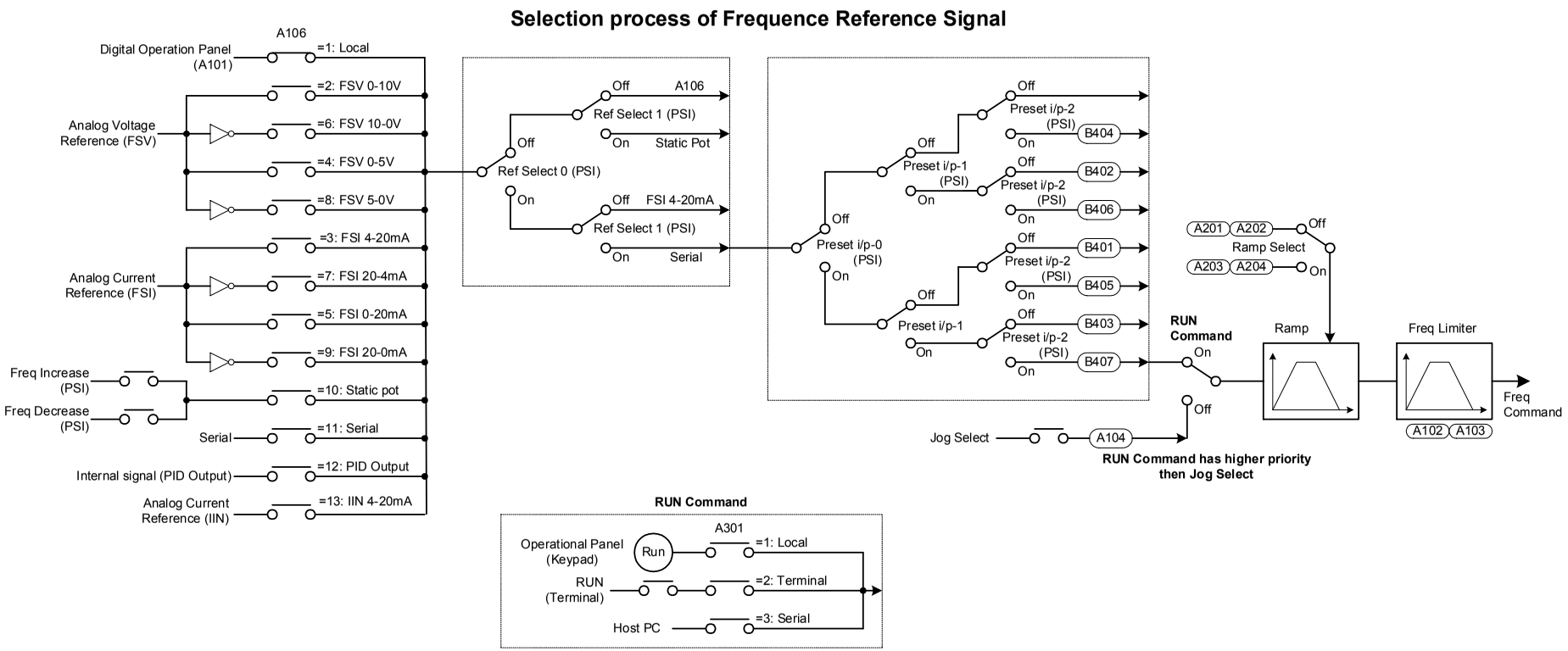
Output transformer must be custom designed for each drive and the required voltage/frequency of the spindle. If the output transformer is not properly sized, drive and / or spindle damage may result.

Output transformer is required when spindle voltage is significantly lower than the line voltage.

4-2 Initialization of Spindle parameters in Mode-B

Input the Spindle rating parameters. Set the following parameters in Mode-B.

B101: Rated Input Voltage (V)
B102: Spindle Voltage (V)
B103: Spindle Current (A)
B104: Spindle Frequency (Hz)
B105: Spindle Speed (KRPM)
B106: Spindle Output (kW)
B107: Spindle Poles


Selection process of Frequence Reference Signal
A106
Digital Operation Panel (A101)
=1: Local
=2: FSV 0-10V
Analog Voltage Reference (FSV)
=6: FSV 10-0V
=4: FSV 0-5V
=8: FSV 5-0V
=3: FSI 4-20mA
Analog Current Reference (FSI)
=7: FSI 20-4mA
=5: FSI 0-20mA
=9: FSI 20-0mA
Freq Increase (PSI)
Freq Decrease (PSI)
=10: Static pot
Serial
=11: Serial
Internal signal (PID Output)
=12: PID Output
Analog Current Reference (IIN)
=13: IIN 4-20mA
Off
Ref Select 0 (PSI)
On
Off
A106
Ref Select 1 (PSI)
On
Static Pot
Off
FSI 4-20mA
Ref Select 1 (PSI)
On
Serial
Off
Preset i/p-0 (PSI)
On
Off
Preset i/p-1 (PSI)
On
Off
Preset i/p-1
On
Off
Preset i/p-2 (PSI)
On
B404
Off
Preset i/p-2 (PSI)
On
B402
Off
Preset i/p-2 (PSI)
On
B406
Off
Preset i/p-2 (PSI)
On
B401
Off
Preset i/p-2 (PSI)
On
B405
Off
Preset i/p-2 (PSI)
On
B403
Off
Preset i/p-2 (PSI)
On
B407
RUN Command
On
Off
Jog Select
A104
RUN Command has higher priority then Jog Select
A201
A202
Off
Ramp Select
A203
A204
On
Ramp
Freq Limiter
A102
A103
Freq Command
RUN Command
A301
Operational Panel (Keypad)
Run
=1: Local
RUN (Terminal)
=2: Terminal
Host PC
=3: Serial

4-3 Test operations

When finished with above steps, test run the isolated Spindle, and make sure that there are no errors.

Use Digital Operation Panel mode to test run the Spindle. Initially set 10.0Hz and press “RUN” key to start the Spindle.

Check

- Did the Spindle run?

- Is the run direction correct? Check the wiring and operation if abnormal.

- Is the rotation smooth?

Select “REVERSE” direction in ‘A305: Spindle Direction’ and Press “RUN” and confirm that the Spindle runs normal in reverse direction.

(Note) Do not carry out this step if a load, which cannot be run in reverse, is connected.

Press the “STOP” key and stop the Spindle.

Now, again set the “FORWARD” direction win ‘A305: Spindle Direction’ and increase the frequency to 50Hz.

This completes the test operation with the operation panel.

After this, carry out the parameter settings and adjust the load operation to match the user's application.

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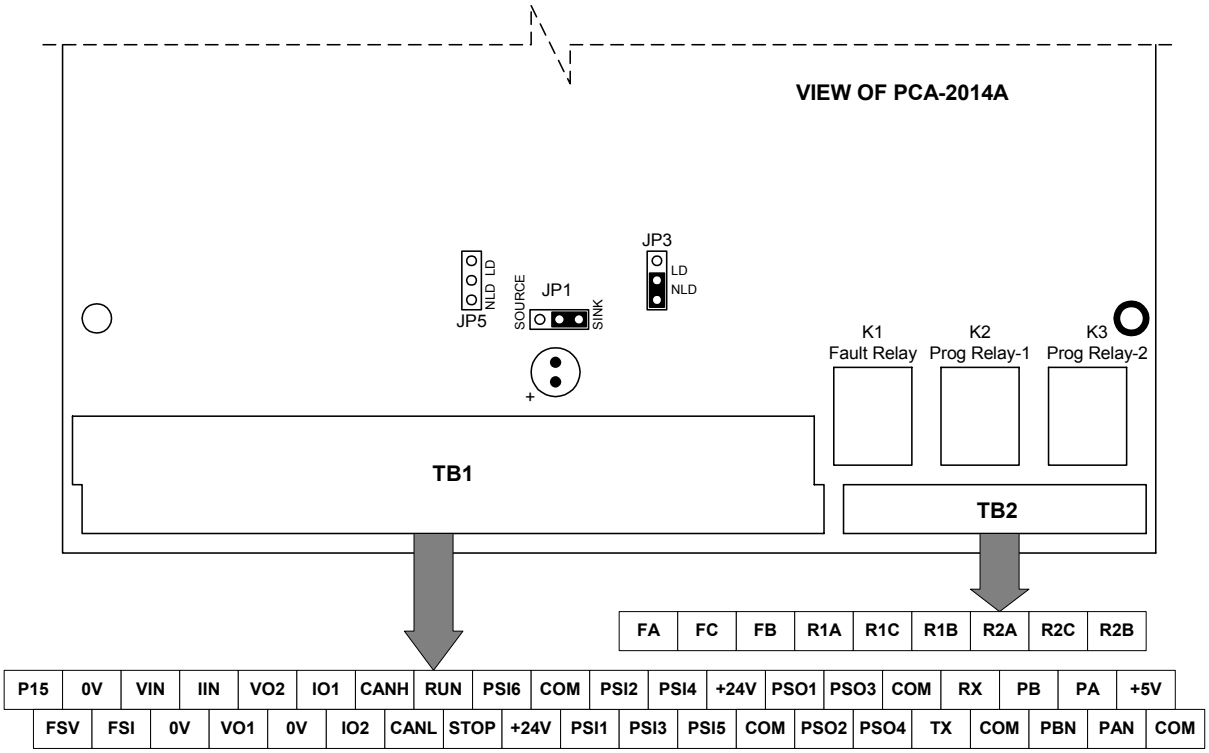
CHAPTER- 5: CONTROL INPUT / OUTPUT TERMINALS

5-1 Input / Output Terminal Functions Of PCA-2014A (Control Unit)



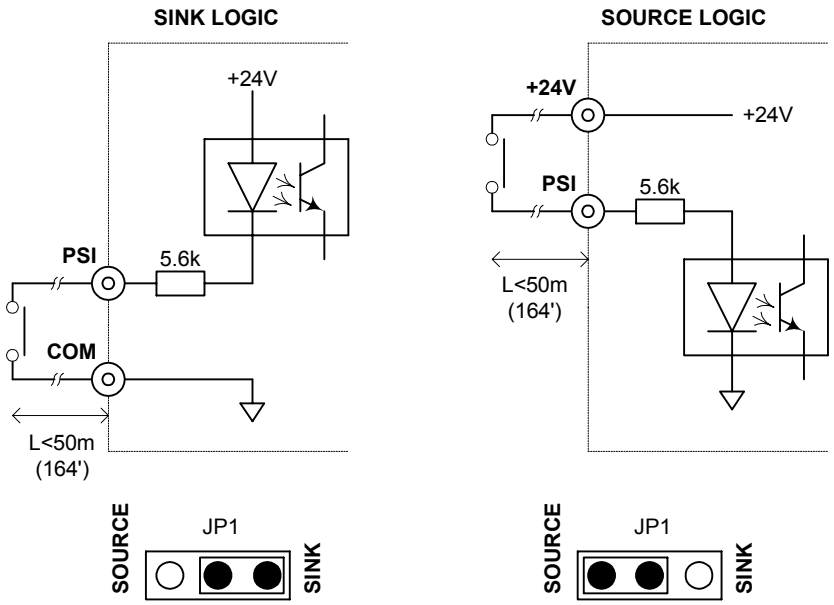
SYMBOL	NAME	USE
+24V	+24V source	This source is used for the Programmable Sequence Inputs. The logic for the Programmable Sequence Inputs can be changed to sink or source with the help of **JP1** on the control board.
COM		
RUN	RUN command (Programmable sequence I/P)	This is programmable sequence input and can be configured for different 26 functions using *C114*. Default function is 23: RUN. This is a command for forward run, when start control is terminal in *A301*. It can be programmed for maintained or momentary mode using *A302*. Use other sequence input to operate in reverse direction.
STOP	STOP command (Programmable sequence I/P)	This is programmable sequence input and can be configured for different 26 functions using *C115*. Default function is 24: STOP. This is stop command when start control mode is terminal in *A301* and momentary start/stop mode is selected in *A302.* It will not have any effect in maintained mode. This is not used as fault reset input.
PSI1-6	Programmable Sequence Inputs 1 ~ 6	These are programmable sequence inputs and can be configured for different 26 functions using *C101 ~ C106*.
PSO1-4	Programmable Sequence Outputs 1 ~ 4	These are programmable sequence outputs and can be configured for different 24 functions using *C107 ~ C110*.
P15	+15V source	This is a 10V source used when a frequency setter is connected to the FSV input circuit. The frequency setter to be used should be a variable resistor of 2k and 2W.
0V	Common	This is a common terminal for analog input signals.

FSV	Frequency Setting Voltage input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 10V input. This setting is valid when FSV 0-10V, FSV 0-5V, FSV 10-0V or FSV 5-0V is selected as frequency reference input in *A106* or *D101*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*).
FSI	Frequency Setting Current input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 20mA input. This setting is valid when FSI 0-20mA, FSI 4-20mA, FSI 20-0mA or FSI 20-4mA is selected as frequency reference input in *A106* or *D101*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*).
VIN	Voltage input (Reserved)	*Reserved*
IIN	Current Input	This is mainly used for setting the frequency (speed) input. A maximum frequency setting is available at 20mA input. This setting is valid when IIN 4-20mA is selected as frequency reference input in *A106*. Also, this input can be configured as PID Reference input (*C603*) or PID Feedback input (*C604*).
CANH, CANL	Spindle Thermistor Input	This terminal is used to connect output terminal from Spindle thermistor. User can select Spindle thermistor function with parameter B312. In this function drive will trip in SPINDLE HOT/THERMISTOR SHORT trip if drive will sense external resistor more than 4.2 kΩ or less than 30 Ω between CANH and CANL terminal. This function can be used to protect the spindle from over heating.
VO1	Vout-1	These are programmable analog voltage outputs 0-10V. In default condition, output frequency signal is assigned to VO1 and output current signal is assigned to VO2. Different six internal signals can be assigned to these outputs using *C201* & *C202*.
VO2	Vout-2	
IO1	Iout-1	These are programmable analog current outputs 4-20mA. In default condition, Spindle power signal is assigned to IO1 and output voltage signal is assigned to IO2. Different six internal signals can be assigned to these outputs using *C203* & *C204*.
IO2	Iout-2	
TX	DATA+	These two signals are for the two-wire RS-485 serial link. The protocol used is Modbus-RTU.
RX	DATA-	
PA	A-Phase Pulses (Reserved)	*Reserved*
PAN		*Reserved*
PB	B-Phase Pulses (Reserved)	*Reserved*
PBN		*Reserved*
+5V	+5V source (Reserved)	*Reserved*
FA	Programmable Fault Relay Contacts	This is programmable relay and its function is assigned to “Fault” in default. If “Fault” occurs, FAULT LED will be flashing on Digital Operation Panel & fault status will be displayed on LCD screen. The section FA-FC will close and the section FB-FC will open. 24 different internal signals can also be output with the help of *C113*.
FC		
FB		
R1A	Programmable Relay 1 contacts	This is programmable relay and its function is assigned to “Run” condition in default. When a programmed condition occurs, the section R1A-R1C will close and the section R1B-R1C will open. Other internal signals can also be output with the help of *C111*.
R1C		
R1B		

R2A	Programmable Relay 2 contacts	This is programmable relay and its function is not assigned to any internal signal in default. When any function is assigned using *C112* and the programmed condition occurs, the section R2A-R2C is closed and the section R2B-R2C is open.
R2C		
R2B		

The control circuit wiring is shown as under. The described precautions must be observed during wiring. Changing the jumper position **JP1** in PCA-2014A between "SINK" and "SOURCE" position can change the sequence input between sink logic and source logic. Open cover designated as "Control Unit" to access this jumper. ***The unit is shipped with sink logic.***

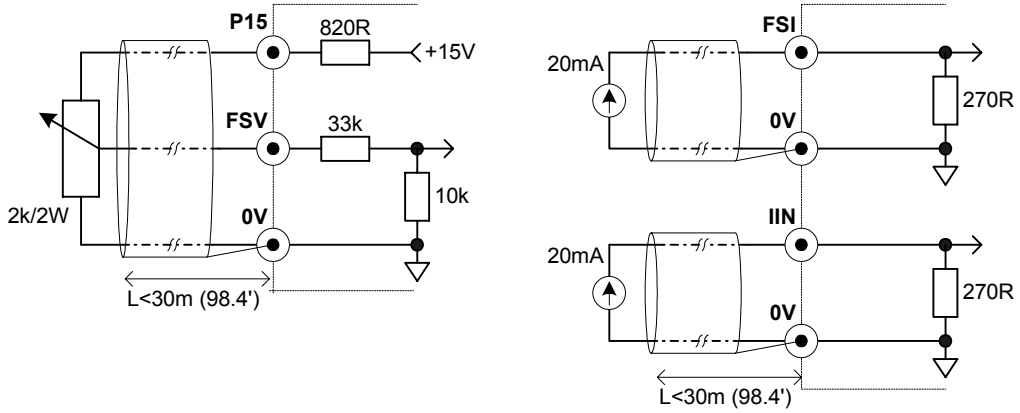
5-2 Programmable Sequence Input (PSI) Wiring



Precautions

1. Wiring must not be longer than 50meters (164').
2. Use minute current contact.
3. Do not connect to the analog input / output.
4. The sink / source logic can be changed with JP1 as shown in the above figure.

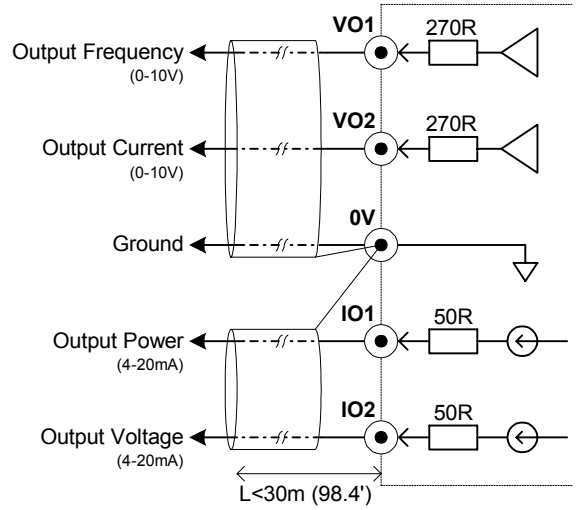
5-3 Programmable Analog Input (PAI) Wiring



Precautions

1. Use 2kΩ / 2W rating potentiometer for the external variable resistor.
2. The maximum input rating of FSV is 0 to 10.5V
3. Use a shielded wire shorter than 30meters (98.4') for the wiring.
4. For the shield connections, open the mate side, and connect to 0V terminal on TB1.
5. The maximum input rating for FSI is 0 to +21mA or 5.67V.
6. Do not connect to the sequence input.

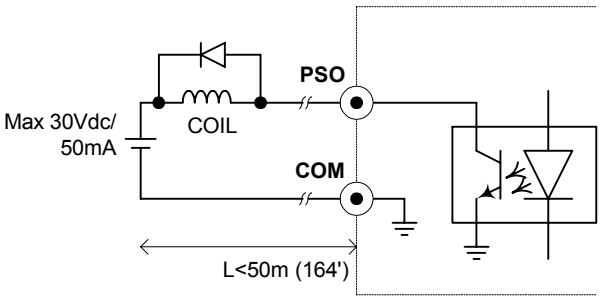
5-4 Programmable Analog Output (PAO) Wiring



Precautions

1. Use 10V full-scale meter (impedance 10k or higher).
2. The maximum output current is 1mA for voltage output.
3. Use a shielded wire shorter than 30meters (98.4') for the wiring.
4. For the shield connections, open the mate side, and connect to 0V terminal on TB1.

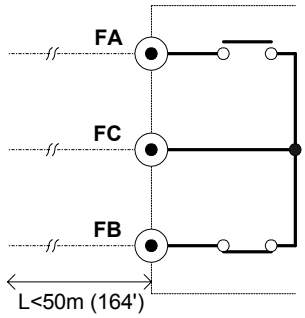
5-5 Programmable Sequence Output (PSO) Wiring (open collector type)



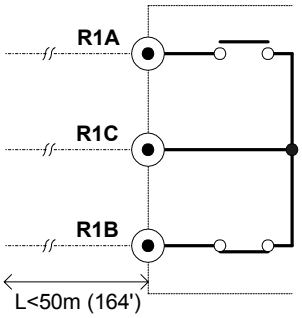
Precautions

1. To drive an L load, such as a coil, insert the flywheel diode shown in the drawing.
2. Keep the wiring length to 50meters (164') or less.
3. Use within the 30VDC, 50mA ratings range.

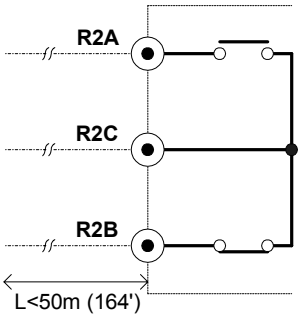
5-6 Programmable Sequence Output (PSO) Wiring (Relay)



PROGRAMMABLE FAULT RELAY



PROGRAMMABLE RELAY1



PROGRAMMABLE RELAY2

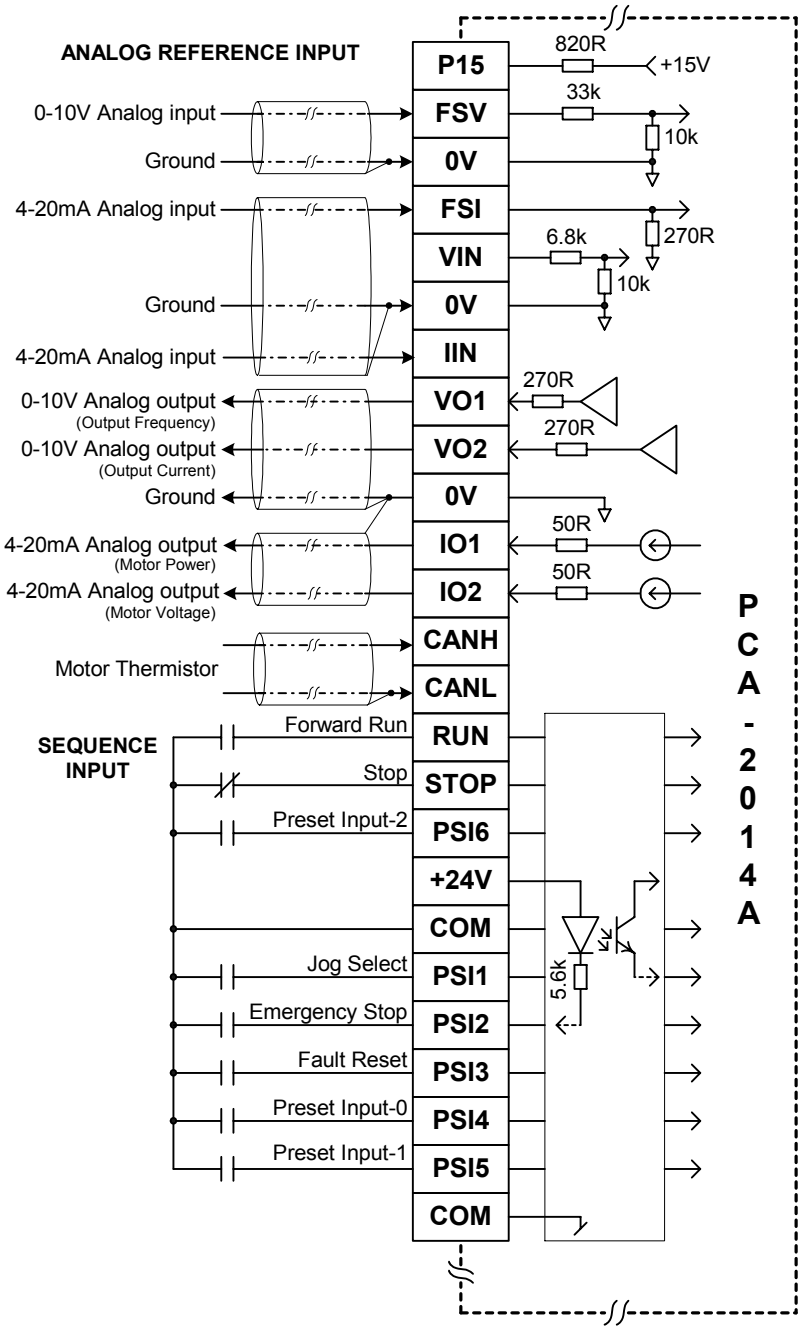
Precautions

1. Use within the rated range shown below.

Rated capacity (resistance load): 250VAC, 1A or 30VDC, 1A
Maximum Voltage: 250VAC
Max. Current: 1A
Switching capacity: 100VA / 100W

2. The wire must be shorter than 50meters (164’).

5-7 Default Function Assignments to Terminals



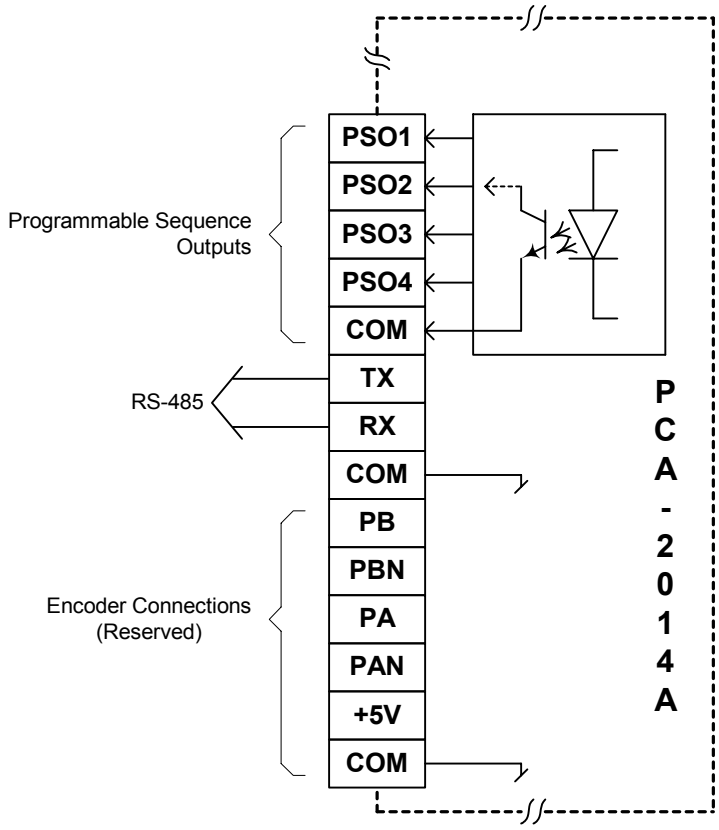
TB1

(Sink logic operation is considered in this diagram)

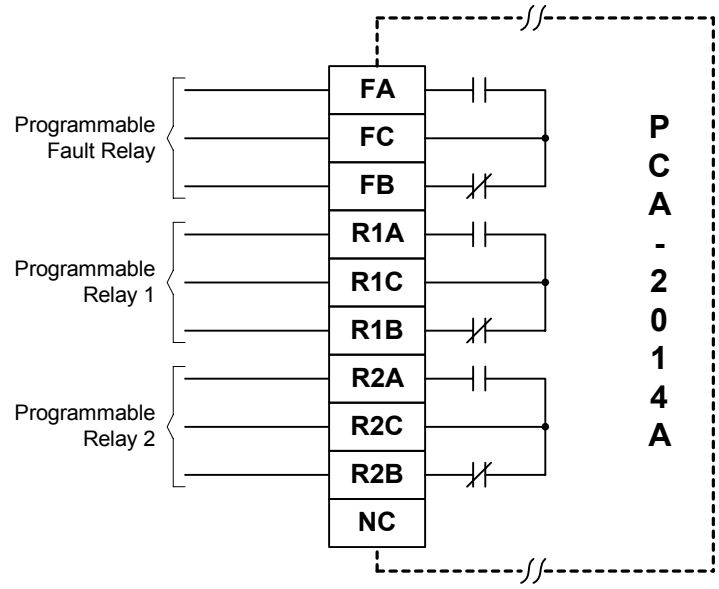
Jumper Position

1. The equipment is shipped with sink logic (JP1 is kept on **Sink** position) for the programmable sequence inputs. To change the sink logic to source, change the jumper JP1 position to **Source**.

2. The equipment is shipped with JP3 in **NLD** position. This means the terminating resistors are not in picture. To insert the terminating resistors, keep the jumper to **LD** position.


Programmable Sequence Outputs
PSO1
PSO2
PSO3
PSO4
COM
RS-485
TX
RX
COM
Encoder Connections (Reserved)
PB
PBN
PA
PAN
+5V
COM
PCA-2014A

TB1


Programmable Fault Relay
Programmable Relay 1
Programmable Relay 2
FA
FC
FB
R1A
R1C
R1B
R2A
R2C
R2B
NC
PCA-2014A

TB2

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CHAPTER- 6: PARAMETER SETTINGS & FUNCTIONS

MODE-M: Monitor Parameters

The monitor mode sequentially displays the frequency, power supply, etc., parameters.

No	Parameter	Unit	Res.	Description
GROUP-1				
M101	Output Frequency	Hz	0.1	It displays the output frequency (Hz) or output speed (KRPM) according to selection in A107. If the AC Drive is off, it will display zero.
M102	Spindle Speed	rpm	1	It displays the calculated Spindle speed or shaft rpm using line speed setting (A105 / D209..DG09)
M103	Output Current	Amp	0.1	It will display the output current. If the AC Drive is OFF, it will display zero.
M104	Output Current	%	1	The output current is displayed as % of Spindle rated current *B103*.
M105	Set Frequency	Hz	0.1	It displays currently set value of frequency (Hz) or speed (KRPM) according to selection in A107.
M106	Frequency Reference Input			The currently selected frequency setting input point in *A105* or *D101* will be displayed.
M107	PID Reference	%	0.1	Displays the value of currently selected PID reference in %.
M108	PID Feedback	%	0.1	Displays the value of currently selected PID feedback in %.
GROUP-2				
M201	Input Voltage Vry	Vac	1	Displays derived value of Input Voltage Vry from DC Bus.
M202	Input Voltage Vyb	Vac	1	Displays derived value of Input Voltage Vyb from DC Bus.
M203	Output Voltage	Vac	1	Displays output voltage command. The display may differ from the actual output voltage. It depends on the power supply voltage. It will display zero when AC Drive is OFF.
M204	DC Bus Voltage	Vdc	1	Displays the voltage of the DC bus in the main circuit.
M205	Output Power	κW	0.1	Displays the AC Drive output power.
M206	Energy Meter	κWH	0.1	Displays the energy consumed by the system in kWH.
M207	Energy Meter	MWH	1	Displays the energy consumed by the system in MWH.
M208	Heat sink Temperature	^{o}C	1	Actual heat sink temperature is displayed.
M209	Spindle Select		1	It displays the selected auxiliary Spindle. When main Spindle is selected it displays zero.
M210	Heat sink Temperature	^{o}F	1	Actual heat sink temperature is displayed in degree F.
GROUP-3				
M301	Total Conductivity Time	Hrs	1	The cumulative power on time after product shipment will be counted and displayed.
M302	Total Run Time	Hrs	1	The cumulative AC Drive run time after product shipment will be counted and displayed.
M303	Rated Current	Amp	0.1	This indicates the rated current of the AC Drive.
M304	Inverter Type	κW		This indicates the AC Drive type.
M305	Control Version			Indicates ROM version of DSP Control Board PCA-2014A.
M306	PSI-123456 Status			The ON/OFF state of various programmable sequence input will display.
M307	PSO-1234567 Status			The ON/OFF state of various programmable sequence o/p will display.
M308	Unit Serial Number			It displays the serial number of the unit.
M309	Ship Month			It displays the month of unit shipment.
M310	Ship Year			It displays the year of unit shipment.
M311	Display Version			Indicates ROM version of Display Board.

No	Parameter	Unit	Res.	Description
GROUP-4: FAULT HISTORY				
FLT-1	Fault 1			Most recent ten faults with DC bus voltage, frequency, current, temperature ^{o}C, Vry, kWH, MWH and Conduction time values at the time of fault will be displayed. Fault 1 indicates latest fault while successive faults give past faults in descending order.
FLT-2	Fault 2			
FLT-3	Fault 3			
FLT-4	Fault 4			
FLT-5	Fault 5			
FLT-6	Fault 6			
FLT-7	Fault 7			
FLT-8	Fault 8			
FLT-9	Fault 9			
FLT10	Fault 10			
GROUP-5: CONTACT				
This provides the manufacturers contact information.				

Amtech Electronics (India) Limited.
E-6, Electronics Zone
GIDC, Gandhinagar
Gujarat, INDIA
Pin: 382028
Ph: ++9179 23289101
Fax: ++9179 23289111
info@amtechelectronics .com
www.amtechelectronics.com

Amtech Drives, Inc
3852, Oakcliff Industrial Court
Doraville,
Georgia - 30340,
USA
Ph: 770 469 5240
Fax: 678 894 4043
www.amtechdrives.com

WP: Indicates that this parameter is Write Protected during RUN condition.

MODE-A Parameters

No	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-1: FREQUENCY SETTING								
A101	Local Set Frequency	Hz	50.0	0.1	1800.0	0.1	This is the frequency set from Digital Operation Panel (LCD Keypad Module). It can be set in Hz (0.1 resolution) or in KRPM (0.01 resolution) according to selection in A107.	
A102	Minimum Frequency	Hz	0.1	0.1	1800.0	0.1	These two parameters are used to configure Minimum and Maximum Frequency of the AC Drive. It can be set in Hz (0.1 resolution) or in KRPM (0.01 resolution) according to selection in A107.	
A103	Maximum Frequency	Hz	50.0	0.1	1800.0	0.1		
A104	Jog Frequency	Hz	5.0	0.1	A103	0.1	This is frequency setting for jog input.	
A105	Line Speed Setting	rpm	0	0	108000	1	RPM line speed display. The entered value will be displayed as Spindle speed in M102 at Maximum Frequency (A103). At zero value (default), Spindle speed (B105) will be displayed as Spindle speed in M102 at Maximum Frequency (A103).	
A106	Frequency Reference Input		1	1	13	1	This is used to select the speed reference. =1: Local =2: FSV 0-10V =3: FSI 4-20mA =4: FSV 0-5V =5: FSI 0-20mA =6: FSV 10-0V =7: FSI 20-4mA =8: FSV 5-0V =9: FSI 20-0mA =10: Static pot =11: Serial =12: PID Output =13: IIN 4-20mA	
A107	Set frequency Unit		0	0	1		This parameter is for frequency unit selection. If it is 0 then in A101 set point can be set in frequency (Hz) unit with 0.1 resolution. And if it is 1 then in A101 set point can be set in KRPM with 0.01 resolution. =0: Hz =1: KRPM	
GROUP-2: ACCELERATION / DECELERATION TIME								
A201	Acceleration Time-1	Sec	10.0	0.1	1200.0	0.1	Time needed to change the output frequency from zero to maximum.	
A202	Deceleration Time-1	Sec	20.0	0.1	1200.0	0.1	Time needed to change the output frequency from maximum to zero.	
A203	Acceleration Time-2	Sec	10.0	0.1	1200.0	0.1	The acceleration time and deceleration time for the second ramp function.	
A204	Deceleration Time-2	Sec	20.0	0.1	1200.0	0.1		
A205	S-Curve Selection		0	0	1	1	This will enable the s-curve shape during acceleration /deceleration. =0: Disable =1: Enable	✓
A206	S-Curve Time-1	Sec	0.1	0.1	600.0	0.1	The maximum value will depend on the currently selected ramp time.	
A207	S-Curve Time-2	Sec	0.1	0.1	600.0	0.1	The maximum value will depend on the currently selected ramp time.	
A208	Current Limit Acceleration Time	Sec	10.0	0.5	1200.0	0.1	This is ramp up time during the stall current limit.	
A209	Current Limit Deceleration Time	Sec	5.0	0.5	1200.0	0.1	This is ramp down time during the stall current limit.	

NO	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-3: START / STOP SELECTION & DC BRAKING								
A301	Start Control		1	1	3	1	Select start location. =1: Local =2: Terminal =3: Serial	
A302	Maintained Start / Stop		0	0	1	0	When using terminal start/ stop facility, this parameter gives the choice of having maintained or momentary contacts for start or stop. =0: The start control maintained type =1: The start/ stop control momentary type.	
A303	Start Delay Time	Sec	0.0	0.0	10.0	0.1	The Spindle will be delayed from the run command by the set time. This is used for synchronization with peripheral machines such as mechanical brakes.	
A304	Stop Mode		0	0	1	1	Select the stop method. =0: Ramp down to stop =1: Coast to stop	
A305	Spindle Direction		0	0	1	1	Select direction of Spindle rotation. =0: Forward =1: Reverse	
A306	DC Braking Start Frequency	Hz	1.5	0.1	50.0	0.1	It is a frequency at which DC braking is initiated during stop.	
A307	DC Braking Current	%	50	15	150	1	Configure amount of current available for the DC braking when DC braking is used during stop.	
A308	DC Braking Time	Sec	0.0	0.0	25.0	0.1	It is amount of time that DC braking will be applied when stop command issued. To disable DC Braking operation set this parameter to zero.	
GROUP-4: V/F CHARACTERISTICS								
A401	V/F Selection		1	1	3	1	Select the appropriate v/f curve. =1: Linear Curve =2: Square Curve =3: Custom setting	✓
A402	VF1 Frequency	Hz	30.0	30.0	1800.0	0.1	These parameters are used to create the custom V/Hz profile. Three different points for the curve can be defined to get the profile suitable for the application. *A402 <= A403 <= A404 <= B104* *A405 <= A406 <= A407 <= B102 <=B101*	✓
A403	VF2 Frequency	Hz	40.0	30.0	1800.0	0.1		✓
A404	VF3 Frequency	Hz	50.0	30.0	1800.0	0.1		✓
A405	VF1 Voltage	Vac	100	50	460	1		✓
A406	VF2 Voltage	Vac	210	50	460	1		✓
A407	VF3 Voltage	Vac	310	50	460	1		✓
GROUP-5: TORQUE BOOST								
A501	Manual Torque Boost setting	%	0.0	0.0	20.0	0.1	When setting manually, set the boost voltage at 0Hz as a percentage in respect to the rated output voltage. When programmed to zero, it will be disabled.	
A502	Gap Eliminator Threshold	%	0.0	0.0	20.0	0.1	This is % of Spindle rated power.	
A503	Slip Compensation	Hz	0.0	0.0	5.0	0.1	Set the Spindle's rated slip. When setting manually, set the slip frequency for the Spindle rated load in respect to the base frequency. The output frequency changes according to the Spindle rated torque.	
A504	Volt compensation gain		1.00	0.00	5.00	0.01	This parameter is to compensate the effect of input supply voltage variation for gap eliminator function.	

NO	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-6: PARAMETER SELECTION FOR NORMAL DISPLAY SCREEN								
A601	Norm Parameter 1		1	1	15	1	Select from this to display on normal screen.	
A602	Norm Parameter 2		5	1	15	1	=1: M101 Hz =2: M102 rpm =3: M103 Amp	
A603	Norm Parameter 3		3	1	15	1	=4: M104 %L =5: M105 Hz* =6: M201 Vry	
A604	Norm Parameter 4		4	1	15	1	=7: M202 Vyb =8: M203 Vo =9: M204 Vdc	
A605	Norm Parameter 5		6	1	15	1	=10: M205 kW =11: M206 Kwh =12: M207 MWh	
A606	Norm Parameter 6		9	1	15	1	=13: M208 ºC =14: M209 Mtr =15: M210 ºF	
A607	Norm Parameter 7		10	1	15	1		
A608	Norm Parameter 8		13	1	15	1		

MODE-B Parameters

NO	Parameter	Unit	Def	Min	Max	Res.	Description	WP
GROUP-1: SPINDLE PARAMETERS								
B101	Rated Input Voltage	Vac	3	1	5		Select suitable rated input voltage from the below selections. =1: 380V =2: 400V =3: 415V =4: 440V =5: 460V	✓
B102	Spindle Voltage	Vac	415	50	460	1	This is the Spindle rated Voltage. Set the voltage mentioned on the Spindle nameplate.	✓
B103	Spindle Current	Amp	M303	0.3* M303	M303	0.1	Set the Spindle rated current from the Spindle nameplate. It can be set to 30% of the AC Drive rated current *M303*	✓
B104	Spindle Frequency	Hz	50.0	30.0	1800.0	0.1	Set the Spindle rated frequency from the Spindle nameplate.	✓
B105	Spindle Speed	KRPM	1.50	0.01	108.00	0.01	Set the Spindle rated KRPM from the Spindle nameplate.	
B106	Spindle Output	kW	M304	0.1	370.0	0.1	The Spindle's rated output at base speed is set.	✓
B107	Spindle Poles		4	2	16	2	Insert the Spindle poles.	✓
B108	Carrier Frequency	kHz	12.0	2.0	18.0	0.1	This parameter sets the AC Drive switching frequency.	
B109	DTC Gain		30	0	255	1	This is gain for the dead time compensation. Adjust incase of Spindle hunting.	
GROUP-2: SPINDLE CONSTANTS								
B201	R1: Primary Resistance	mΩ	Inv rating	0.100	9.999	0.001	The Spindle circuit constant is set. This combination means below} R2' = 1.000 x (10) exp 0 [mΩ]. This is exponent section.	✓
B202	R1: Primary Resistance		Inv rating	-3	4	1	This is exponent section of the entered value for Primary Resistance of Spindle.	
GROUP-3: PROTECTION PARAMETERS								
B301	Stall Current Limit	%	150	50	200	1	Set the current value as a percentage of Spindle rated current for normal running condition.	
B302	Adjustable Over Current Level	%	200	50	300	1	Set the upper current level as a percentage of Spindle rated current. When set to 200%, this feature is disabled.	
B303	Acceleration Current Limit	%	150	50	200	1	Set the upper current limit as a percentage of Spindle rated current for Acceleration.	
B304	Under Current Level	%	0	0	90	1	Set the lower current level as a percentage of Spindle rated current for running condition.	
B305	Overload Setting	%	105	50	105	1	This is reference for timed overload characteristic. The inverse time characteristics will change with change in *B305.*	
B306	Earth Fault detection Level	%	50	0	100	1	This parameter sets the earth fault detection level.	
B307	DC Bus Voltage Control		0	0	1	1	When enabled, it will control the deceleration time to prevent the over voltage during deceleration condition. =0: Disable =1: Enable	

NO	Parameter	Unit	Def	Min	Max	Res.	Description	WP
B308	Reverse Direction Lock		0	0	1	1	Set this to prevent unintentional reverse direction operation. When enabled, ensure that forward direction is selected in *A305* (or at terminal). *The AC Drive will not start otherwise.* =0: Disable =1: Enable	✓
B309	Parameter Lock		0	0	9999	1	User selectable 4-digit password to prevent unintentional parameter changes from the digital operation panel.	
B310	Change Password		0	0	9999	1	User can change the 4-digit user password for parameter lock.	
B311	Default Value Load		0	0	333	1	All default values will be loaded excluding C205 ~C216, C219~C222 as per 60Hz/460V (US standard).	✓
					444		All default values will be loaded excluding C205 ~C216, C219~C222 as per 50Hz/415V.	✓
					555		When set to 555, the fault history buffer is cleared. No previous fault code and parameter will be available.	✓
					666		All the user parameters will be set to default including C205 ~C216, C219~C222 as per 50Hz/415V system.	✓
Note that the value entered in this parameter will not be memorized. It correct value is entered, appropriate action will be taken and "00" will be displayed. If incorrect value is entered, no action will be taken and "00" will be displayed.								
B312	Spindle Thermistor Trip		0	0	1	1	0: Disable 1: Enable	
B313	Unbalance Level (Output current)	%	10	0	100	1	Set the unbalance current level for output When the current unbalance exceeds the set level, the unit will trip. Set to 0% to disable the function.	
GROUP-4: PRESET SPEED								
B401	Preset Speed-1	Hz	200.0	0.1	1800.0	0.1	These preset speeds can be selected by programmable sequence inputs and one can set the frequencies as per requirement.	
B402	Preset Speed-2	Hz	400.0	0.1	1800.0	0.1		
B403	Preset Speed-3	Hz	800.0	0.1	1800.0	0.1		
B404	Preset Speed-4	Hz	1000.0	0.1	1800.0	0.1		
B405	Preset Speed-5	Hz	1200.0	0.1	1800.0	0.1		
B406	Preset Speed-6	Hz	1400.0	0.1	1800.0	0.1		
B407	Preset Speed-7	Hz	1600.0	0.1	1800.0	0.1		
GROUP-5: SKIP FREQUENCY								
B501	Skip Frequency-1	Hz	0.1	0.1	1800.0	0.1	Sets the skip frequencies and the avoidance band for the each frequency.	
B502	Skip Frequency-2	Hz	0.1	0.1	1800.0	0.1		
B503	Skip Frequency-3	Hz	0.1	0.1	1800.0	0.1		
B504	Skip Band	Hz	0.0	0.0	10.0	0.1		

MODE-C Parameters

NO	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: PROGRAMMABLE INPUT/OUTPUT								
C101	PSI-1		2	1	26	1	The different options are as under.	
C102	PSI-2		9	1	26	1	=1: Not Used =2: Jog Select =3: Ramp Select =4: Preset i/p-0 =5: Preset i/p-1 =6: Preset i/p-2 =7: Freq Increase =8: Freq Decrease =9: E-Stop (NO) =10: Fault Reset =11: Ext Flt (NO) =12: Terminal =13: Ref Select 0 =14: Ref Select 1 =15: Reverse =16:Base load Input =17: Spindle sel 1 =18: Spindle sel 2 =19: Spindle sel 3 =20: Spindle sel 4 =21: E-Stop (NC) =22: Ext Flt (NC) =23: RUN =24: STOP =25: Enable (NO) =26: Enable (NC)	
C103	PSI-3		10	1	26	1		
C104	PSI-4		4	1	26	1		
C105	PSI-5		5	1	26	1		
C106	PSI-6		6	1	26	1		
C107	PSO-1		2	1	24	1	The different options are as under.	
C108	PSO-2		6	1	24	1	=1: Not Used =2: Run =3: Local =4: Reverse Run =5: I-Detection =6: Freq Attain =7: Speed Detect1 =8: Speed Detect2 =9: Acceleration =10: Deceleration =11: Timer Output =12: Zero Speed =13: Fault Alarm =14: PID Up Limit =15: PID Lo Limit =16: Gap eli. Detected =17: Spindle Sel 1 =18: Spindle Sel 2 =19: Spindle Sel 3 =20: Spindle Sel 4 =21: Thermal trip =22: Temp Alarm =23: Ready =24: Fault	
C109	PSO-3		1	1	24	1		
C110	PSO-4		1	1	24	1		
C111	Programmable Relay1		2	1	24	1		
C112	Programmable Relay2		1	1	24	1		
C113	Programmable fault Relay		24	1	24	1		
C114	PSI-RUN		23	1	26	1	Different options are as per PSI-1 to PSI-6	
C115	PSI-STOP		24	1	26	1		
GROUP-2: ANALOG OUTPUT SELECTION								
C201	Vout-1		1	1	7	1	This configures the function of analog output.	
C202	Vout-2		2	1	7	1	=1: O/p Frequency =2: Output Current =3: Output Power =4: Output Voltage =5: DC Bus Volt =6: PID Output =7: Heat sink Temp	
C203	Iout-1		3	1	7	1		
C204	Iout-2		4	1	7	1		
C205	Vout-1 Gain		0.980	0.500	2.500	0.001	This is gain setting for the VO1 analog output.	
C206	Vout-2 Gain		0.982	0.500	2.500	0.001	This is gain setting for the VO2 analog output.	
C207	Iout-1 Gain		0.915	0.500	2.500	0.001	This is gain setting for the IO1 analog output.	
C208	Iout-1 Bias		790	500	1500	1	This is bias setting for the IO1 analog output.	
C209	Iout-2 Gain		0.915	0.500	2.500	0.001	This is gain setting for the IO2 analog output.	
C210	Iout-2 Bias		795	500	1500	1	This is bias setting for the IO2 analog output.	
C211	FSV Gain		1.265	0.500	2.500	0.001	This is gain setting for the FSV analog output.	
C212	FSV Bias		20	0	1000	1	This is bias setting for the FSV analog output.	
C213	FSI Gain		1.077	0.500	2.500	0.001	This is gain setting for the FSI analog output.	
C214	FSI Bias		826	0	1500	1	This is bias setting for the FSI analog output.	
C215	IIN Gain		1.070	0.500	1.500	0.001	This is gain setting for the IIN analog output.	
C216	IIN Bias		820	0	1500	1	This is bias setting for the IIN analog output.	
C217	FSV/FSI Time Constant	mS	50	0	1000	1	This parameter set the filter time constant for the FSV and FSI analog inputs.	

NO	Parameter	Unit	Def	Min	Max	Res	Description	WP
C218	IIN Time Constant	mS	50	0	1000	1	This parameter set the filter time constant for the VIN and IIN analog inputs.	
C219	Vout-1 Bias		87	0	1000	1	This is bias setting for the VO1 analog output.	
C220	Vout-2 Bias		82	0	1000	1	This is bias setting for the VO2 analog output.	
C221	Spindle Thermistor Gain		1.000	0.100	1.500	0.001	This is gain setting for the Spindle thermistor input.	
C222	Spindle Thermistor Bias		0	0	1000	1	This is bias setting for the Spindle thermistor input.	
GROUP-3: STATUS OUTPUT DETECTION LEVEL								
C301	Frequency Attainment Detection Width	%	1.0	0.0	20.0	0.1	The attained frequency output (*Freq Attain*) operation width is set.	
C302	Crush current Level (current detection)	%	100.0	5.0	200.0	0.1	The crush current level (current detection) is set. Set with a percentage of the rated current (B103). A 5% hysteresis will occur with the current-Detection operation.	
C303	Speed Detection Level-1	%	95.0	1.0	105.0	0.1	The speed detection operation level is set. Set with a percentage to the max frequency *A103*. The output frequency or the Spindle speed will be the comparison target. A 1% hysteresis will occur with speed detection operation.	
C304	Speed Detection Level-2	%	50.0	1.0	105.0	0.1		
C305	Zero Speed Detection Level	%	1.0	0.0	50.0	0.1	The Zero speed detection operation level is set. Set with a percentage to the max frequency (*A103*). The output frequency or the Spindle speed will be the comparison target. A 1% hysteresis will occur with zero speed operation.	
C306	4-20mA Reference Loss		2	1	7	1	This parameter configures the AC Drive's response to a failure of 4-20mA Frequency reference input signal. =1: No action at fault detection =2: Minor fault alarm & run at minimum speed =3: Minor fault alarm & run at max speed =4: Minor fault alarm & run at set speed =5: Minor fault alarm & run at preset speed-1 =6: Fault, ramp down to stop =7: Fault, coast to stop	
C307	Output Phase Loss		1	0	1	1	Output open-phase is detected if one phase current is <5% and other two phase currents are >10% of Spindle rated current, when this protection is enabled. =0: Disable =1: Enable	
C308	Timer Output Selection		0	0	1	1	Set the ON/OFF control for the timer output. =0: ON only when AC Drive is ON =1: ON whenever power is ON	
C309	Timer output Off Delay time	Sec	60	0	3000	1	Set the time in seconds to delay turning OFF the timer output after the AC Drive OFF command is received.	
C310	Temperature Control selection		1	0	1	1	This parameter controls the automatic change of carrier frequency in case of temperature rise above the predefined level. =0: Disable =1: Enable	

NO	Parameter	Unit	Def	Min	Max	Res	Description	WP
C311	Temperature Alarm Level		82	0	95	1	This temperature alarm level set point. Whenever the heat sink temperature exceeds the set value, the Temp Alarm output will be set. Hysteresis of 2°C hysteresis will occur with temperature alarm.	
GROUP-4: SERIAL COMMUNICATION								
C401	Baud Rate	bps	4	1	5	1	Sets the baud rate for the serial communication. =1: 1200 =4: 9600 =2: 2400 =5: 19200 =3: 4800	
C402	Station Number		1	1	247	1	Sets the station number (address).	
C403	Parity		1	1	3	1	Setting the parity requirement for the communication =1: No Parity =2: Odd parity =3: Even Parity	
C404	Response Time	Sec	0.01	0.00	2.00	0.01	Set the minimum time from receiving the command to returning an answer.	
C405	Operation Panel Communication Loss Selection		0	0	1	1	Enable or disable the operation panel communication loss fault. If enabled, AC Drive will generate fault if it does not receive any response from the operation panel within 5 sec. =0: Disable =1: Enable	
GROUP-5: AUTO RESTART & SPEED SEARCH FUNCTION								
C501	No. Of Restart		0	0	10	1	Sets the number of restart for ten faults.	
C502	Restart Wait Time	Sec	5	1	30	1	Sets the wait time before auto restart.	
C503	Emergency Stop Mode		1	1	3	1	Set the stopping method for the emergency stop. =1: Coast to stop without fault output =2: Coast to stop with fault output =3: Ramp down to stop	
C504	Speed Search Selection		0	0	1	1	Enable or disable the speed Search operation. =0: Disable =1: Enable	
C505	Speed Search Current Limit	%	100	30	200	1	Sets the speed search operation current as a percentage, taking the AC Drive rated current as 100%. Not usually necessary to set. When restarting is not possible with the factory settings, reduce the value.	
C506	Speed Search Frequency Deceleration Time	Sec	0.60	0.01	10.00	0.01	This decides the frequency ramp down time from max frequency during speed search operation.	
C507	Speed Search Voltage Acceleration Time	Sec	0.6	0.1	10.0	0.1	This decides the output voltage ramp up time from zero to base voltage during speed search operation.	
C508	Speed Search Wait Time	Sec	2.0	0.0	20.0	0.1	The wait time after the output is cut off to when the speed search operation is started is set. Set the time to when the Spindle residual voltage is abated for this parameter. The search operation is delayed by the time set here.	
C509	PLCT Time	Sec	2.0	0	5.0	0.1	Set time interval to perform PLCT. When programmed to 0, the PLCT function will be disabled.	

NO	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-6: PID CONTROL SELECTION								
C601	PID Control Selection		0	1	1	1	Enable or disable the PID control action. =0: Disable =1: Enable	
C602	PID Polarity		1	0	1	1	This can be used to invert the PID output. =0: Negative =1: Positive	
C603	PID Reference Input		4	1	5	1	Decides the set input point for the PID. =1: FSV 0-10V =2: FSI 4-20mA =3: IIN 4-20mA =4: Local =5: Serial	
C604	PID Feedback Input Selection		3	1	4	1	Decides the feedback input point for the PID. =1: FSV 0-10V =2: FSI 4-20mA =3: IIN 4-20mA	
C605	Proportional Gain		1.0	0	10.0	0.1	Sets the proportional gain for the PID controller.	
C606	Integral Time	Sec	1.0	0.1	100.0	0.1	Sets the Integral time for the PID controller.	
C607	Derivative Gain		0.00	0.00	1.00	0.01	Sets the Derivative gain for the PID controller.	
C608	PID deviation Upper Limit	%	100.0	50.0	100.0	0.1	Sets PID Deviation upper limit.	
C609	PID deviation Lower Limit	%	0.0	0.0	50.0	0.1	Sets PID Deviation lower limit.	
C610	PID Offset Adjustment	%	0.0	-100.0	100.0	0.1	Sets offset for output after PID control.	
C611	PID Reference Setting	%	50.0	1.0	100.0	0.1	Set the reference value in % if operational panel option is selected in parameter *C603*.	

MODE-D: Auxiliary Drive Parameters

NO	Parameter	Unit	Def	Min	Max	Res	Description	WP
GROUP-1: MULTI-SPINDLE PARAMETERS								
D101	Frequency Reference Input		1	1	12	1	This is used to select the speed reference for multi-Spindle. =1: Local =2: FSV 0-10V =3: FSI 4-20mA =4: FSV 0-5V =5: FSI 0-20mA =6: FSV 10-0V =7: FSI 20-4mA =8: FSV 5-0V =9: FSI 20-0mA =10: Static pot =11: Serial =12: PID Output	✓
D102	O/p transformer secondary selection		0	0	4	1	This parameter selects o/p transformer secondary. =0: Disable =1: Transformer Secondary select 1 =2: Transformer Secondary select 2 =3: Transformer Secondary select 3 =4: Transformer Secondary select 4	✓
D103	O/p transformer Secondary 1	Volt	415	50	500	1	This selects the transformer secondary for displaying the out put voltage accordingly. O/p voltage = (set voltage * secondary volt) / Rated I/p voltage	✓
D104	O/p transformer Secondary 2	Volt	415	50	500	1		✓
D105	O/p transformer Secondary 3	Volt	415	50	500	1		✓
D106	O/p transformer Secondary 4	Volt	415	50	500	1		✓
GROUP-2: SPINDLE-1 PARAMETERS								
D201	Spindle Voltage	Vac	415	50	460	1	Set the rated Spindle nameplate voltage.	✓
D202	Spindle Current	Amp	M303	0.3* M303	M303	0.1	Insert the rated Spindle current from the nameplate.	✓
D203	Spindle Frequency	Hz	50.0	30.0	1800.0	0.1	Set the rated base frequency from the nameplate.	✓
D204	Spindle Speed	KRPM	1.50	0.01	108.00	0.01	Set the base speed from the Spindle nameplate.	
D205	Spindle Type	kW	M304	0.1	315.0	0.1	The Spindle's rated output at the base speed is set from the nameplate.	✓
D206	Local Set Frequency	Hz	50.0	0.1	1800.0	0.1	This is the frequency set from Digital Operation Panel (LCD Keypad Module) for this auxiliary Spindle. It can be set in Hz (0.1 resolution) on in KRPM (0.01 resolution) according to selection in A107.	
D207	Min Frequency	Hz	0.1	0.1	1800.0	0.1	These two Parameters are used to configure Minimum and Maximum Frequency of the AC Drive for this auxiliary Spindle. It can be set in Hz (0.1 resolution) on in KRPM (0.01 resolution) according to selection in A107	
D208	Max Frequency	Hz	50.0	0.1	1800.0	0.1		
D209	Line Speed Setting	rpm	1500	0	108000	1	The set value will be displayed as Spindle speed in M102 at Maximum Frequency (D208) when this auxiliary drive is selected. At zero value (default), Spindle speed (D204) will be displayed as spindle speed in M102 at Maximum Frequency (D208)	
D210	Acceleration Time-1	Sec	10.0	0.1	1200.0	0.1	Time needed for the speed to change from zero to maximum.	

NO	Parameter	Unit	Def	Min	Max	Res	Description	WP
D211	Deceleration Time-1	Sec	20.0	0.1	1200.0	0.1	Time needed for the speed to change from maximum to zero.	
D212	Manual Torque Boost Setting	%	0.0	0.0	20.0	0.1	When setting manually, set the boost voltage at 0Hz as a percentage in respect to the rated output voltage. When programmed to zero, it will be disabled.	
D213	Gap Eliminator Threshold	%	0.0	0.0	20.0	0.1	This is % of Spindle rated power.	
D214	V/F Selection		1	1	3	1	Select the appropriate v/f curve. =1: Linear Curve =2: Square Curve =3: Custom setting	✓
D215	VF1 Frequency	Hz	30.0	30.0	100.0	0.1	These parameters are used to create the custom V/Hz profile. Three different points for the curve can be defined to get the profile suitable for the application. D215 <= D216 <= D217 <= D203 & D218 <= D219 <= D220 <= D201 <=B101	✓
D216	VF2 Frequency	Hz	40.0	30.0	100.0	0.1		✓
D217	VF3 Frequency	Hz	50.0	30.0	100.0	0.1		✓
D218	VF1 Voltage	Vac	100	50	460	1		✓
D219	VF2 Voltage	Vac	210	50	460	1		✓
D220	VF3 Voltage	Vac	310	50	460	1		✓
GROUP-3: SPINDLE-2 PARAMETERS								
Parameters similar to Spindle-1. Starts from D301~D322								
GROUP-4: SPINDLE-3 PARAMETERS								
Parameters similar to Spindle-1. Starts from D401~D422								
GROUP-5: SPINDLE-4 PARAMETERS								
Parameters similar to Spindle-1. Starts from D501~D522								
GROUP-6: SPINDLE-5 PARAMETERS								
Parameters similar to Spindle-1. Starts from D601~D622								
GROUP-7: SPINDLE-6 PARAMETERS								
Parameters similar to Spindle-1. Starts from D701~D722								
GROUP-8: SPINDLE-7 PARAMETERS								
Parameters similar to Spindle-1. Starts from D801~D822								
GROUP-9: SPINDLE-8 PARAMETERS								
Parameters similar to Spindle-1. Starts from D901~D922								
GROUP-A: SPINDLE-9 PARAMETERS								
Parameters similar to Spindle-1. Starts from DA01~DA22								
GROUP-B: SPINDLE-10 PARAMETERS								
Parameters similar to Spindle-1. Starts from DB01~DB22								
GROUP-C: SPINDLE-11 PARAMETERS								
Parameters similar to Spindle-1. Starts from DC01~DC22								
GROUP-D: SPINDLE-12 PARAMETERS								
Parameters similar to Spindle-1. Starts from DD01~DD22								
GROUP-E: SPINDLE-13 PARAMETERS								
Parameters similar to Spindle-1. Starts from DE01~DE22								
GROUP-F: SPINDLE-14 PARAMETERS								
Parameters similar to Spindle-1. Starts from DF01~DF22								
GROUP-G: SPINDLE-15 PARAMETERS								
Parameters similar to Spindle-1. Starts from DG01~DG22								

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FUNCTION EXPLANATIONS

GROUP-1

M101: Output Frequency (Hz)

It displays output frequency of AC Drive in Hz or in KRPM according to unit selection in A107. When the AC Drive is stop, it will display zero. When auxiliary drive is selected, this parameter displays the output frequency of the auxiliary drive. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Hz**" or "**KRPM**" unit.

M102: Spindle Speed (rpm)

It displays the Spindle / shaft speed in rpm. When the AC Drive is stop, it will display zero.

It displays calculated Spindle speed or shaft rpm using Line speed display setting *A105 or D209 (for auxiliary Spindle-1) or D309 (for auxiliary Spindle-2) or……up to DG09 (for auxiliary Spindle-15)* and *M101*.

When auxiliary drive is selected, this parameter displays the auxiliary Spindle speed.

When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**rpm**" unit.

M103: Output Current (Amp)

It displays actual output current of AC Drive in Ampere. When the AC Drive is stop, it will display zero. When auxiliary drive is selected, this parameter displays the output current of the auxiliary drive.

When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Amp**" unit.

M104: Output Current (%)

It displays actual output current of AC Drive as a percentage of rated Spindle current *B103*. When auxiliary drive is selected the rated Spindle current programmed in *D202 (for auxiliary Spindle-1)* is considered.

Output current (%) = Output current *(M103)* X 100 / Spindle current *(B103 or D202)*

When the AC Drive is stop, it will display zero. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**%L**" unit.

M105: Set Frequency (Hz*)

This parameter displays the set value of frequency in Hz or in KRPM according to unit selection in A107. When local (Digital Operation Panel) option is selected as frequency reference input in *A106*, it will display the value of *A101* or *D206 ~ DG02 (for auxiliary drive).* When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Hz***" or "**KRPM**" unit.

M106: Frequency Reference Input

It displays currently selected frequency reference input source in *A106 or D101 (for auxiliary drive).*

M107: PID Reference (%)

This parameter displays the value of currently selected PID reference input source in %. When local (Digital Operation Panel) option is selected as PID reference input source, it will display the value of *C611*.

M108: PID Feedback (%Fb)

This parameter displays the value of currently selected PID feedback input source in %.

GROUP-2

M201: Input Voltage Vry (Vac)

This parameter displays the input line-to-line voltage between R & Y at input. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Vry**" unit. Note that this is the calculated value from DC Bus and may differ from the actual input voltage.

M202: Input Voltage Vyb (Vac)

This parameter displays the actual input line-to-line voltage between Y & B at input. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Vyb**" unit. Note that this is the calculated value from DC Bus and may differ from the actual input voltage.

M203: Output Voltage (Vac)

This parameter displays the output line-to-line voltage. This is calculated voltage based on the voltage command. This may differ from the actual output voltage. The actual output voltage depends on input supply voltage. When the AC Drive is stop, it will display zero. When auxiliary drive is selected, it displays the output voltage for the auxiliary drive.

When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Vo**" unit.

M204: DC Bus Voltage (Vdc)

This parameter displays the dc bus voltage. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**Vdc**" unit.

M205: Output Power (kW)

This parameter displays the output power. This may differ from the actual output power. When the AC Drive is stop, it will display zero. When the auxiliary drive is selected, the output power of auxiliary drive is displayed.
When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**kW**" unit.

M206: Energy Meter (kWH)

M207: Energy Meter (MWH)

This parameter displays the total output power consumption per hour basis. This may differ from the actually consumed output energy. This is stored in the non-volatile memory.
When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**kWH**" and "**MWH**" unit respectively.

M208: Heat sink Temperature (°C)

This parameter displays the actual heat sink temperature. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**°C**" unit.

M209: Spindle Select

It displays the selected auxiliary Spindle. When main Spindle is selected it displays zero.

M208: Heat sink Temperature (°F)

This parameter displays the actual heat sink temperature. When selected for the normal parameter display in *A601~A608*, the value will be displayed with "**°F**" unit.

GROUP-3

M301: Total Conductivity Time (Hrs)

The total (cumulative) power on time after product shipment is counted and displayed in this parameter.

M302: Total Run Time (Hrs)

The total (cumulative) AC Drive run time after product shipment is counted and displayed in this parameter.

M303: AC Drive Rated Current (Amp)

This parameter displays the rated current capacity of AC **Drive**.

M304: AC Drive Type (kW)

This parameter displays the rated kW capacity of AC **Drive**.

M305: Control Version

This parameter displays the ROM version of DSP Control Board (PCA-2014A) of AC **Drive**.

M306: Programmable Sequence Inputs

This parameter displays the status of various programmable sequence inputs.

M	o	d	e	-	M							G	r	o	u	p	-	3
M	3	0	6		P	S	I	-	1	2	3	4	5	6	7	8		
									0	1	0	0	0	0	0	0		
F	w	d	,	L	c	l	,	N	o	r	m	a	l		R	u	n	

As shown above, line-2 shows the programmable sequence input and line-3 shows the status of respective input. The zero value indicates that the programmable sequence input is OFF and 1 indicates ON. In the above screen, only PSI-2 is ON and the others are OFF.PSI-7 shows status of PSI-RUN and PSI-8 shows status of PSI-STOP.

M307: Programmable Sequence Outputs

This parameter displays the status of various programmable sequence outputs.
PSO-5, 6 & 7 indicates the status of programmable fault relay, programmable relay 1 and programmable relay 2 respectively.

M	o	d	e	-	M							G	r	o	u	p	-	3
M	3	0	7		P	S	O	-	1	2	3	4	5	6	7			
									0	1	0	0	0	1	0			
F	w	d	,	L	c	l	,	N	o	r	m	a	l		R	u	n	

As shown above, line-2 shows the programmable sequence output and line-3 shows the status of respective output. The zero value indicates that the programmable sequence output is OFF and 1 indicates ON. In the above screen, only PSO-2 and 6 are ON and the others are OFF.

M308: Unit Serial Number

This parameter displays the serial number of the unit.

M309: Ship Month

This parameter displays the month of unit shipment.

M310: Ship Year

This parameter displays the year of unit shipment.

M311: Display Version

This parameter displays the ROM version of Display Board (PCA-2012) of AC Drive.

GROUP-4: FAULT HISTORY

FLT-1 ~ FLT10: Fault 1 ~ 10

Parameter FLT-1 displays the latest fault. It also displays the DC Bus Voltage (Vdc), Load Current (Amp), Output Frequency (Hz), and Heat sink Temperature (°C) at the time of fault occurrence. Other four parameters Input Voltage (Vry), Total Conductivity Time (Hr), Energy Meter (MWH) and Energy Meter (kWH) will be stored in the next page.

PAGE-1

M	o	d	e	-	M		F	L	T	-	1		G	r	o	u	p	-	4
			E	x	t	e	r	n	a	l		F	a	u	l	t			
		5	8	5		V	d	c					0	.	0		A	m	p
	1	0	.	0		H	z							3	5		°	C	

PAGE-2

M	o	d	e	-	M		F	L	T	-	1		G	r	o	u	p	-	4
			E	x	t	e	r	n	a	l		F	a	u	l	t			
		4	2	0		V	r	y			6	0	1	1	0		H	r	
		1	1	0		M	W	H					7	3	5		k	W	H

As shown above, in the first page, line-2 shows the fault code, line-3 shows the DC Bus Voltage & Output Current and line-4 shows the Output Frequency & Heat sink Temperature. In the second page also, line-2 shows the fault code, line-3 shows Input Voltage (Vry) & Total Conductivity Time (Hr) and line-4 shows the Energy Meter (MWH & kWH). If no fault is detected since shipment, line-2 in both the pages will display “No previous fault” and the value of different parameters will be read as zero.

Same way **FLT-2 ~ FLT10** shows the previous fault codes and parameters at the time of fault occurrence.

MODE – A

GROUP – 1: FREQUENCY SETTING

A101: Local Set Frequency (Hz)

This is the set frequency when the frequency reference input source is *Local* (A106=1). The output will ramp to this frequency, when start command is given. It can be set in Hz (0.1 resolution) or in KRPM (0.01 resolution) according to selection of unit in *A107*.

The minimum limit for this parameter is decided by minimum frequency *A102*. If *A102* is set higher then *A101*, the value of *A102* is automatically assigned to *A101*.

The maximum value of this parameter is decided by Maximum frequency *A103*. The value of *A101* cannot be set higher than *A103*.

A102: Minimum Frequency (Hz)

This is the minimum output frequency of the AC Drive. It can be set in Hz (0.1 resolution) or in KRPM (0.01 resolution) according to selection in *A107*.

In terminal mode, this is the minimum output attained with minimum analog input reference. This value should always be lower then the maximum frequency *A103*. The minimum frequency will be reached after start command with selected acceleration ramp up time. This is applicable to all frequency references including jog select input, preset inputs and static pot inputs.

A103: Maximum Frequency (Hz)

This is the maximum output frequency of the AC Drive. It can be set in Hz (0.1 resolution) or in KRPM (0.01 resolution) according to selection in *A107*.
In terminal mode, this is the maximum output attained with maximum analog input reference.

A104: Jog Frequency (Hz)

This frequency setting is selected when executing jogging run with the programmable sequence input command *Jog Select*. The selected acceleration time *A201* (or *A203*) / deceleration time *A202* (or *A204*) and stop mode *A304* will be applicable to this signal.

If auxiliary drive is selected, then the acceleration time *D210* (or *A203)* / deceleration time *D211 (*or *A204)* will be applicable.

The minimum limit for this parameter is *A102* and maximum limit is *A103*.

Speed search function is carried out, when executing jogging run command, if it is enabled. *Jog Select* is valid in all conditions of *A301.* However, *RUN* command has the higher priority then *Jog Select*, if both the signals are input together.

A105: Line Speed Setting (rpm)

The entered value will be displayed as Spindle speed in *M102* at Maximum Frequency (*A103*). In default condition (i.e. when *A105*=0), Spindle speed (*B105*) will be displayed as Spindle speed in M102 at Maximum Frequency (*A103*).

If the value of Maximum Frequency (*A103*) = 1800Hz & value entered in A105 = 108000.

Then, at 600Hz the Spindle speed *M102* will show (108000 X 600 / 1800) i.e. 3600 rpm.

A106: Frequency Reference Input

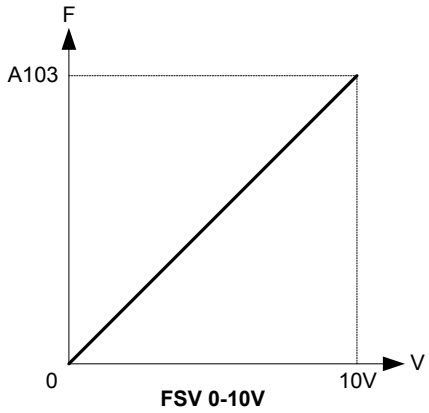
This parameter can be used to select the speed reference input to the AC Drive. The speed reference can be independently selected from the given options even if the AC Drive is controlled from any of three sources, i.e. Local (Digital Operation Panel), Terminal or Serial. The different frequency reference inputs are explained as under. The minimum and maximum limits are decided by *A102* and *A103* respectively in all the options.

1. Local

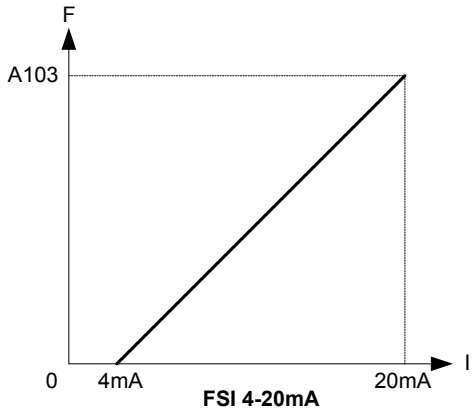
When this option is selected, the set frequency *M105* corresponds to local set frequency *A101*. Use Digital Operation Panel (keypad) to change the set value. The monitor mode parameter *M105* shows the value of local set frequency *A101* and *M106* will show keypad as frequency reference input. *The local set frequency A101 will not have any effect in other options.*

2. FSV 0-10V

When this option is selected, the set frequency *M105* corresponds to analog input FSV. The output frequency will be zero at 0V and maximum at 10V.



FSV 0-10V



FSI 4-20mA

3. FSI 4-20mA

When this option is selected, the set frequency *M105* corresponds to analog input FSI. Zero frequency will be available at 4mA and maximum at 20mA.

4. FSV 0-5V

When this option is selected, the set frequency *M105* corresponds to analog input FSV. Zero frequency will be available at 0V and maximum at 5V.

5. FSI 0-20mA

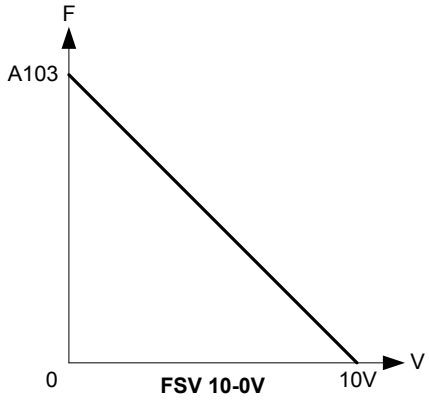
When this option is selected, the set frequency *M105* corresponds to analog input FSI. Zero frequency will be available at 0mA and maximum at 20mA.

6. FSV 10-0V

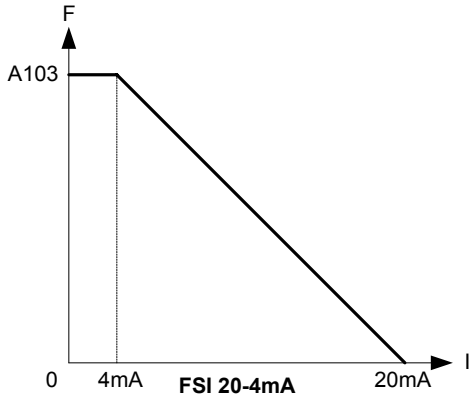
This is an inverse to option-2. When this option is selected, the set frequency *M105* corresponds to analog input FSV. Zero frequency will be available at 10V and maximum at 0V.

7. FSI 20-4mA

This is an inverse to option-3. When this option is selected, the set frequency *M105* corresponds to analog input FSI. Zero frequency will be available at 20mA and maximum at 4mA. The maximum limit is decided by *A103*.



FSV 10-0V



FSI 20-4mA

8. FSV 5-0V

This is an inverse to option-4. When this option is selected, the set frequency *M105* corresponds to analog input FSV. Zero frequency will be available at 5V and maximum at 0V.

9. FSI 20-0mA

This is an inverse to option-5. When this option is selected, the set frequency *M105* corresponds to analog input FSI. Zero frequency will be available at 20mA and maximum at 0mA.

10. Static potentiometer

When this option is selected, the set frequency *M105* will be decided by programmable sequence inputs. Assign two programmable sequence inputs to *Freq Increase* and *Freq Decrease* respectively. When *Freq Increase* is applied, the set frequency will increase and when *Freq Decrease* is applied, the frequency will reduce. If both the signals are applied simultaneously, it will have no effect. The rate of frequency increase / decrease is 0.1Hz at every 100msec.

11. Serial

In this option, the set frequency *M105* can be assigned from serial link.

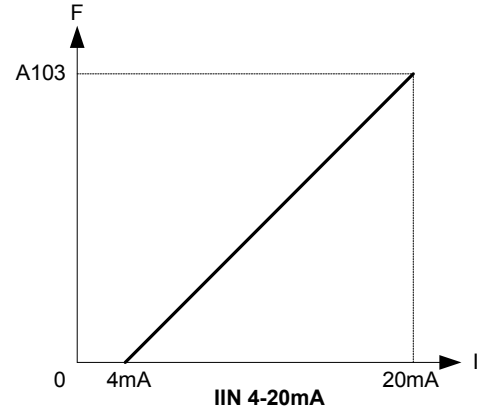
12. PID Output

In this option, the PID output will be the set point. When selecting this input, enable the PID Control.

The monitor option M105 will display the corresponding set frequency value, even if the AC Drive is stop.

13 IIN 4-20mA

When this option is selected, the set frequency *M105* corresponds to analog input IIN. Zero frequency will be available at 4mA and maximum at 20mA.



IIN 4-20mA

A107: Set Frequency Unit

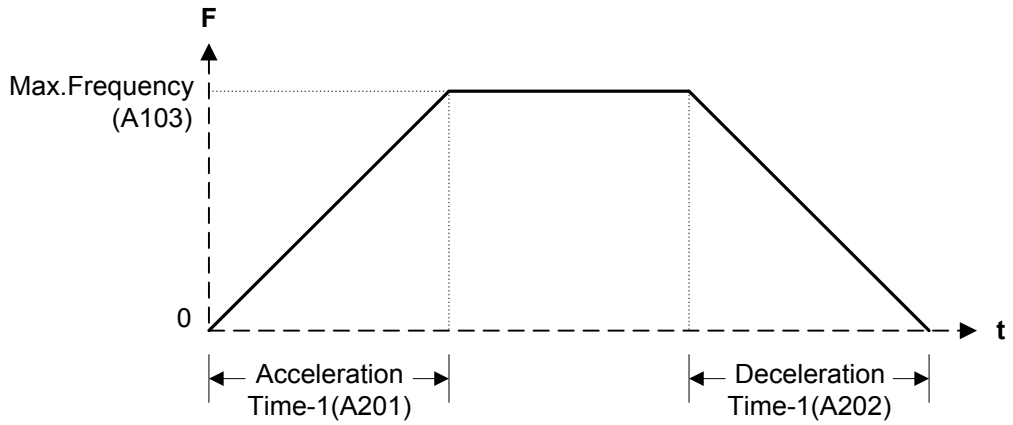
This parameter is for frequency unit selection. If it is 0 then in *A101* set point can be set in “Hz” unit with 0.1 resolution and if it is 1 then in *A101* set point can be set in “KRPM” unit with 0.01 resolution.

GROUP – 2: ACCELERATION / DECELERATION

A201: Acceleration Time-1 (Sec)

Acceleration Time-1 is the time taken by AC Drive output frequency to ramp up from zero frequency to maximum frequency *A103*.

Short acceleration time can result in excessive output current and if it exceeds the acceleration current limit *B303*, the acceleration will cease until the current reduces below the *B303* value. In such case, the actual acceleration time will differ from programmed value. The AC Drive may trip in over current fault if the condition persists for long time. Increase acceleration time in such cases.



A202: Deceleration Time-1 (Sec)

Deceleration Time-1 is the time taken by AC Drive output frequency to ramp down from maximum frequency *A103* to zero frequency.

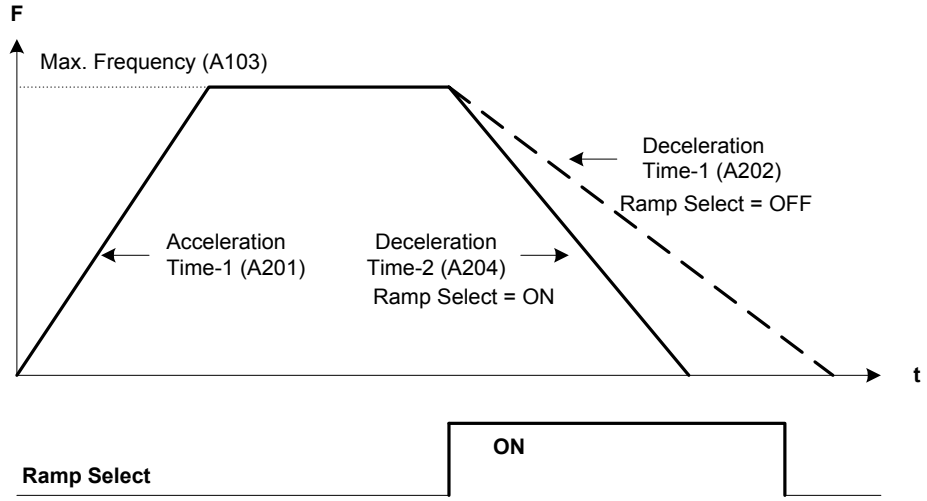
Short deceleration time can result in excessive output current and if it exceeds the stall current limit *B301*, the deceleration will cease until the current reduces below the *B301* value. In such case, the actual deceleration time will differ from programmed value. The AC Drive may trip in over current / dc bus over voltage fault if the condition persists for long time. Increase deceleration time in such cases.

A203: Acceleration Time-2 (Sec)

A204: Deceleration Time-2 (Sec)

The Acceleration Time-2 and Deceleration Time-2 can be selected in place of Acceleration Time-1 and Deceleration Time-1. This is valid only if *Ramp Select* input is ON. Acceleration Time-2 is the time taken by AC Drive output frequency to ramp up from zero frequency to maximum frequency *A103*.

Deceleration Time-2 is the time taken by AC Drive output frequency to ramp down from maximum frequency *A103* to zero frequency.

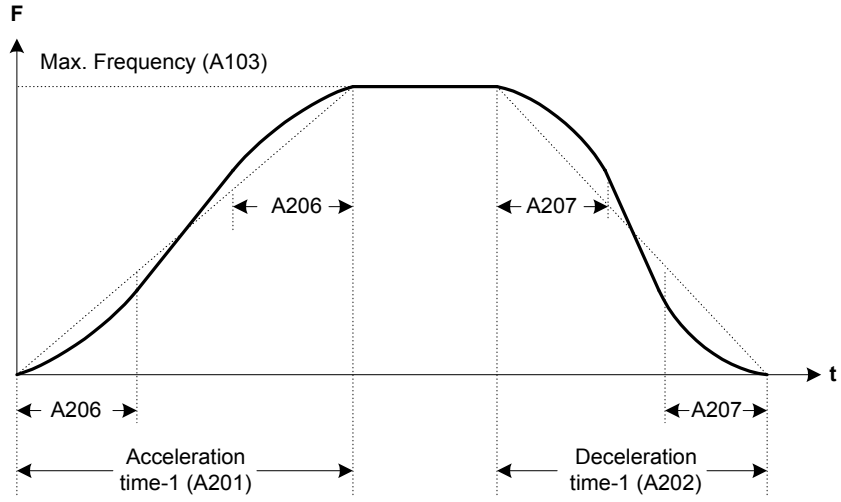


A205: S-Curve Selection

A206: S-Curve Time-1 (Sec)

A207: S-Curve Time-2 (Sec)

Acceleration/deceleration with the S-shape pattern is possible by setting parameter *A205=1*. The higher the S-curve time period, the more pronounced is the S-shape.
The total acceleration / deceleration times will not change.
When this parameter is set, all acceleration and deceleration will be as shown in below fig.
(Note) Set so that the relation of the *A206 / A207* setting and acceleration / deceleration time is as shown below. *A206 / A207* Setting value × 2 ≤acceleration / deceleration time

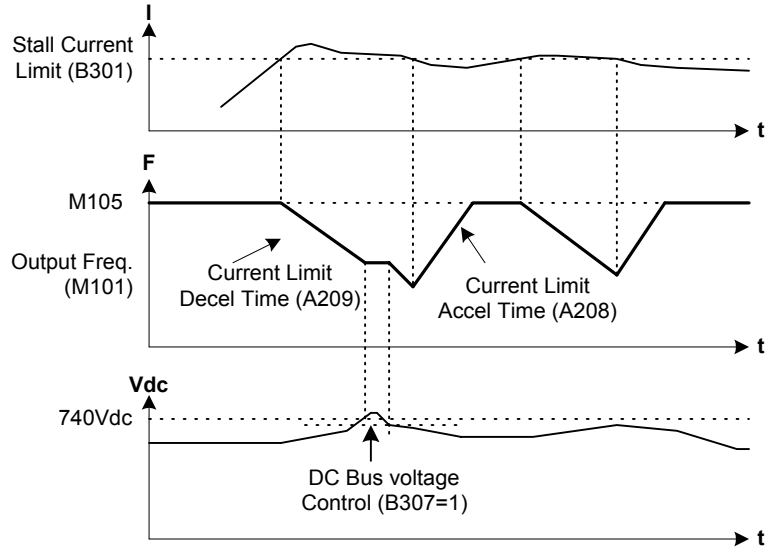


A208: Current Limit Acceleration Time (Sec)

A209: Current Limit Deceleration Time (Sec)

These are the acceleration / deceleration time for the stall current limit function. When the AC Drive is operating at set frequency and output current exceeds the stall current limit *B301* value, the output frequency and voltage are reduced. The deceleration time is decided by current limit deceleration time *A209*. The dc bus voltage will rise in this process. If DC bus voltage control (*B307=1*) is enabled, it will stop the deceleration, if dc bus voltage exceeds 740Vdc level. This level is factory settable. The deceleration will resume, if dc link voltage reaches to 710V (hysteresis of 30V) and the output current

is still higher than the stall current limit. When the output current falls below the stall current limit, the output frequency and output voltage will ramp up with current limit acceleration time *A208* to set frequency value.



GROUP – 3: START / STOP SELECTION & DC BRAKING

A301: Start Control

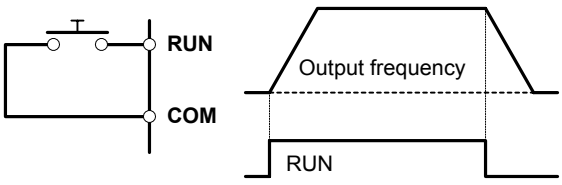
The AC Drive can be started from *Local* (Digital Operation Panel), *Terminal* or *Serial* irrespective of the frequency reference input. However, the direction will be decided as per the start control selection only. When the start control is *Local*, the direction can only be changed through Digital Operation Panel. The same applies to other selections also.

If in running condition, start control is changed from *Local* to *Terminal*, the operation will continue as per the status of the new selection. For example, present selection is *Local*. Now if in running condition, the selection is changed to *Terminal.* If *RUN* signal is present in terminal mode, the AC Drive will continue running. If *RUN* signal is absent, the AC Drive will stop. When the selection is changed from *Terminal* to any other mode (*Local* or *Serial*), AC Drive will continue its operation as per the status of *Terminal* and not as per the new selection (*Local* or *Serial*).

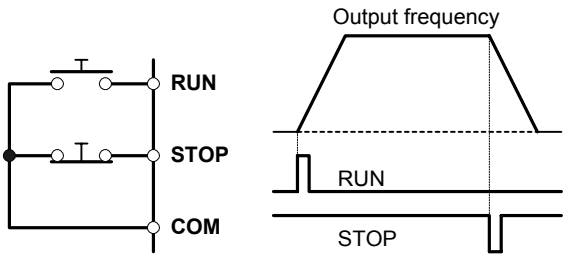
A302: Maintained Start / Stop

When using Terminal as start control (*A301=2*), this parameter gives the choice of having maintained or momentary contacts for start or stop.

If *A302=0*: The start / stop control is maintained type as described in below figure.



If *A302=1*: The start / stop control is momentary type as described in below figure.



A303: Start Delay Time (Sec)

The Spindle will be delayed start from the run command by the set time. This is used for synchronization with peripheral machines such as mechanical brakes. The start command can be from Digital Operation Panel (keypad), Terminal or Serial.

The start delay time is also applicable to *Jog Select* input.

A304: Stop Mode

This parameter allows the user to select the stop mode. If *A304=0* selected, the output will ramp down to stop with deceleration time after the stop command and then applying the dc brake (if programmed) to stop. If *A304=1* selected, the output will be turned off simultaneously with the stop command. The dc braking will not be applicable in this mode. The Spindle will stop depending on its inertia.

To restart after coast to stop, confirm that the Spindle has stopped. The AC Drive may trip if attempted when the Spindle is running. (Enable the speed search function in such applications.)

A305: Spindle Direction

This parameter allows the user to set the Spindle direction, when Start control selection is local (Digital Operation Panel) *A301=1*. Set *A305=0*, to rotate the Spindle in forward direction and *A305=1* to rotate the Spindle in reverse direction in Local mode.

When *A301=2: Terminal*, the direction of rotation is determined by the status of programmable sequence input.

A306: DC Brake Start Frequency (Hz)

This is the frequency at which the dc brake will be applied. To enable this feature, the stop mode should be ramp down and the dc braking time should not be zero. ***If dc braking time is zero, this feature will be disabled.***

A307: DC Brake Current (%)

This parameter decides the dc brake current.

A308: DC Brake Time (Sec)

This parameter decides the length of time for which dc braking is on.

When the stop mode is ramp down and stop command is issued, the output will ramp down with deceleration time. When the AC Drive output reaches to dc braking start frequency, the dc voltage is injected to the Spindle. The amount of voltage and the length of time for which it is applied are decided by the dc braking current *A307* and *A308* respectively.

The dc braking is utilized to stop high inertia load forcefully. During dc braking mechanical energy trapped in rotor due to system inertia will be dissipated as heat in the Spindle. Hence for safety dc breaking is utilized at lower frequency.

GROUP – 4: V / F CHARACTERISTICS

A401: V/F Selection

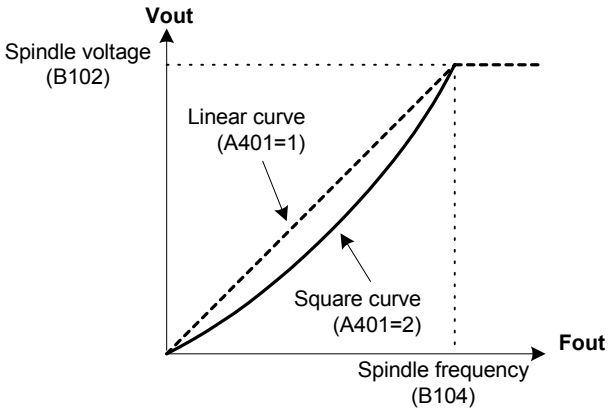
Select appropriate v/f curve as per the application.

The AC Drive can be operated in linear curve mode, Square curve or custom setting mode.

In a linear curve mode, the v/f curve will be linear through out the range from minimum frequency to Base frequency.

In square curve, the v/f curve will be square as shown in the figure. Fan and pump application require additional energy conservation on variable torque/ horsepower loads due to reduced output v/f at lower frequencies. So that Fan and pump loads can be programmed with $X=Y^2$ law.

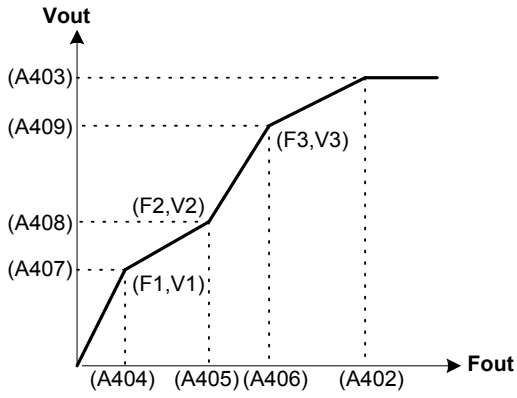
The custom mode setting allows the user to set different v/f points on characteristic curve using parameters *A402 ~ A407*.



A402 ~ A404: V/F1 ~ 3 Frequency (Hz)

A405 ~ A407: V/F1 ~ 3 Voltage (Vac)

Custom three-point v/f characteristics as shown in the below figure can be set for the Spindles having special v/f characteristics. Choose custom v/f curve in *A401*.

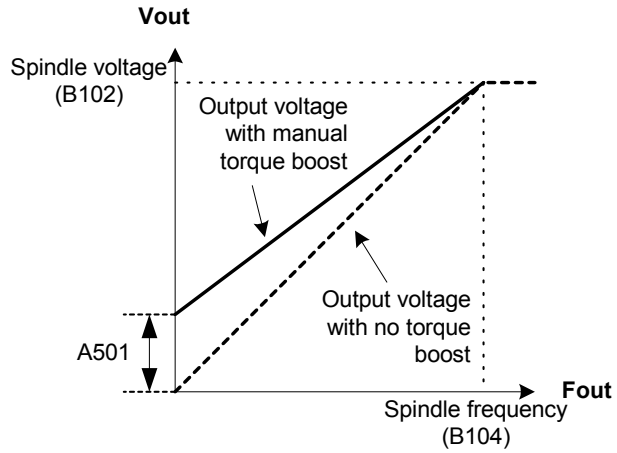


Set so that F1 (*A402*) ≤ F2 (*A403*) ≤ F3 (*A404*) ≤ Spindle Frequency (*B104*) and
V1 (*A405*) ≤ V2 (*A406*) ≤ V3 (*A40*) ≤ Spindle Voltage (*B102*) ≤ Rated input Voltage (*B101*).

GROUP – 5: TORQUE BOOST

A501: Manual Torque Boost setting (%)

When setting manually, set the boost voltage at 0Hz as a percentage in respect to the Spindle voltage (*B102*). When programmed to zero, it will be disabled.



A502: Gap Eliminator Threshold (%)

This is % of spindle rated power (*B106*). Gap Eliminator Threshold sets the threshold level which, when exceeded, causes “Gap eliminator detect” (if selected in PSO or programmable relays) output to activate and displays status “Gap Elimi On” in status line. Base load sample is taken internally after reaching the set speed. The function will not work in Ramp up or Ramp down. Gap eliminator threshold is added to the base load level to set the actual threshold level.

This parameter can be set individually for 15 different auxiliary spindles. (D213, D313,….., DG13).

Gap eliminator function is disable, when gap eliminator threshold value is 0.0% (default) or “16: Gap Eli Det” option is not selected in programmable output.

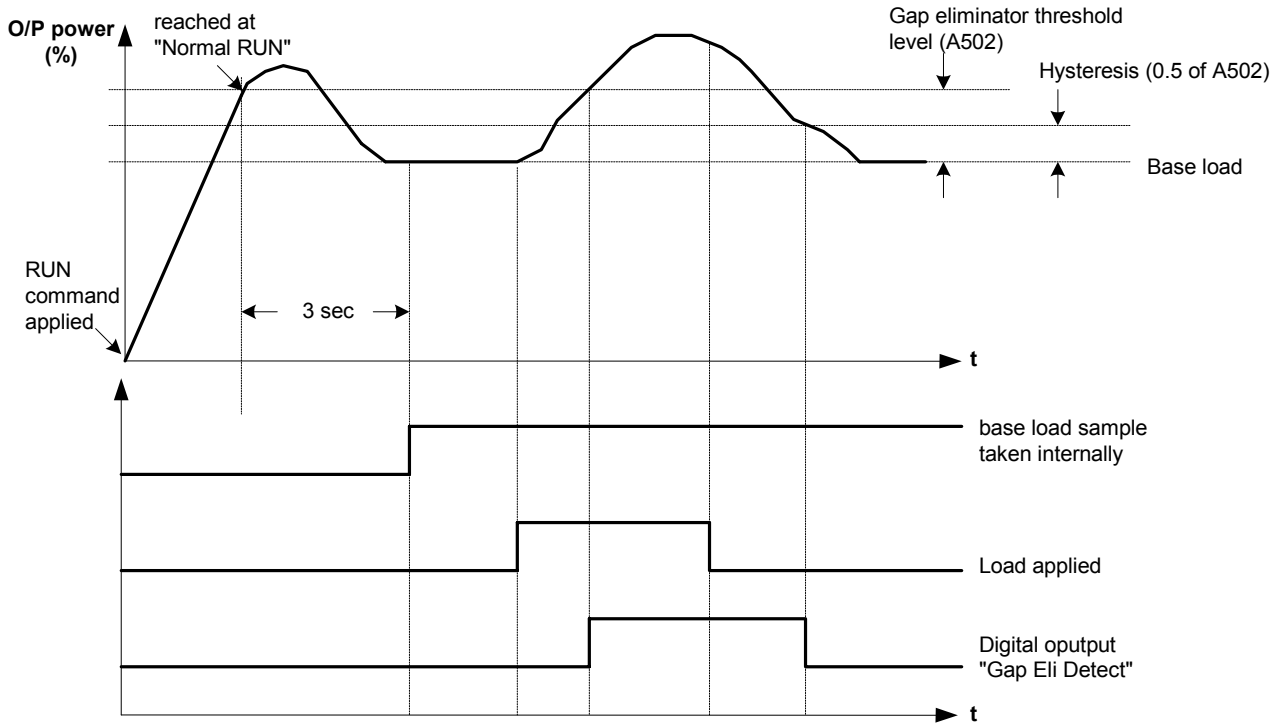
The gap eliminator function is useful in applications where it is necessary to “close the gap” between a spindle’s tool and the work piece using a fast feed rate. When the tool hits the part face and the load threshold is exceeded, the relay is activated and the feed rate is reduced (by the user).

Volt compensation gain (*A504*) compensates the effect of input supply voltage variation in power when spindle is in “Normal Run” condition but the tool is not yet in contact with the part.

Any time the spindle reaches to the “Normal Run” condition, the present load (output power) is sampled and stored as the base load. The sampling and storage of the base load level occurs 3 sec after “Normal Run” condition is reached.

Note:

1. It is important that the frequency reference input (0~10V or 4-20mA) remain stable during the entire operation. Fluctuation in frequency reference may cause malfunction of gap eliminator function.
2. Machining must not start until 3 sec after “Normal Run” condition has been reached. Changing the spindle load during this period will cause the sampling of an improper base load level.

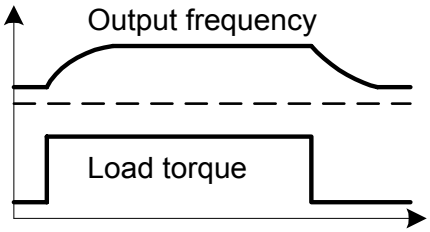


The base load sample can alternatively be taken from digital input (PSI "16: Base Load Input") by user after reaching at set speed ("Normal Run" condition). The feature is useful in applications where the speed is constant. By periodically taking a base load sample input, machine load variations (temperature, time, etc.) are eliminated. This is momentary type input and once this digital input is active, the base load sample will be taken after 1 second. Note that if the digital input is kept ON all the time, it will not update the base load sample again. Reapply the digital input to take next sample.

When "Gap Eli Det" is selected in digital programmable sequence output (PSO) or programmable relay output, it will activate on the output power crosses the programmed threshold level (*A502*) form base load sample taken. It will deactivate with Hysteresis (0.5 of *A502*).

A503: Slip Compensation (Hz)

Set Spindle's rated slip. When setting manually, set the slip frequency for the Spindle rated load in respect to the base frequency. The output frequency changes according to the Spindle rated torque. The output frequency will respond with a time constant of approximately 10msec in respect to the change in the load torque.



A503: Volt compensation gain

This parameter is to compensate the effect of input supply voltage variation in power. It is used in gap eliminator function.

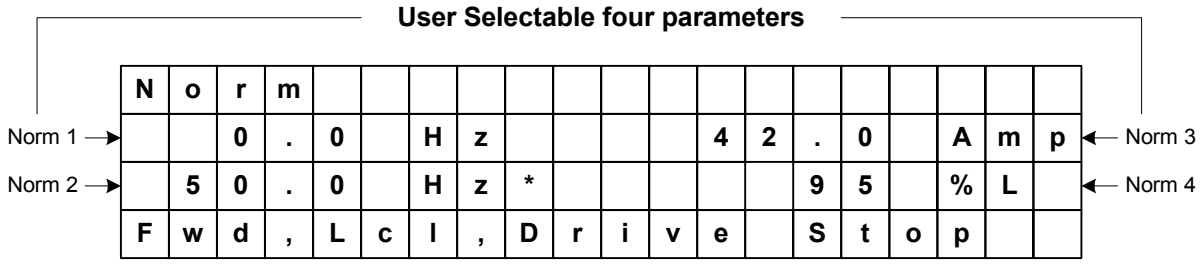
GROUP – 6: DISPLAY PARAMETER SELECTION

A601 ~ A608: Normal parameter 1 ~ 8

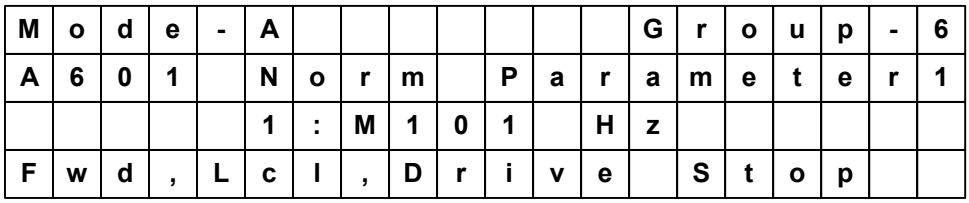
A601: It selects parameter wishing to display on normal screen position *Norm-1* out of M101~M105 and M201~M210 of monitor mode.

Similarly A602~A608 selects parameters for *Norm-2* to *Norm-8* positions.

The default setting will be as under.

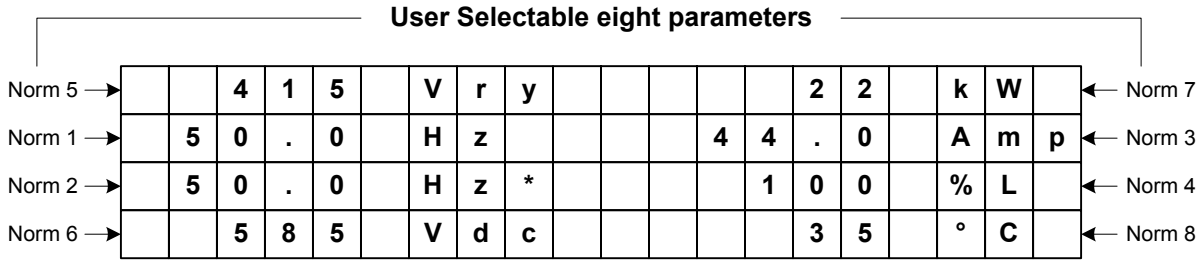


To display the Output Frequency M101 (Hz) parameter at *Norm 1* position as shown in the above screen, select option 1 (M101 Hz) in parameter A601 Norm Parameter1.



Similarly, to display the desired parameters at positions Norm 2, Norm 3 and Norm 4, select the appropriate option in A602, A603 and A604 respectively.

Parameters A605~A608 selects parameters for *Norm-5* to *Norm-8* positions for the meter screen and are not applicable for the normal screen. Below is the meter screen with eight parameters.



MODE – B

GROUP – 1: SPINDLE PARAMETERS

B101: Rated Input Voltage (Vac)

Select suitable rated input voltage for the AC Drive. When the rated input voltage is changed, the Spindle voltage may change accordingly.

B102: Spindle Voltage (Vac)

Enter Spindle nameplate voltage. This is the Spindle terminal voltage during full load at the spindle frequency.

B103: Spindle Current (Amp)

Enter Spindle rated current from the Spindle nameplate. This is full load Spindle current at base frequency. The timed over current and other current related protections are based on this value. This value cannot be set higher than AC Drive rated current *M303*.

Note)

When using the output transformer (D102 =Enable), the drive current and spindle current will be different. The displayed current (M103 & M104) will be of spindle and not of the inverter.

*Enter the Spindle current in B103 (= Spindle Name plate current * B101 Rated Input voltage / Output Transformer Secondary Voltage D103~D106)*

B104: Spindle Frequency (Hz)

Enter Spindle base frequency from the Spindle nameplate.

B105: Spindle Speed (KRPM)

Enter Spindle base speed in KRPM from the Spindle nameplate.

B106: Spindle Type (kW)

Enter Spindle capacity from the Spindle nameplate.

B107: Spindle Poles

Enter Spindle poles from the Spindle nameplate.

B108: Carrier Frequency

This is the carrier frequency of the pwm. Set in accordance to the rated capacity of the AC Drive. If set higher than the specified carrier frequency, derate the output current accordingly.

B109: DTC Gain

This is gain for the dead time compensation. Adjust incase of Spindle hunting.

GROUP – 2: SPINDLE CONSTANT

B201 & B202: Primary Resistance R1 (mΩ)

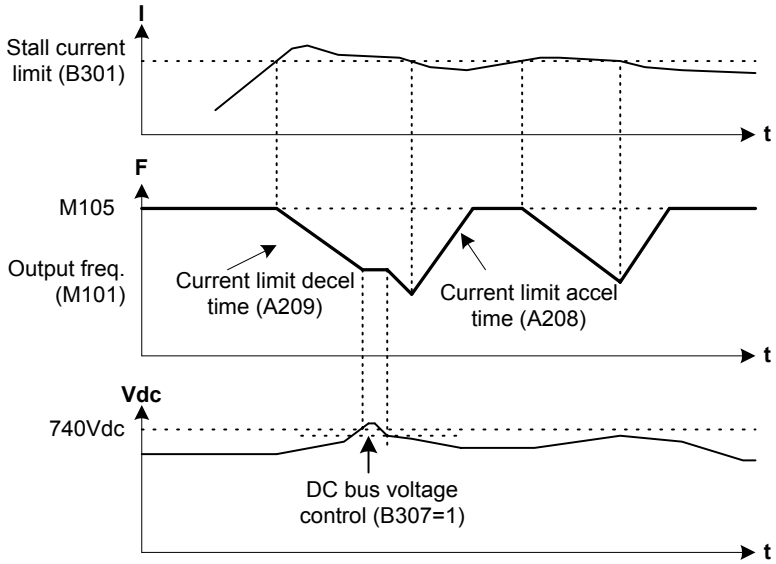
The Spindle circuit constant is set. This value is decided by mantissa section *B201* and exponent section *B202* as below. R1 = Value of B201 x (10^ value of *B202)* [mΩ].

For example, if B201= 0.200 and B202= 2, the value of R1= 0.200 x 10^2 = 0.200 x 100 = 20 mΩ

GROUP – 3: PROTECTION PARAMETERS

B301: Stall Current Limit (%)

When the AC Drive output current crosses the stall current limit, the output ramps down with Current limit deceleration time *A209*. This is effective only when the AC Drive is operating at set speed. This feature is not active while the AC Drive is accelerating or decelerating. When the current decreases below the programmed value, the AC Drive again starts accelerating to the set speed with Current limit acceleration time *A208*. This feature helps in maintaining relatively constant output torque characteristics.



Set the current limit as a percentage of Spindle rated current.

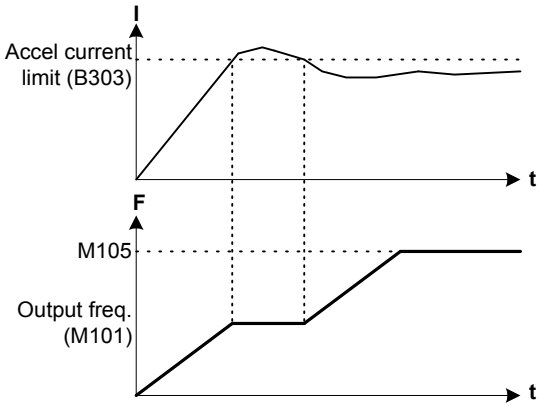
B302: Adjustable Over Current Level (%)

Set the upper current limit as a percentage of Spindle rated current. Whenever the AC Drive output current exceeds the set value, the AC Drive trips indicating Adjustable over current fault. Always set higher side to prevent the unnecessary tripping of the AC Drive during normal operation. This gives the user to program the current level below the standard inverse time curve. This may be used in cases where excessive torque shocks can lead to a harmful effect on the machinery.

The default setting of 200% disables this feature and standard inverse time trip remains in effect.

B303: Acceleration Current Limit (%)

This is acceleration current limit and effective only during normal acceleration. It stops the acceleration during acceleration, if the Spindle current exceeds the programmed value. When the current reduces below the programmed value, the AC Drive again starts accelerating to the set speed. This feature helps in preventing over current tripping of high inertia load during fast acceleration.



B304: Under Current Level (%)

This feature trips the AC Drive when the current falls below the programmed value for more than 1sec after the speed reaches its set speed. This feature is not active while the AC Drive is accelerating or decelerating. Making this 0 will disable this.

Note: In pump applications, if the flow decreases below a minimum speed there will be cavitations. This feature becomes useful to turn off the pump in such case.

B305: Overload Setting (%)

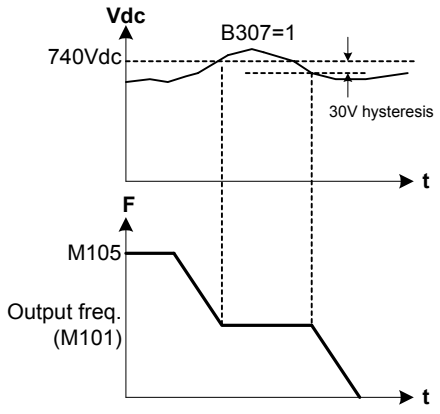
This is reference for the inverse time overload characteristics. Changing this parameter can change the inverse time overload characteristics. The setting uses Spindle rated current as 100%.
The available over load is 150% for 60 seconds inverse time characteristics. Note that if 155% of the rated current is exceeded, a trip will occur at the 160% for 10 seconds and at 170% for 4 seconds.

B306: Earth Fault Detection level

This is % of Spindle current. This decides the level for tripping because of earth fault.

B307: DC Bus voltage Control

When enabled it will stop deceleration to prevent the over voltage during deceleration condition. Refer below figure for the functioning of dc bus voltage control. The deceleration will cease, if dc bus voltage is >740V. It will resume only after the dc bus voltage reduces to 710V (30V hysteresis). In this case actual deceleration time will be more than the programmed deceleration time.



B308: Reverse Direction Lock

Set this to prevent unintentional reverse direction operation. When enabled it will prevent the AC Drive to start in reverse direction. This parameter cannot be changed during running condition.

Not: If reverse direction is locked and run command is given with reverse direction selection, the AC Drive will not start in reverse direction.

B309: Parameter Lock

This is user programmable 4-digit password to prevent unintentional parameter change from the digital operation panel. When programmed, it will not allow the user to change any parameter from digital operation panel or serial link except Local Set Frequency *A101 (or D206 or D306…)*, PID Reference Setting *C611* and terminal functions. ***The unit will be shipped without any password protection.*** To lock the parameters, first enter your selected 4-digit password in *B310* and then enter any value other than your selected password to *B309*. The parameters will be locked and cannot be changed (except the set frequency). Now, to open the lock, enter the selected password to *B309.* If you have entered correct password, you will have the access of all parameters. Now you can change the parameters, even the password. To lock the parameters again follow the same thing.

B310: Change Password

This parameter is used to change the 4-digit user password for parameter locking.

B311: Default value Load

Default Load as per US standard

When set to 333, default value will be loaded as per 60Hz/460V (US standard) in all the parameters. However, this will not change the factory setting parameters, user password, C205~C216 and C219~C222. Following parameters will be different than the general default.
A101, A103, B104, D203, D206, D208, D303, D306, D308, ……, DG03, DG06, DG08 = 60.00Hz
B101, B102, D201, D301, ….., DG01 = 460V
B105, D204, D304, ….., DG04 = 1.80 KRPM

General Default Load

When set to 444, default value will be loaded in all the parameters as per 50Hz/415V. However, this will not change the factory setting parameters, user password, C205~C216 and C219~C222.

Fault History Clear

When set to 555, the fault history buffer is cleared. No previous fault code and parameter will be available.

Full Default Load

When set to 666, all the parameters will be set to default condition including C205~C216 and C219~C222. However, this will not change the factory setting parameters and user password.

Note that the value entered in B311 will not be memorized. If correct value is entered, appropriate action will be taken and "00" will be displayed. If incorrect value is entered, no action will be taken and "00" will be displayed.

B312: Spindle Thermistor Trip

If spindle thermistor is connected to terminals CANH & CANL, user can select Spindle thermistor function with this parameter. If "1: Enable" is selected, drive will trip in SPINDLE HOT/THERMISTOR SHORT ("Spindle hot/short") trip when drive will sense external resistor more than 4.2 kΩ or less than

30 Ω between CANH and CANL terminal. This function can be used to protect the spindle from over heating.
In default condition this function is Disable.

B313: Output Current Unbalance Level (%)

Set the unbalance current level for the output. When the current unbalance exceeds the set level, the unit will trip. Set to 0% to disable the function.

GROUP – 4: PRESET SPEED

B401 ~ B407: Preset Speed 1 ~ 7 (Hz)

This is frequency setting for different preset speeds. The drive supports eight different speeds that can be set by three programmable sequence input using parameters *C101 ~ C106, C114, C115* The following preset speed can be selected with the sequence input commands *Preset i/p-0*, *Preset i/p-1* and *Preset i/p-2*. Set desire frequencies in *B401 ~ B407*. When no sequence input is present, the set frequency will be decided by the Frequency reference input *A106*.

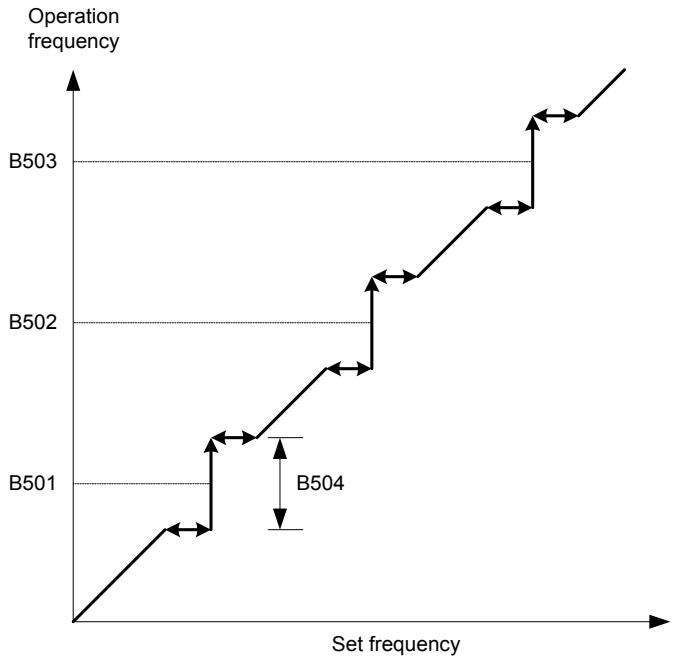
Preset i/p-2	Preset i/p-1	Preset i/p-0	Speed Selected
OFF	OFF	OFF	Normal Speed Reference (*A106*)
OFF	OFF	ON	Preset Speed 1 (*B401*)
OFF	ON	OFF	Preset Speed 2 (*B402*)
OFF	ON	ON	Preset Speed 3 (*B403*)
ON	OFF	OFF	Preset Speed 4 (*B404*)
ON	OFF	ON	Preset Speed 5 (*B405*)
ON	ON	OFF	Preset Speed 6 (*B406*)
ON	ON	ON	Preset Speed 7 (*B407*)

The *Start Control A301* determines the direction of rotation. If *Local* (Digital Operation Panel) is selected as start control, the direction can be change only through parameter *A305*. When *Terminal* is selected as start control, the status of sequence input terminal would decide the direction.
The preset speed can be set higher than max frequency *A103* up to 1800Hz. However, the output frequency will not exceed the maximum frequency *A103*.

GROUP – 5: SKIP FREQUENCY

B501: Skip Frequency 1 (Hz)

If the equipment being driven has problems due to mechanical resonance at some frequencies, the same can be jumped over by programming them in parameters *B501 ~ B503*. The AC Drive output settles for top or the bottom of the skip band, the one being closest to the desired speed. This is only applicable during normal operation of the AC Drive. During acceleration or deceleration this parameter will not function.


Operation
frequency
B503
B502
B501
B504
Set frequency

MODE – C

GROUP – 1: PROGRAMMABLE INPUT / OUTPUT SELECTION

C101 ~ C106: PSI-1 ~ 6

C114 ~ C115: PSI-RUN, PSI-STOP

User can configure eight programmable sequence inputs for different functions using parameters *C101 ~ C106, C114 & C115*. The status of the *Programmable Sequence Input* can be monitored in *M306*. The various options are explained as under.

<table>
<tr><th>OPTION</th><th>FUNCTION NAME</th><th colspan="4">FUNCTION</th></tr>
<tr><td>1</td><td>Not Used</td><td colspan="4">Indicates that no function is selected on the PSI.</td></tr>
<tr><td>2</td><td>Jog Select</td><td colspan="4">This is a jog command. If this signal is ON while RUN is OFF, operation then conforms to the setting of jogging speed. For stoppage, either ramp down stop or coast to stop is available.</td></tr>
<tr><td>3</td><td>Ramp select</td><td colspan="4">Acceleration / Deceleration ramp performance is switched over. Acceleration / Deceleration Time-2 is available with ON, and Acceleration / Deceleration Time-1 is available with OFF.</td></tr>
<tr><td>4</td><td>Preset i/p-0</td><td colspan="4" rowspan="3">The Preset Speed 1~7 are selected as per the binary combination of the Preset i/p-0 ~ 2.</td></tr>
<tr><td>5</td><td>Preset i/p-1</td></tr>
<tr><td>6</td><td>Preset i/p-2</td></tr>
<tr><td>7</td><td>Freq Increase</td><td colspan="4" rowspan="2">The currently selected frequency setting is increased or decreased. When the ON state continues, the frequency is incremented /decremented with 0.1Hz at every 100msec. This is valid only if static potentiometer is selected as frequency reference source in A106</td></tr>
<tr><td>8</td><td>Freq Decrease</td></tr>
<tr><td>9</td><td>E-Stop (NO)</td><td colspan="4">This is used as emergency stop. This is Normally Open type. When the digital input (connected to COM in case of sink logic or to +24V in case of source logic) is close, Emergency stop occurs as per the selection in C503.</td></tr>
<tr><td>10</td><td>Fault Reset</td><td colspan="4">This is used for the fault reset. If RUN input is present at the time of fault reset, the AC Drive will not start after fault reset. Issue fresh RUN command to start the AC Drive after fault reset.</td></tr>
<tr><td>11</td><td>Ext Flt (NO)</td><td colspan="4">This is used for the external fault function. This is Normally open type. When the digital input (connected to COM in case of sink logic and to +24V in case of source logic) is close, external fault occurs.</td></tr>
<tr><td>12</td><td>Terminal</td><td colspan="4">When this input is selected, the operation control will be switched over to terminal.</td></tr>
<tr><td>13</td><td>Ref Select 0</td><td rowspan="5">These two inputs are used to select the frequency reference as shown in the side table.</td><td>Ref Select 1</td><td>Ref Select 0</td><td>Freq reference</td></tr>
<tr><td rowspan="4">14</td><td rowspan="4">Ref Select 1</td><td>0</td><td>0</td><td>A106</td></tr>
<tr><td>0</td><td>1</td><td>FSI 4-20mA</td></tr>
<tr><td>1</td><td>0</td><td>Static Pot</td></tr>
<tr><td>1</td><td>1</td><td>Serial</td></tr>
<tr><td>15</td><td>Reverse</td><td colspan="4">This input is used to select reverse direction of rotation in terminal mode.</td></tr>
<tr><td>16</td><td>Base Load Sample i/p</td><td colspan="4">This is used to sample the power for the gap eliminator function from the digital input. Sample is taken after 1 second the activation of the digital input in normal run condition. This is momentary type input, so reapply the digital input to take the next sample.</td></tr>
</table>

<table>
<tr><td rowspan="16">17

18

19

20</td><td rowspan="16">Spindle Sel 1

Spindle Sel 2

Spindle Sel 3

Spindle Sel 4</td><td rowspan="16">These four inputs are used to select the auxiliary Spindle as shown in the side table.</td><td>Spindle Sel 4</td><td>Spindle Sel 3</td><td>Spindle Sel 2</td><td>Spindle Sel 1</td><td>Selected Spindle</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>Main Spindle</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>Auxiliary Spindle 1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>Auxiliary Spindle 2</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>Auxiliary Spindle 3</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>Auxiliary Spindle 4</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>Auxiliary Spindle 5</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>Auxiliary Spindle 6</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>Auxiliary Spindle 7</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>Auxiliary Spindle 8</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>Auxiliary Spindle 9</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>Auxiliary Spindle 10</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>Auxiliary Spindle 11</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>Auxiliary Spindle 12</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>Auxiliary Spindle 13</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>Auxiliary Spindle 14</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>Auxiliary Spindle 15</td></tr>
<tr><td>21</td><td>E-Stop (NC)</td><td colspan="6">This is used as emergency stop. This is Normally Close type. When the digital input (connected to COM in case of sink logic or to +24V in case of source logic) is open, Emergency stop occurs as per the selection in C503.</td></tr>
<tr><td>22</td><td>Ext Flt (NC)</td><td colspan="6">This is used for the external fault function. This is Normally Close type. When the digital input (connected to COM in case of sink logic and to +24V in case of source logic) is open, external fault occurs.</td></tr>
<tr><td>23</td><td>RUN</td><td colspan="6">This is used to give RUN command from terminal.</td></tr>
<tr><td>24</td><td>STOP</td><td colspan="6">This is used to give STOP command from terminal.</td></tr>
<tr><td>25</td><td>Enable (NO)</td><td colspan="6">This is used for the “Enable” function. It allows drive output when RUN command is given. When “Enable” is not active, output will not come even though RUN command is present. This is Normally open type. When link (connected to COM in case of sink logic and to +24V in case of source logic) is closed, “Enable” function activates.</td></tr>
<tr><td>26</td><td>Enable (NC)</td><td colspan="6">This is used for the “Enable” function. It allows drive output when RUN command is given. When “Enable” is not active, output will not come even though RUN command is present. This is Normally Closed type. When link (connected to COM in case of sink logic and to +24V in case of source logic) is open, “Enable” function activates.</td></tr>
</table>

The default selection is as under.

TERMINAL	OPTION	NAME
PSI1	2	***Jog Select***
PSI2	9	***Emergency stop***
PSI3	10	***Fault Reset***
PSI4	4	***Preset i/p-0***
PSI5	5	***Preset i/p-1***
PSI6	6	***Preset i/p-2***

PSI-RUN	23	***RUN***
PSI-STOP	24	***STOP***

C107 ~ C110: PSO-1 ~ 4

User can configure four programmable sequence outputs for different functions using parameters *C107 ~ C110*. The status of the *Programmable Sequence Output* can be monitored in *M307*. The various options are explained as under.

OPTION	NAME	FUNCTION
1	***Not Used***	No function is selected.
2	***Run***	This turns ON during running, jogging or DC braking.
3	***Local***	This turns ON when the operation mode is local (operation from the digital operation panel is selected).
4	***Reverse Run***	This turns ON when the Spindle is reverse running.
5	***I-Detection***	This turns ON when the output current reaches the programmed crush current (current detection) Level *C302* or higher.
6	***Freq Attain***	This turns ON when the output frequency (speed) reaches the set frequency (speed). The detection reach width is set with frequency attainment detection width *C301*.
7	***Speed Detect1***	This turns ON when the output frequency (speed) value reaches a speed higher than the speed set with the detection level –1 *C303*.
8	***Speed Detect2***	This turns ON when the Spindle speed reaches a speed higher than that set in the detection level-2 *C304*.
9	***Acceleration***	This turns ON during acceleration.
10	***Deceleration***	This turns ON during deceleration.
11	***Timer Output***	This turns ON during running, jogging, pre-excitation and DC braking. A programmable off delay is provided (*C309*), so even if the above operations turn OFF, this control will not turn OFF for programmed time. This is used for external fan/ Spindle control.
12	***Zero Speed***	This turns ON when the output frequency (speed) value is below the level set with zero speed detection level *C305*.
13	***Fault Alarm***	This output is ON when minor fault alarm is detected.
14	***PID Up Limit***	The output will be activated when the PID output reaches to the programmed upper limit value *C608*.
15	***PID Lo Limit***	The output will be activated when the PID output reaches to the programmed lower limit value *C609*.
16	***Gap Eli. Detected***	This will be activated when the output power crosses the programmed threshold level (*A502*) form base load sample taken. It will deactivate with Hysteresis (0.5 of *A502*). See description of parameter *A502*.
17	***Spindle Sel 1***	These four outputs will be turned ON as per the binary number when the respective auxiliary Spindle is selected as shown in the below table.
18	***Spindle Sel 2***	
19	***Spindle Sel 3***	
20	***Spindle Sel 4***	
21	***Thermal Trip***	This output will be turned ON when the resistance of the Spindle thermister is measured outside the range of 30R ~ 4k2.
22	***Temp Alarm***	The output is ON when the heat sink temperature exceeds the set Temperature Alarm Level in *C311.*

23	***Ready***	The output is ON when the unit is ready to start. The soft charge contactor is energized and no fault condition persists.
24	***Fault***	The output is ON when fault occurs.

Status of outputs with respect to the selected Spindle

Selected Spindle	Spindle Sel 4	Spindle Sel 3	Spindle Sel 2	Spindle Sel 1
Main Spindle	0	0	0	0
Auxiliary Spindle 1	0	0	0	1
Auxiliary Spindle 2	0	0	1	0
Auxiliary Spindle 3	0	0	1	1
Auxiliary Spindle 4	0	1	0	0
Auxiliary Spindle 5	0	1	0	1
Auxiliary Spindle 6	0	1	1	0
Auxiliary Spindle 7	0	1	1	1
Auxiliary Spindle 8	1	0	0	0
Auxiliary Spindle 9	1	0	0	1
Auxiliary Spindle 10	1	0	1	0
Auxiliary Spindle 11	1	0	1	1
Auxiliary Spindle 12	1	1	0	0
Auxiliary Spindle 13	1	1	0	1
Auxiliary Spindle 14	1	1	1	0
Auxiliary Spindle 15	1	1	1	1

The default setting of the programmable sequence outputs are as under.

TERMINAL	OPTION	NAME
PSO1	2	***Run***
PSO2	6	***Freq Attain***
PSO3	1	***Not Used***
PSO4	1	***Not Used***

C111 ~ C113: Programmable Relay-1 ~ 2 & fault relay

User can configure three programmable relays for different functions using these parameters. The status of the *Programmable Relay* can be monitored in *M307*. The options are same as PSO.
The default settings are as under.

RELAY	OPTION	NAME
Programmable Relay-1	2	***Run***
Programmable Relay-2	1	***Not Used***
Programmable fault Relay	24	***Fault***

GROUP – 2: ANALOG OUTPUT SELECTION

C201 ~ C202: Vout-1 ~ 2

User can configure two programmable analog outputs (0~10V) for different functions using parameters *C201 ~ C202*.

OPTION	NAME	FUNCTION
1	***Output Freq***	The analog output will correspond to the output frequency (0~A103).
2	***O/P Current***	The analog output will correspond to the output current (0~200%).
3	***Output Power***	The analog output will correspond to the output power (0~B106).
4	***Output Volt***	The analog output will correspond to the output voltage (0~100%).
5	***DC Bus Volt***	The analog output will correspond to the dc bus voltage (0~800).
6	***PID Output***	The analog output will correspond to the PID Output (0~100%)
7	***Heat sink Temp***	The analog output will correspond to the heat sink temperature, 0~100°C (32~212°F)

The default setting of the programmable analog outputs are as under.

TERMINAL	OPTION	NAME
VO1	1	***Output Freq***
VO2	2	***O/P Current***

C203 ~ C204: Iout-1 ~ 2

User can configure two programmable analog outputs (4~20mA) for different functions using these parameters. The options are same as above.

The default setting of the programmable sequence outputs are as under.

TERMINAL	OPTION	NAME
IO1	3	***Output Power***
IO2	4	***Output Volt***

C205: Vout-1 Gain

This is gain setting for the VO1 analog output.

C206: Vout-2 Gain

This is gain setting for the VO2 analog output.

C207: Iout-1 Gain

This is gain setting for the IO1 analog output.

C208: Iout-1 Bias

This is bias setting for the IO1 analog output.

C209: Iout-2 Gain

This is gain setting for the IO2 analog output.

C210: Iout-2 Bias

This is bias setting for the IO2 analog output.

C211: FSV Gain

This is gain setting for the FSV analog output.

C212: FSV Bias

This is bias setting for the FSV analog output.

C213: FSI Gain

This is gain setting for the FSI analog output.

C214: FSI Bias

This is bias setting for the FSI analog output.

C215: IIN Gain

This is gain setting for the IIN analog output.

C216: IIN Bias

This is bias setting for the IIN analog output.

C217: FSV / FSI Time Constant

This parameter set the filter time constant for the FSV and FSI analog inputs.

C218: IIN Time Constant

This parameter set the filter time constant for the VIN and IIN analog inputs.

C219: Vout-1 Bias

This is bias setting for the VO1 analog output.

C220: Vout-2 Bias

This is bias setting for the VO2 analog output.

C221: Spindle Thermistor Gain

This is gain setting for the Spindle thermistor input.

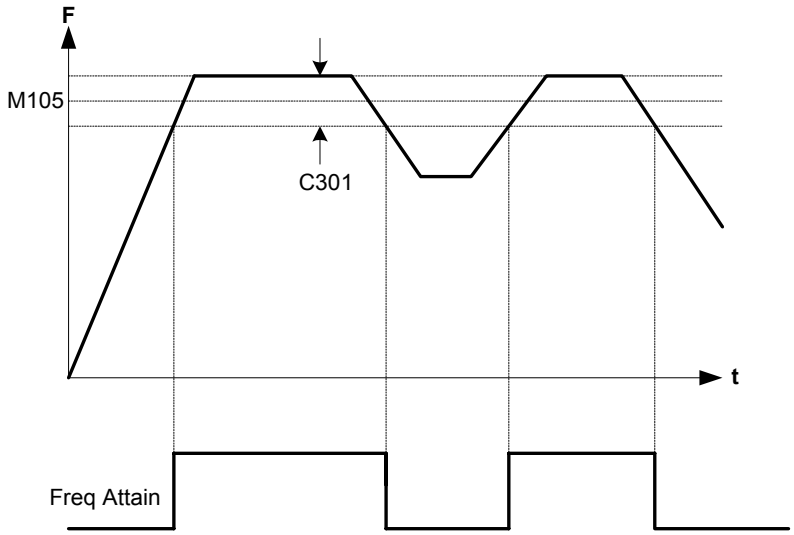
C222: Spindle Thermistor Bias

This is bias setting for the Spindle Thermistor input.

GROUP – 3: STATUS OUTPUT DETECTION LEVEL

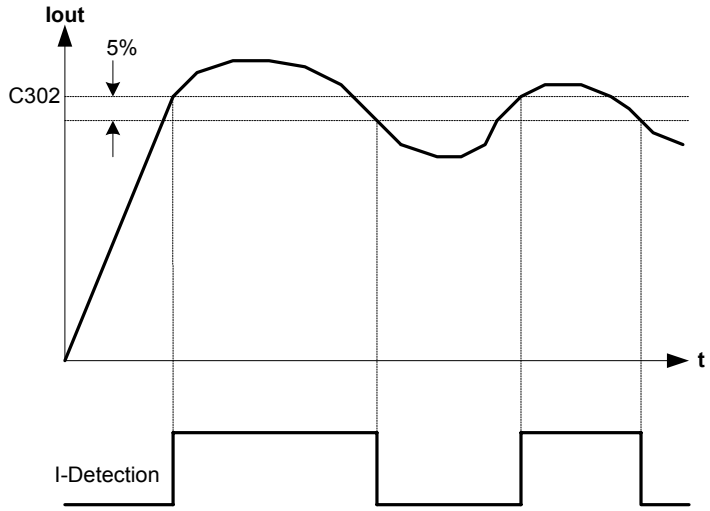
C301: Frequency Attainment detection Width (%)

The frequency output attained operation width is set using this parameter as % of maximum frequency *A103*. If ***Freq Attain*** option is selected for the PSO and relay outputs in parameter *C107 ~ C112*, the output is enabled when the output frequency attains the set frequency. The width of the attainment detection is decided by the programmed value in *C301* as explained in below figure. The output remains high even if drive recent frequency deviates above or below set frequency by Attainment width. Set with a percentage to the maximum frequency *A103*.



C302: Crush current (current detection) Level (%)

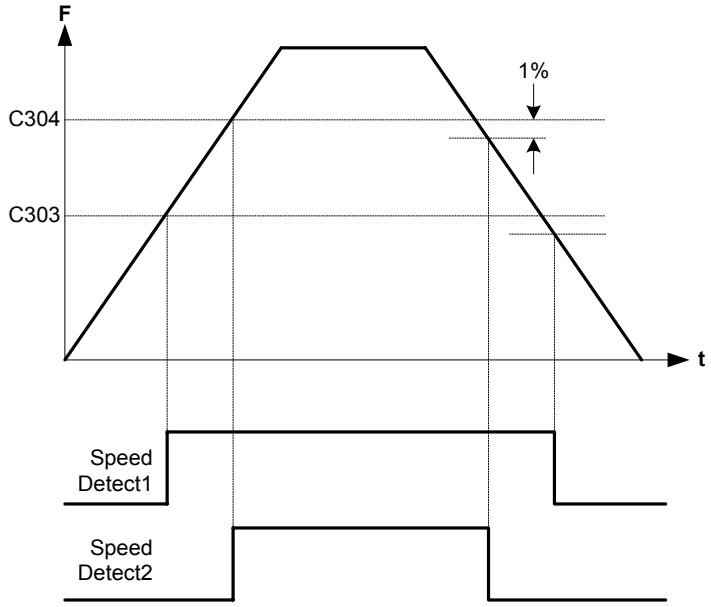
The crush current (current detection) level is set. Set with a percentage of the rated current *(B103)*. A 5% hysteresis will occur with the I-Detection operation, which means the output will be off only when the output current drops below the Current detection level by 5%. The state of the ***I-Detection*** programmable sequence output is shown in the below figure.



C303: Speed Detection Level – 1 (%)

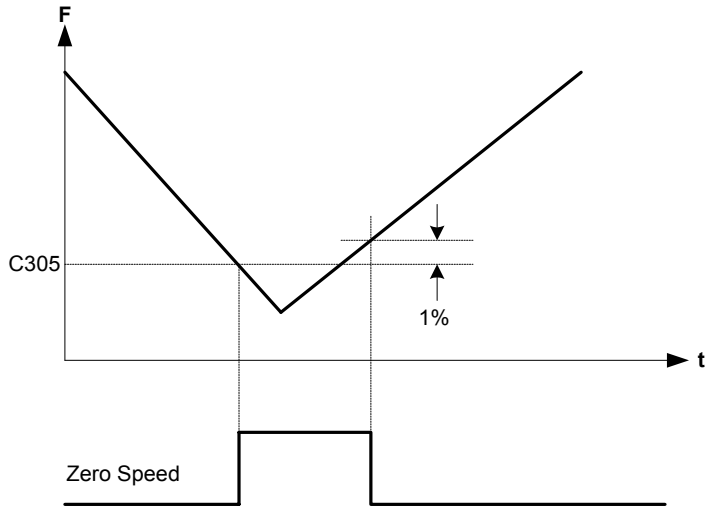
C304: Speed Detection Level – 2 (%)

The speed detection operation level is set. Set with a percentage to the maximum frequency *A103*. The output frequency or the Spindle speed will be the comparison target. When the output frequency reaches the set level, the output will be ON. When the frequency reduces below the 1% hysteresis level, the output will be OFF.



C305: Zero Speed Detection Level (%)

The Zero speed detection operation level is set. Set with a percentage to the maximum frequency *A103*. The output frequency or the Spindle speed will be the comparison target. A 1% hysteresis will occur with zero speed operation. The status of ***Zero Speed*** programmable sequence output is as under.



C306: 4-20mA Reference Loss

This parameter configures the AC Drive's response to a failure or fault of the 4-20mA frequency reference input signal. The various options are as under.

1: No action at fault detection
2: Minor fault alarm and run at Minimum Speed
3: Minor fault alarm and run at Maximum Speed
4: Minor fault alarm and run at set speed
5: Minor fault alarm and run at preset speed-1
6: Fault, ramp down to stop
7: Fault, coast to stop

C307: Output Phase Loss Selection

When enabled, AC Drive will trip in the following condition. If the output current of any one phase is <5% and the other two-phase current is >10% (factory set) of Spindle rated current.

C308: Timer Output control Selection

This parameter decides the status of the ***Timer Output*** option of the programmable sequence output. When set to "0", the programmable sequence output will be ON only when AC Drive is ON. When set to "1", it will be ON whenever power is applied.

C309: Timer Output Off Delay Time (Sec)

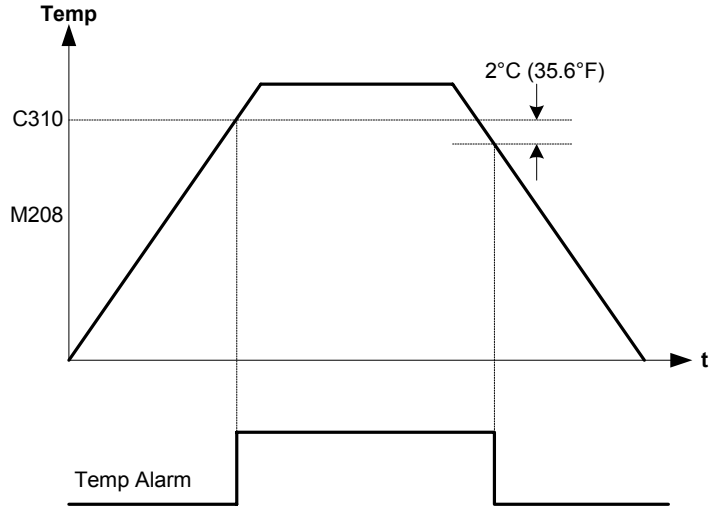
This parameter is applicable if timer output control selection is "0". This is the delay time in turning off the programmable sequence output after the AC Drive is off. Set the time in seconds.

C310: Temperature Control selection

This parameter controls the automatic change of the carrier frequency in case of temperature rise above 90°C (194°F) level. When enabled, the carrier frequency will be automatically reduced to control the heat sink temperature. Once the frequency is reduced, it will only be increased if the heat sink temperature reduces below 75°C (167°F).

C311: Temperature Alarm Level

This is temperature alarm level set point. Whenever the heat sink temperature exceeds the set value, the Temp Alarm output will be set. Hysteresis of 2°C (35.6°F) hysteresis will occur with temperature alarm.



GROUP – 4: SERIAL COMMUNICATION

C401: Baud Rate

Drive is facilitating with serial communication between drive unit and computer terminal. To control or monitor single/ multiple units from single computer terminal, serial link can be used. This parameter defines Baud rate (number of signal transition per second, it can be number of bits per second). The available options are as under. Option-4 is set as default baud rate.

1: 1200	4: 9600
2: 2400	5: 19200
3: 4800	

Refer the detail manual for the ModBus protocol and other information.

C402: Station Number

This parameter defines the address of the unit when connected to the serial network. This AC Drive supports the ModBus protocol. The station number can be assigned to 1 ~ 247.

C403: Parity

This parameter is used to set the parity. Parity is error-checking code to prevent from erroneous data transformation between drive unit and terminal.

C404: Response Time (Sec)

Set the minimum time from receiving the command to returning an answer.

C405: Operation Panel Communication Loss selection

Enable or disable the operation panel communication loss fault. If enabled, AC Drive will generate fault if it does not receive any response from the operation panel within 5 sec. By default setting, this fault is disabled.

For detail information on the ModBus protocol and register assignment, please refer "Serial Communication Guide, Version 1.0".

Note: Put jumper JP3 to "LD" position to use terminating resistors. Remove the cover designated as "Control Unit" to access this jumper on PCA-2014A.

GROUP – 5: AUTO RESTART & SPEED SEARCH

C501: Number Of Restart

C502: Restart wait Time (Sec)

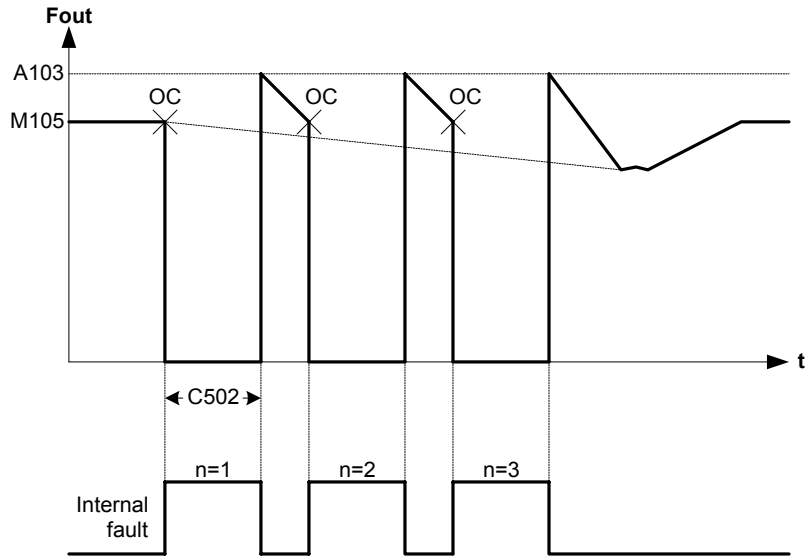
Restart is function to reset the fault in the AC Drive and restart automatically to continue operation if a fault occurs. User can select these parameters to automatically restart the unit in fault condition to provide reliability and continuity of process during fault conditions.

Programming 0 in *C501* disables the restart feature. Number of restart *C501* defines the number of attempts to restart during the fault condition.

When a fault is detected, the AC Drive output is shut off for the restart wait time *C502*. The operation panel displays the fault while the AC Drive output is OFF.

When the restart wait time elapses, a fault is reset automatically and speed search operation is performed.

When the number of such attempts exceeds the number of restart *C501*, the faults are not reset automatically and the AC Drive output remains OFF. At this time a fault relay is activated and the fault data will be stored in fault history. The RUN relay will also be deactivated.



The number of restart times is cleared to 0 in the following cases.

1. A fault does not occur for more than 10 minutes.
2. A fault reset signal is applied from the operation panel or terminal.
3. The power supply is turned off and turned ON again.

This function is applicable to the following nine faults.

1. Instantaneous over current fault.
2. Timed over current fault.
3. Over voltage fault.
4. Under voltage fault.
5. Adjustable over current fault.
6. Earth fault.
7. Over temperature fault.
8. Under current fault.
9. External fault.

C503: Emergency Stop mode

Set the stopping method for the emergency stop from the following options.

1. Coast to stop without fault output
2. Coast to stop with fault output
3. Ramp down to stop

C504: Speed Search selection

C505: Speed Search Current Limit (%)

C506: Speed Search Frequency Deceleration time (Sec)

C507: Speed Search Voltage Acceleration time (Sec)

C508: Speed Search Wait Time (Sec)

Speed search operation is useful to start the coasting Spindle or AC Drive changeover operation without tripping. When selected, the AC Drive starts speed search from the maximum frequency. The

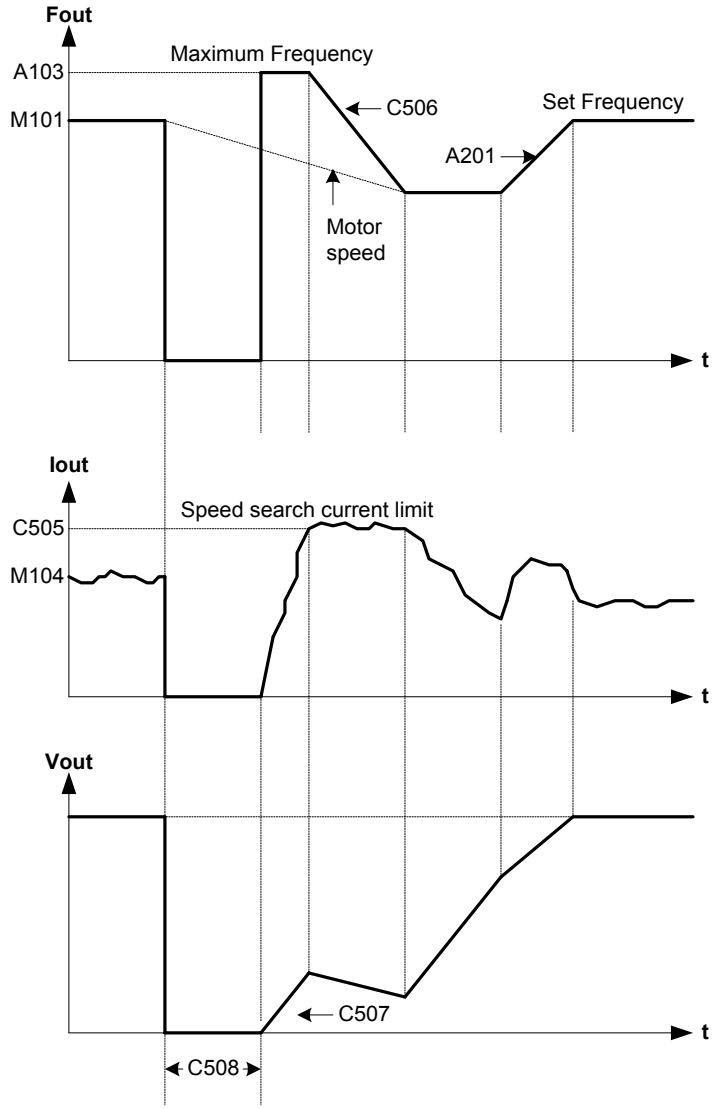
operation starts after the speed search wait time *C508* after the start command. The following figure explains the sequence of operation.

Speed search current limit *C505* is applicable only during the speed search operation. The output frequency deceleration time and output voltage acceleration time during the SSF can be adjusted using *C506* and *C507* respectively as per the application.

C509: PLCT Time (Sec)

Power Loss Carry Through is a function that allows the AC Drive to run trip-less during the short-term power outage / under voltage. As soon as the power outage / under voltage is detected, the AC Drive output is turned OFF. If the supply resumes before the programmed time in *C509*, the AC Drive will start with the speed search operation and reach to the set frequency. The fault relay will not be enabled during this process nor the under voltage fault displayed on the operation panel. However, if the power outage or under voltage condition persists for longer time than the programmed time, the AC Drive will trip indicating under voltage fault. When programmed to 0, the PLCT feature is disabled.

Note: The time in C509 must be less than the time for which the control power supply remains stable during the power outage or under voltage condition.



SPEED SEARCH FUNCTION

GROUP – 6: PID CONTROL SELECTION

C601: PID Control Selection

The AC Drive provides one inbuilt PID controller, which can be used to change the AC Drive output frequency or can be utilized as stand alone module. This parameter is used to validate the PID operation. When PID is used to control the speed of the AC Drive, select ***PID Output*** as frequency reference in *A106*. The PID output can also be selected for the analog output. This will be useful when using PID control block as stand alone module.

C602: PID Polarity

This parameter can be used to invert the output of PID as per the system requirement.

C603: PID Reference Input

The PID reference input can be selected from any of the five options. The various options include ***FSV 0-10V, FSI 4-20mA, Iin 4-20mA, Local*** and ***Serial***.
The value of selected PID reference input is displayed in *M107 in %*.

C604: PID Feedback Input Selection

The PID feedback input can be selected from any of the three options. The various options include ***FSV 0-10V, FSI 4-20mA*** and ***Iin 4-20mA***. The option selected for the PID reference input cannot be selected for the PID feedback input.
The value of selected PID feedback input is displayed in *M108 in %*.

C605: Proportional Gain

This parameter is used to set the proportional gain for the P-control. Setting to zero does not perform P-control.

C606: Integral Time

This parameter is used to set the integral time for the I-control. Setting to maximum value does not perform I-control.

C607: Derivative Gain

This parameter is used to set the derivative gain for the D-control. Setting to zero does not perform D-control.

C608: PID deviation Upper Limit

This is the upper limit for the PID output deviation. If the programmable sequence output ***PID Up Limit*** is selected, the output will be ON, when the PID output reaches to this level.

C609: PID deviation Lower Limit

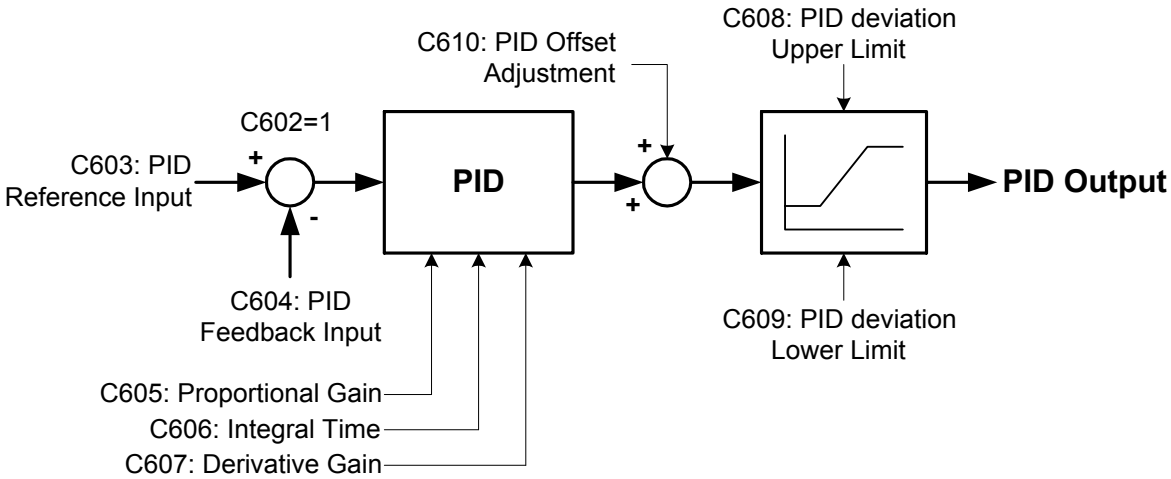
This is the lower limit for the PID output deviation. If the programmable sequence output ***PID Lo Limit*** is selected, the output will be ON, when the PID output reaches to this level.

C610: PID Offset Adjustment

Sets offset for the output after PID control.

C611: PID Reference Setting

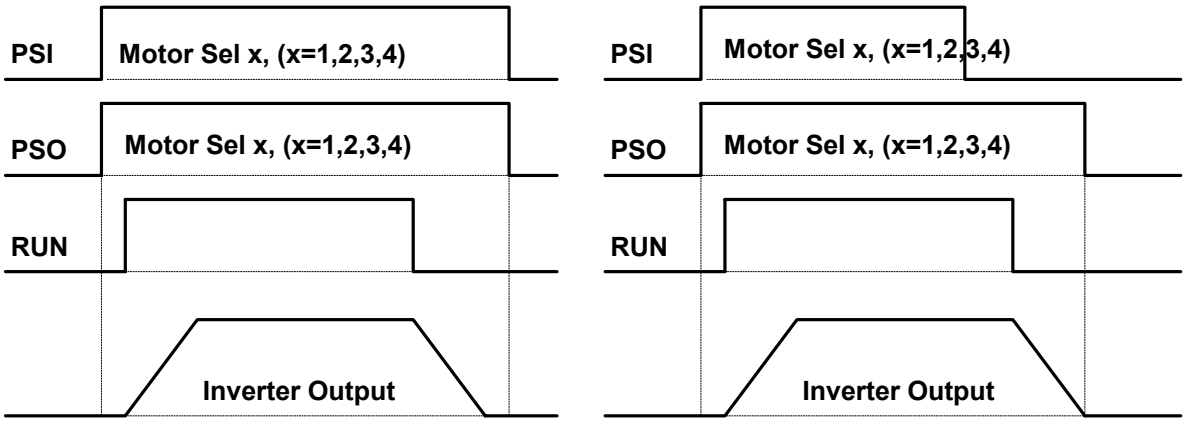
When ***Local*** is selected as PID reference, this parameter is used to set the PID reference using digital operation panel. This parameter will not have any effect if other options are selected as reference.



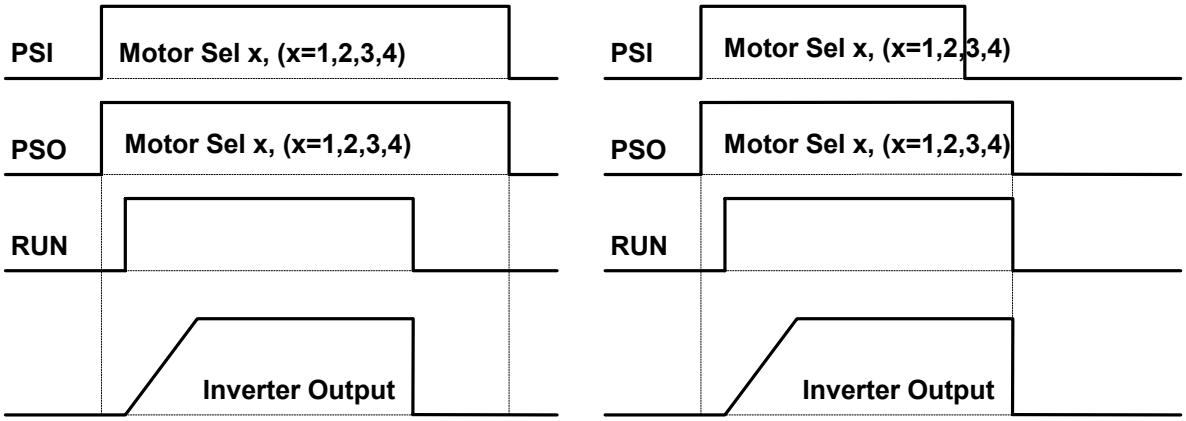
PID Controller

MULTI-SPINDLE SELECTION PARAMETER

When multi-Spindle operation is selected the inverter output & different sequence output commands will be as shown in the below figure.



When stop mode seletced is Ramp down to stop



When stop mode seletced is Coast to stop

MODE – D

GROUP – 1: SPINDLE PARAMETERS

D101: Frequency Reference Input Selection (Multi-Spindle)

This selects the Frequency Reference for selected Spindle.

D102: O/p Transformer Secondary Selection

Select the required O/p Transformer Secondary using this parameter.

Output transformers are useful in high frequency applications when spindle voltage is significantly lower then the available line voltage. It is also useful for increasing the output current without increasing the drive current rating (output voltage reduction).

Note)

When using the output transformer (D102=Enable), the drive current and spindle current will be different. The displayed current (M103 & M104) will be of spindle and not of the inverter.

*Enter the Spindle current in DX02 (= Spindle Name plate current * B101 Rated Input voltage / Output Transformer Secondary Voltage D103~D106), where X = 2, 3, 4…. 9, A…. G*

D103: O/p Transformer Secondary 1

Enter the secondary-1 voltage of output transformer.

This is used to display the correct output voltage *M203*.

For example, the displayed output voltage *M203*= (Commanded output voltage x Output transformer secondary voltage *D103~D106*) / Rated input voltage *B101*

D104: O/p Transformer Secondary 2

D105: O/p Transformer Secondary 3

D105: O/p Transformer Secondary 4

GROUP – 2: SPINDLE PARAMETERS

D201: Spindle Voltage (Volt)

Enter Spindle nameplate voltage of Spindle-1. This is the Spindle terminal voltage during full load at the Spindle frequency.

D202: Spindle Current (Amp)

Enter Spindle rated current from the Spindle-1 nameplate. This is full load Spindle current at spindle frequency. The timed over current and other current related protections are based on this value. This value cannot be set higher than AC Drive rated current *M303*.

Note:

When using the output transformer (D102 =Enable), the drive current and spindle current will be different. The displayed current (M103 & M104) will be of spindle and not of the inverter.

*Enter the Spindle current in DX02 (= Spindle Name plate current * B101 Rated Input voltage / Output Transformer Secondary Voltage D103~D106), where X = 2, 3, 4…. 9, A…. G*

D203: Spindle Frequency (Hz)

Enter Spindle base frequency from the Spindle-1 nameplate.

D204: Spindle Speed (KRPM)

Enter Spindle base speed from the Spindle-1 nameplate. When higher than this speed, the flux control during vector control will be weakened.

D205: Spindle Type (kW)

Enter Spindle rated capacity from the Spindle-1 nameplate.

D206: Local Set Frequency (Hz)

This is the set frequency for Spindle-1 when the frequency reference input source is **local (*D101=1*)**. The output will ramp to this frequency, when start command is given. It can be set in Hz (0.1 resolution) on in KRPM (0.01 resolution) according to selection in *A107*.

The minimum limit for this parameter is decided by minimum frequency *D207*.

The maximum value of this parameter is decided by Maximum frequency *D208*. The value of *D206* cannot be set higher than *D208*.

D207: Minimum Frequency (Hz)

This is the minimum output frequency of the AC Drive when Spindle-1 is selected. It can be set in Hz (0.1 resolution) on in KRPM (0.01 resolution) according to selection in *A107*.

In terminal mode, this is the minimum output attained with minimum analog input reference. This value should always be lower then the maximum frequency *D208*. The minimum frequency will be reached after start command with selected acceleration ramp up time.

D208: Maximum Frequency (Hz)

This is the maximum output frequency of the AC Drive when Spindle-1 is selected. It can be set in Hz (0.1 resolution) on in KRPM (0.01 resolution) according to selection in *A107*.
In terminal mode, this is the maximum output attained with maximum analog input reference.

D209: Line Speed Setting (rpm)

The set value will be displayed as Spindle speed in *M102* at Maximum Frequency (D208) when this Spindle-1 is selected.

If the value of Maximum Frequency (D208) = 1800 Hz. & D209 = 108000.

Now, at 600Hz the Spindle speed *M102* will show (108000 X 600 / 1800) i.e. 3600 rpm.

In default condition, at zero value Spindle speed (D204) will be displayed as spindle speed in M102 at Maximum Frequency (D208).

D210: Acceleration Time-1 (Sec)

Acceleration Time-1 is the time taken by AC Drive output frequency to ramp up from zero frequency to maximum frequency *D208*, when Spindle-1 is selected.

Short acceleration time can result in excessive output current and if it exceeds the Acceleration current limit *B303*, the acceleration will cease until the current reduces below the *B303* value. In such case, the actual acceleration time will differ from programmed value. The AC Drive may trip in timed over current fault if the condition persists for long time. Increase acceleration time in such cases.

D211: Deceleration Time-1 (Sec)

Deceleration Time-1 is the time taken by AC Drive output frequency to ramp down from maximum frequency *D208* to zero frequency.

Short deceleration time can result in excessive output current and if it exceeds the Stall current limit *B301*, the deceleration will cease until the current reduces below the *B301* value. In such case, the actual deceleration time will differ from programmed value. The AC Drive may trip in timed over current / dc bus over voltage fault if the condition persists for long time. Increase deceleration time in such cases.

D212: Manual Torque Boost setting (%)

This parameter is for the Spindle-1. When setting manually, set the boost voltage at 0Hz as a percentage in respect to the Spindle voltage *D201*. When programmed to zero, it will be disabled.

D213: Gap Eliminator Threshold (%)

It is gap eliminator threshold level (% of rated power) for the Spindle-1.For gap eliminator function see description of parameter A502.

D214: V/F Selection

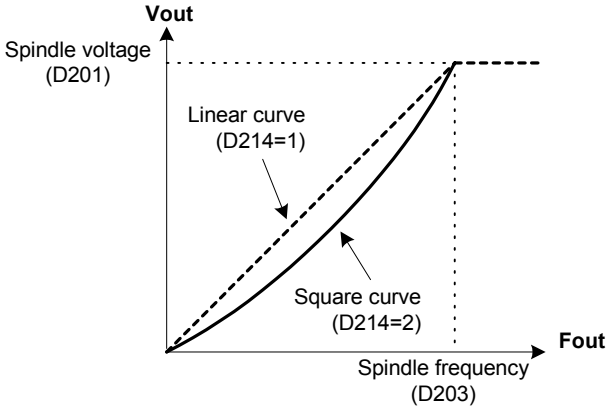
Select appropriate v/f curve as per the application.

The AC Drive can be operated in linear curve mode, Square curve or custom setting mode.

In a linear curve mode, the v/f curve will be linear through out the range from minimum frequency to Base frequency.

In square curve, the v/f curve will be square as shown in the figure. Fan and pump application require additional energy conservation on variable torque/ horsepower loads due to reduced output v/f at lower frequencies. So that Fan and pump loads can be programmed with $X=Y^2$ law.

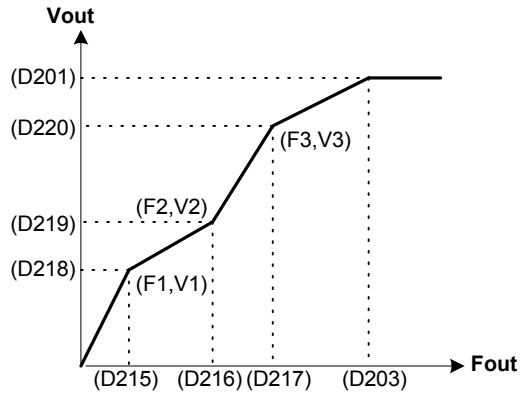
The custom mode setting allows the user to set different v/f points on characteristic curve using parameters *D215~ D220*.



D215 ~ D217: V/F1 ~ 3 Frequency (%)

D218 ~ D220: V/F1 ~ 3 Voltage (%)

Custom three-point v/f characteristics as shown in the below figure can be set for the Spindles having special v/f characteristics. Choose custom v/f curve in D214.



Set so that F1 (*D215*) ≤ F2 (*D216*) ≤ F3 (*D217*) ≤ Spindle frequency (D203) and
V1 (*D218*) ≤ V2 (*D219*) ≤ V3 (*D220*) ≤ Spindle Voltage (D201) ≤ Rated input voltage (B101).

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CHAPTER- 7: ELECTRONICS CIRCUIT BOARDS

AXPERT Eazy Series High frequency AC Drive has following electronics circuit boards.

1. Main Control Board PCA-2014A

The control board PCA-2014A is designed for Standard Variable frequency AC drives of lower HP and High Frequency.

It uses **32-bit High-Performance Digital Signal Processor TMS320F2811**. The control board generates the necessary pwm control signals for AC Drive operation. It accepts various inputs from different circuits, gate drive board and Digital Operation Panel (LCD Keypad Module) to generate the necessary control and gate signals.

The TMS320F2811 (U1) is the heart of this board. It handles the user interfaces and core algorithm and generates IGBT gate signals. The PCA-2014A is connected to PCA-2012 Display Card with RS-485 link. PCA-2012 displays various parameters of the drive.

2. Display Board PCA-2012

The unit is equipped with Digital Operation Panel (LCD Keypad Module) for the user interface. All parameters of drives can be accessed from Digital Operation Panel. The Digital Operation Panel consists of Display Board PCA-2012 and 8-keys. The display board uses 20x4 Liquid Crystal Display (LCD).

It has LPC2368 controller. When interfaced with main control board PCA-2014A, this becomes master and the main control boards works as slave. The master and slave communication is based on RS-485 (Modbus-RTU Protocol).

3. Power Supply and IGBT Gate driver Unit

Power supply and SMPS board PCA-92A is used for control supply and PCA-1024 is used for IGBT gate driving circuit. Input for SMPS circuit is derived form DC link. Main control board PCA-2014A provides the input gate pulse via FRC cable. In case of fault, PCA-1024 transmits the fault signal to the main control board.

4. MOV, RC Snubber, SC & BLEEDER Board PCA-91

This is snubber board for the input diode. It is a combination of R and C connected across the dc bus. This board also includes Soft charge resister and MOV network to protects the unit against the surge / voltage transients coming in the power lines.

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CHAPTER- 8: MAINTENANCE, INSPECTION & PART REPLACEMENT

DANGER

- Always wait at least 20 minutes after turning the input power OFF before starting inspection.
  Wait at least 20 minutes after turning the input power OFF before starting work. Make sure that the displays on the operation panel have gone out before removing the front cover.
  Remove the front cover, and confirm that the "DC BUS CHARGE LED" on bleeder board has gone out. Also check that the voltage between terminals L+1 or L+2 and L– is 15V or less before starting the inspections.
  Failure to observe this could lead to electric shocks.
- Maintenance, inspections and part replacement must be done by a designated person.
  (Remove all metal accessories such as watches, bracelets, etc., before starting the work.)
  (Always use an insulation measure tool.)
  Failure to observe this could lead to electric shocks and injuries.
- Always turn the power OFF before inspecting the Spindle or machine. A potential is applied on the Spindle terminal even when the Spindle is stopped.
  Failure to do so could lead to electric shocks and injuries.
- Do not use parts other than those designated for the replacement parts.
  Contact your AC Drive dealer for replacement parts.
  Failure to observe this could lead to fires.
- Never modify the product.
  Failure to observe this could lead to electric shocks or injuries or product failure.

CAUTION

- ✓ Vacuum the AC Drive with a vacuum cleaner to clean it. Do not use water or organic solvents.
  Failure to observe this could lead to fires or damage.
- ✓ Do not megger the unit.
  Failure to observe this could lead to damage to semiconductor devices.

8-1 Inspection Items

The inspections must be carried out periodically according to the working environment and frequency of use. If there are any abnormalities, the cause must be inspected immediately and countermeasures taken.

Daily inspections

Inspection item	Inspection details and work
Temperature/humidity	Confirm that the ambient temperature is –10 to 50°C (14 to 122°F), and that the humidity is 95% or less with no dew condensation.
Oil mist and dust	Confirm that there is no oil mist or dust in the AC Drive.
Abnormal noise and vibration	Confirm that there is no abnormal noise or vibration from the installation site or AC Drive.
Input power source	Confirm that the input voltage and frequency are within the specifications range.
Cooling fan	Confirm that the cooling fan rotates normally and that no lint, etc. is stuck on it.
Indicator	Confirm that all lamps on the operation panel light properly.

Periodic Inspections

Inspection item	Inspection details and work
Appearance	Check the state of dirt and dust on the vent or heatsink, and clean if necessary.
Interior	Check the state of dirt and dust on the PCB and inside the equipment, and clean if necessary.
Terminal block	Tighten the terminal block screws if loose.
Cooling fan	Replace the fan every three years.
Electrolytic capacitor	Confirm that there is no liquid leaking or sheath discoloration.
Insulation resistance inspection	Do not perform a megger test on the AC Drive. When doing a megger test on the external circuit, disconnect all wires connected to the AC Drive.

Inspection of spares

The inspection shown in above table must also be performed for spare AC Drives that are left connected but are not used in normal operation. The operation of the AC Drive must be checked every six months by turning the power on.

8-2 Measuring Devices

As the voltage and current on the input and output sides include high harmonics, the measured value will differ according to the measuring device. When measuring with a device for commercial frequencies, measure with the following circuits and noted measuring devices.

Input voltage: Moving iron type voltmeter

Output voltage: Rectifying voltmeter

Input / output power: Electrodynamometer type wattmeter

CHAPTER- 9: OPTIONS

Besides the standard features available in the **Axpert Eazy HF series AC Drive**, which satisfies most of the industrial applications, *AMTECH* offers its users a spectrum of optional products designed to match their requirement.

The list of optional products offered by *AMTECH* herewith is all developed, field tested and commissioned at various locations in India. A brief description of the option is given. Contact *AMTECH* with relevant data to design one for you.

Green Power Technology

Non-linear loads like AC Drive, *UPS*, Converters etc. draw power from mains in a way, which introduce harmonic currents into the mains. They behave like harmonic source, which feeds harmonic to all the equipments, connected with the power source. **IEEE STD 519: 1992; *IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power System*** states that it is the responsibility of the consumer to curb this mains 'Pollution' at the source point itself within acceptable limits.

AMTECH offers *Input Harmonic Converter* as a solution for this problem. As per the requirement and acceptable limits of induced harmonics such converters can be tailor made for you. Contact *AMTECH* for details on *Input Harmonic Converter.*

Output Sinus Filter

Output of any AC Drive is Sine PWM (Pulse Width Modulation) modulated at high frequency carrier wave. When this kind of waveform encounters Spindle load, it tends to create very high dV/dt stress for the stator winding. After a long time the stator insulation gets weakened up and ultimately the stator flashover takes place. The problem is particularly severe in places where the location of Spindle and AC Drive is at large distance. This happens because of the impedance mismatch between cable and the Spindle surge impedance. This can reach as high as 1.9 times the DC bus voltage.

Output Sinus Filter helps to outcome this problem. The output after sinus filter becomes sinusoidal and the Spindle gets relieved from excessive dV/dt stress. Spindle can be placed far away from AC Drive. The Spindle loss due to harmonic heating also reduces considerably.

Output Sinus Filter also helps in controlling the EMI and RFI generated by the power cable and Spindle. That means an added advantage for equipments operating with small voltages and high frequencies. Contact *AMTECH* for details on *Output Sinus Filter*.

Input/ Output Filter

Input filter is installed before the converter stage of the any AC Drive to smoothen the current drawn from mains power supply. This also improves the wave shape at the input, as the peak value of drawn current is restricted and the mains transformer do not goes towards saturation.

Output filter with around 3% impedance helps in changing the characteristic impedance of the Spindle. Now the AC Drive sees the output filter as the reflecting impedance and the filtering choke bears the dV/dt spikes. Thus the dV/dt transient do not hampers the Spindle thereby increasing its insulation life and reduced heating. Alternatively *RC Filters* and *LC Filters* and other passive component combinations are also designed to suit a particular requirement. For sizing and best filter selection for your system, contact *AMTECH*.

Metering

At times there may be need of monitoring the internal AC Drive data. Optional analog or digital metering of AC Drive operating data like various voltages, currents, rpm etc can be provided in the panel. For the AC Drive data, which can be monitored, and the extra hardware, contact *AMTECH* for details.

Enclosure

Some applications may demand enclosures, which suit the environment where the unit is to be installed. Protection against water or ingress or against some harmful ambient gas can be provided within the scope of the manufacturer. The enclosure can be modified for required degree of protection like IP54/ 55. Occasionally the shape and size of the enclosure can also be discussed for incorporating the unit in some other predefined structure. Contact *AMTECH* for details on *Enclosure options.*

Battery Backup AC Drive

For critical applications where the equipment can't bare the stoppage due to interruptions in the power supply or its complete failure, *AMTECH* offers battery backup AC Drives. This is also applicable at locations where the input power provided for AC Drive is DC. Contact *AMTECH* for details on *Battery Backup AC Drive.*

Remote Operator Box

Remote box for operation from near the actual driven Spindle site can be provided for the user with optional controls and displays. We remind you here that our standard keypad control box can be taken up to 1000 feet without any problem. Contact *AMTECH* for details on *Remote Operator Box.*

EMI Filter

AC Drive output carries high frequency carrier wave generates electromagnetic radiations. *AMTECH* offers EMI filters to minimize the affect of AC Drive generated EMI noise on other equipments, which are microprocessor based, and are placed very near to such EMI sources.

Dynamic Braking Unit

Dynamic breaking up 100% of the unit rating can be provided for high inertia loads, which require fast deceleration. The mechanical inertial rotating energy is converted into electrical energy and dissipated at dynamic breaking resistors. Contact *AMTECH* for details on *Dynamic Braking.*

AC Drive Bypass

A bypass with Direct-On-Line or Star-Delta bypass start can be provided for Spindle at critical places where the process cannot bear any eventuality arising out of AC Drive failure. Contact *AMTECH* for the scheme of bypass and other details on *AC Drive bypass option*.

CHAPTER- 10: SERIAL COMMUNICATION SET-UP

The AXPERT Eazy Drive is equipped with a serial communication function using RS485 as a standard. It acts as a Modbus slave in the network. The unit can be controlled with a host computer (master) using this function.

10-1 Connection method

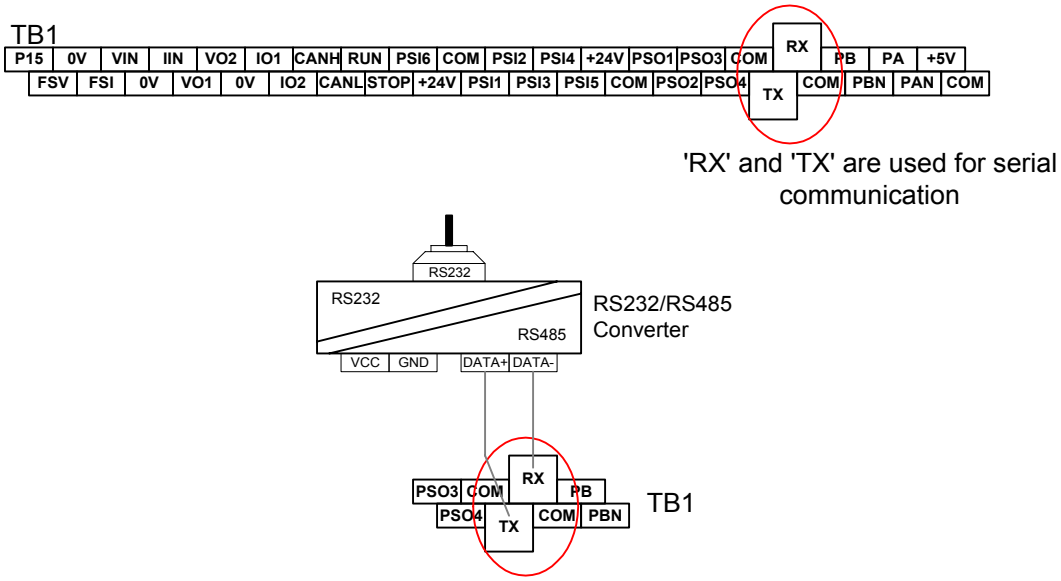
This network is configured of one host computer (master) and 1 to 247 max AXPERT Eazy units (slaves). TB1 on main control board is used for the connection.

Refer to Chapter-2 Installation and Wiring for wiring the control signal and for the wiring methods.

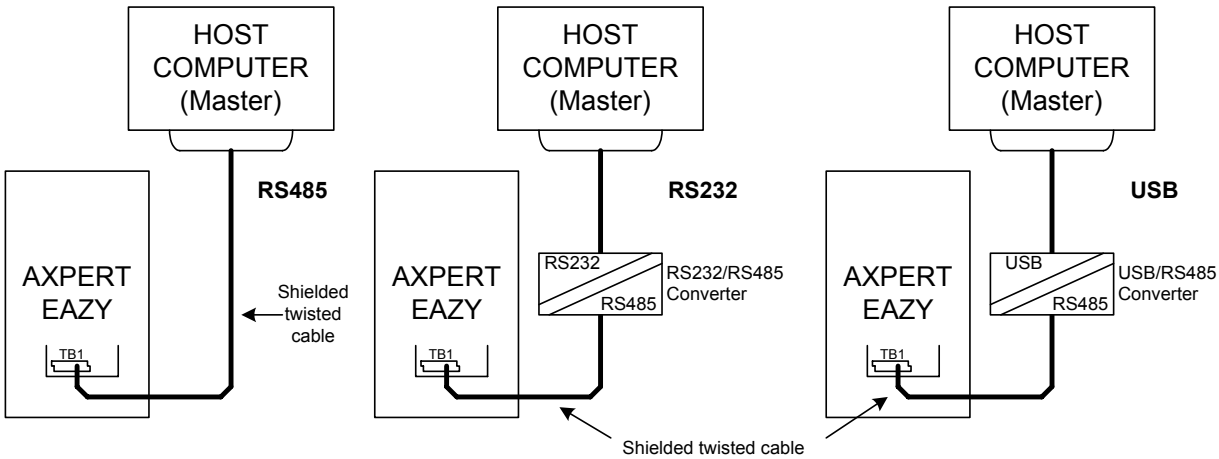
The total length of the connected cable must be within 300mt (1000ft).

By using a commercially available RS485-RS232C converter or USB converter unit, the inverter can be connected to a host computer equipped with a serial port or USB, such as a commercially available personal computer.

The details of the TB1 terminal section are shown below.



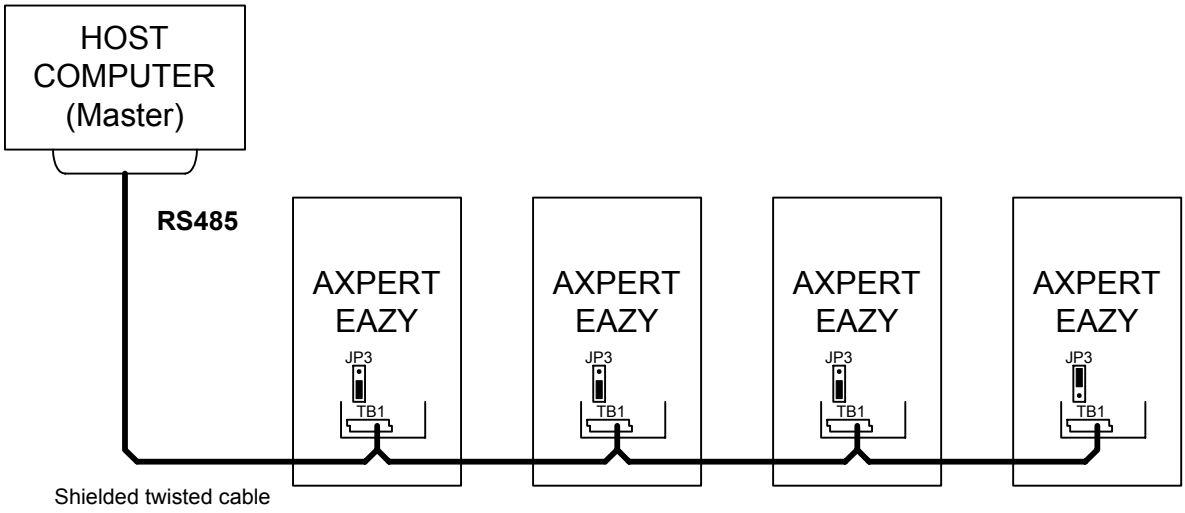
10-2 Connecting the host computer and Axpert Eazy (1-to-1)



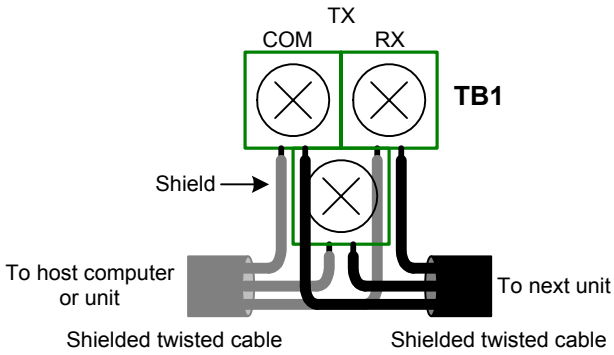
CAUTION

- ✓ Separates the communication cable from the main circuit cable and other power cables.
- ✓ A shielded twisted pair cable should be used for connecting TB1 and the host computer. Connect the shielded twisted pair cable's shield to the COM terminal of TB1.
- ✓ When connecting the TB1 and shielded twisted pair cable, do not solder the wires, which are exposed after the sheath is peeled off.
- ✓ If the communication is distorted and not carried out properly because of noise, etc., connect a ferrite core, etc., to the cable, and increase the noise resistance.
- ✓ When connecting several Axpert Eazy units, connect two wires to each TB1 terminal, and couple the Axpert Eazy units. An example of the connection is shown below.

10-3 Connecting the host computer and Axpert Eazy (1-to-many)



The details of the TB1 terminal section are shown below.



CAUTION

- ✓ Separates the communication cable from the main circuit cable and other power cables.
- ✓ A shielded twisted pair wire should be used for connecting TB1 and the host computer. Connect the twisted pair cable's shield to the COM terminal of TB1.
- ✓ When using several slave units, set JP3 of last unit to 'LD' position to connect the terminating resistors as shown in the above fig.
- ✓ When connecting the TB1 and shielded twisted pair cable, do not solder the wires, which are exposed after the sheath is peeled off.
- ✓ If the communication is distorted and not carried out properly because of noise, etc., connect a ferrite core, etc., to the cable, and increase the noise resistance.

10-4 Communication specifications

Connection method	: RS485, 2-wire type
Transmission distance	: Total extension distance less then 300mt (1000ft)
Baud rate	: Select from 1200, 2400, 4800, 9600, 14400, 19200bps
Transmission method	: Start-stop synchronization, half-duplex communication
Frame configuration	: Start - 1 bit Data - 8 bits Stop: 1 bit (with parity) or 2 bits (if no parity) Parity: Select from none, odd or even
Error detection	: Sum check, parity, framing
Communication protocol	: Modbus-RTU communication
Number of stations	: Set between 1 and 247

The default factory settings are shown below.

C401	Baud Rate	bps	=4: 9600
C402	Station Number		1
C403	Parity		=1: No Parity
C404	Response Time	Sec	0.01

Appendix-A: Standard Specifications

Power		380~460Vac, 3-Phase, 3-Wire, 50/ 60 Hz										
Tolerance		Voltage tolerance: +/-10%, Frequency tolerance: +/-5%										
AXPERT Eazy AMT- □ □ □ HF		1P5	2P2	4P0	5P5	7P5	011	015	018	022	030	037
Rated Capacity	kW	1.5	2.2	4.0	5.5	7.5	11	15	18	22	30	37
	Hp	2.0	3.0	5.0	7.5	10	15	20	25	30	40	50
Rated Current (A) **Note 1**		3.6	5.5	8.6	13	17	23	31	37	44	60	73
Applicable Spindle kW **Note 2**		1.5	2.2	4.0	5.5	7.5	11	15	18	22	30	37

Control Functions	Control Method	Space Vector PWM Control
	Frequency Range	0.1~1800.0Hz
	Output Frequency Resolution	0.027 Hz (16-bit)
	Frequency setting Resolution	0.1Hz (Digital), Max Frequency/ 4096 (Analog)
	Output Frequency Stability	0.01% (0~45 ºC)
	V/ Hz Characteristics	2-Preprogrammed patterns, 1-Custom 3-point setting pattern
	Voltage Boost	0~20%
	Acceleration/ Deceleration Time	0.1~1200 Seconds (2 Ranges)
		Linear or S-Curve selective
	Skip Frequency	Three frequencies can be set, band can be set up to 10.0Hz
	Air Gap Eliminator	Air gap eliminator function for the machine tools industries
	Switching Frequency **Note 3**	Default: 10.0 kHz, 2.0~18.0 kHz selectable with 0.1kHz resolution
	Overload Capacity	150% Overload for 60 seconds at every 10 minutes
Operation Specifications	Speed Search Function	When enabled, rotating Spindle can be started at any moment
	Power Loss Carry Through	Up to 5 seconds for smooth operation of the system during power loss
	DC Braking	DC Braking start frequency 0.1~50 Hz, Time: 0~25 seconds, Brake current: 15 to150%
	Frequency Setting Inputs	Digital Input: Digital Operation Panel (Local) or Serial RS485
		Potentiometer: 2 k Ohm
		FSV: 0~5Vdc or 0~10Vdc (or Inverse)
		FSI: 0~20mA or 4~20mA (or Inverse)
		IIN: 4~20mA
		Static Pot: Freq Increase/Frequency Decrease using digital I/P
		Preset Speeds: Using Preset input-0, 1 & 2
	Programmable Analog Input	IIN: 4~20mA (or Inverse)
	Input Commands	Run, Stop, Reverse, Jog, Preset input-0, 1 & 2, Frequency Increase/ Frequency Decrease for static potentiometer, Run command with maintained / momentary facility, Ramp select, Aux drive select (Aux Spindle-1 ~ 15), Emergency stop, Fault reset, Ext Fault, Terminal select, Ref select 0 & 1, Base load input, Enable

Operation Specifications	Digital inputs	8-Programmable Sequence Inputs, Sink / Source changeable	
		Programmable to 26 different options: Not Used, Jog Select, Ramp Select, Preset i/p-0, Preset i/p-1, Preset i/p-2, Freq Increase, Freq Decrease, Emergency Stop (NO), Fault Reset, Ext Fault (NO), Terminal, Ref Select 0, Ref Select 1, Reverse, Base Ld I/P, Spindle Sel 1, Spindle Sel 2, Spindle Sel 3, Spindle Sel 4, Emergency stop (NC), Ext Fault (NC), RUN, STOP, Enable (NO), Enable (NC)	
	Digital outputs	4-Programmable Sequence Outputs, open collector type	
		Programmable to 24 different options: Not Used, Run, Local, Reverse Run, I-Detection, Freq Attain, Speed Detect1, Speed Detect2, Acceleration, Deceleration, Timer Output, Zero Speed, Fault Alarm, PID Up Limit, PID Lo Limit, Gap Eli Det, Spindle Sel 1, Spindle Sel 2, Spindle Sel 3, Spindle Sel 4, Thermal Trip, Temp Alarm, Ready, Fault	
	Potential Free Contacts	3-Programmable relays	1-NO, 1-NC for 2A @ 240Vac
			Programmable to 24 different options same as digital outputs
	Programmable Analog Outputs	2-Programmable analog voltage outputs VO1 & VO2: 0~10Vdc	
		2-Programmable analog current outputs IO1 & IO2: 4~20mA	
		Programmable between 7 different options: Output Frequency, Output Current, Output Power, Output Voltage, DC Bus Volt, PID Output and heatsink temperature	
	Network connectivity	RS-485 for PC Interface with Modbus-RTU protocol as standard	
	Auto Restart	Adjustable up to 5 times for ten faults	
	PID Controller	Inbuilt PID can be used as stand alone	
Display	Display and Keypad unit	20-Character, 4-Line LCD panel with backlit, 8-Key keypad, 3-Status indicating LED for Run, Stop and Fault -Simultaneous display of eight selectable monitor parameters	
Protective Specifications	Protective Function	Current Limit, Over current fault, Timed over current fault, Load side short circuit fault, Under current fault, Over voltage fault, Under voltage fault, Temperature fault, Spindle Hot/Short, Output phase loss fault, Ground fault, External fault, Charging fault, Current sensor fail fault, EEPROM Fault, 4~20mA reference missing fault, Emergency stop, Communication loss fault, Output current unbalance fault.	
	Smooth Operation	Speed Search, Auto Restart and Power Loss Carry Through functions, heat sink over temperature alarm	
	Fault history	Last ten faults with status and operational parameters like output frequency, output current, dc bus voltage, heat sink temperature, input voltage Vry, energy in kWH, energy in MWH and total conduction time.	
	Electronic thermal overload	150% Overload for 60 Seconds	
Environment	Installation location	Indoor	
	Vibration	As per EN 60068-2-6, Acceleration: 1g, Frequency: 10 Hz ~ 150 Hz	
	Ambient temperature	0~50°C (32~122°F)	
	Storage temperature	-20~70°C (-4~158°F)	
	Altitude (above sea level)	1000m (3300ft) without derating, above this derate 5% per 305m (1000ft)	
	Humidity	0~95% maximum non-condensing	
	Enclosure	IP00	

Note1: Indicates the total effective value including the higher harmonics

Note2: The maximum applicable Spindle output is given for a standard 4-pole Spindle.
Note3: If the default carrier frequency is exceeded, derate the output current by 3.5% per 1kHz as the reduced rating in 37 kW model.

Appendix-B: Fault Codes

No.	Fault Name	Fault Description
1	**Over Current Fault**	This fault indicates that the unit has tripped due to excessive over current (200% of the rated current). This is very fast acting. A short circuit condition on the output will also cause the unit to display this fault.
2	**Timed Over Current Fault**	This fault indicates that the unit has tripped due to over current condition for a period of time. It is an inverse time trip. The unit is rated for 150% current for 60sec. The timed over current counter starts at 105% load current.
3	**Adjustable Over Current Fault**	This fault occurs when load current cross the adjustable over current level programmed in *B302* for 50msec.
4	**Under Current Fault**	This fault occurs when the load current falls below the programmed under current level (*B304)* for 1 second after reaching set speed.
5	**Current Sensor Fail**	It indicates that one or more current sensor has failed.
6	**Over Voltage Fault**	This fault occurs when the dc link voltage exceeds 800VDC level may be due to increased mains voltage or regeneration. If this fault occurs. The fault is instantaneous in order to protect the unit. Over voltage can be a serious condition and can lead to failure of the semiconductor components. When an over voltage fault occurs, the cause should be investigated and promptly corrected.
7	**Under Voltage Fault**	This fault indicates that the unit has shut down due to the dc bus voltage being low (below the *420V DC*) for 2msec.
8	**Charging Fault**	This fault occurs when dc bus voltage doesn't reach at preset level within 5 sec.
9	**Output Phase Loss**	This fault indicates that the one of the output phase has lost its current flow (below 5%) and so the other two phases has over loaded (>70%) for *five cycles*. This fault will not occur during speed search operation. It can be disabled using *C307.* ***Note that this fault will not occur if the output terminals are open circuit.***
10	**Reference Missing**	This fault occurs if the analog current input (4-20mA) falls below 3mA for *40msec* when it is selected as reference source.
11	**External Fault**	This fault occurs if the external fault input, selected at the terminal activates. This comes from the user.
12	**Temperature Fault**	This fault occurs if heat sink temperature exceeds 95°C (203°F) or <0°C (32°F).
13	**Spindle Hot/Short**	This fault occurs if resistance of Spindle thermistor is more than 4.2kΩ or less than 30Ω between CANH and CANL terminal if Spindle thermistor trip is enable in *B312*
14	**Emergency Stop**	This fault indicates that the unit has shut down due to the emergency stop command.
15	**EEPROM Fault**	This fault indicates that the data received from the EEPROM is incorrect. After reset, it will store default values in the EEPROM memory.
16	**Ground Fault**	This fault indicates that the unit has shut down due to ground fault. Before reset, check that any output is not shorted with the ground.
17	**Communication Loss**	If the slave (main control unit) is not responding to the master (Digital Operation Panel), this fault will occur. It is auto reset type. If the communication resumes, this will be cleared. In this fault, the AC Drive functioning will be affected only if *C405=1*.
18	**Output Current Unbalance**	This fault indicates that the unbalance in output current between any two-output phases is higher then the set value in *B313* for *60sec*. Set to 0% to disable the function.

Appendix-C: Trouble Shooting Guidelines

In case of fault condition, first ensure that the mains voltage applied at L1, L2 and L3 are ok.
Then check the control supply voltage in PCA-2014A.

Sr. No.	Measure @		Expected Voltage
1	1,J8	4,J8	+20V ~ 25.5V
2	2,J8	4,J8	+14.9 ~ 15.1VDC
3	3,J8	4,J8	+4.5 ~ 5.5VDC
4	5,J8	4,J8	-13.5 ~ 16.5VDC
5	3.3VD	DGND	+3 ~ 3.6VDC
6	1.9VD	DGND	+1.86 ~ 1.94

If the above voltages are correct, check the following jumper positions.

Jumper Position

1. The equipment is shipped with sink logic (JP1 is kept on **Sink** position) for the programmable sequence inputs. To change the sink logic to source, change the jumper JP1 position to **Source**.

2. The equipment is shipped with JP3 in **NLD** position. This means the terminating resistors are not in picture. To insert the terminating resistors, keep the jumper to **LD** position.

If the above jumper positions are correct, check the following as per the fault displayed on the Operation Panel (LCD Display)

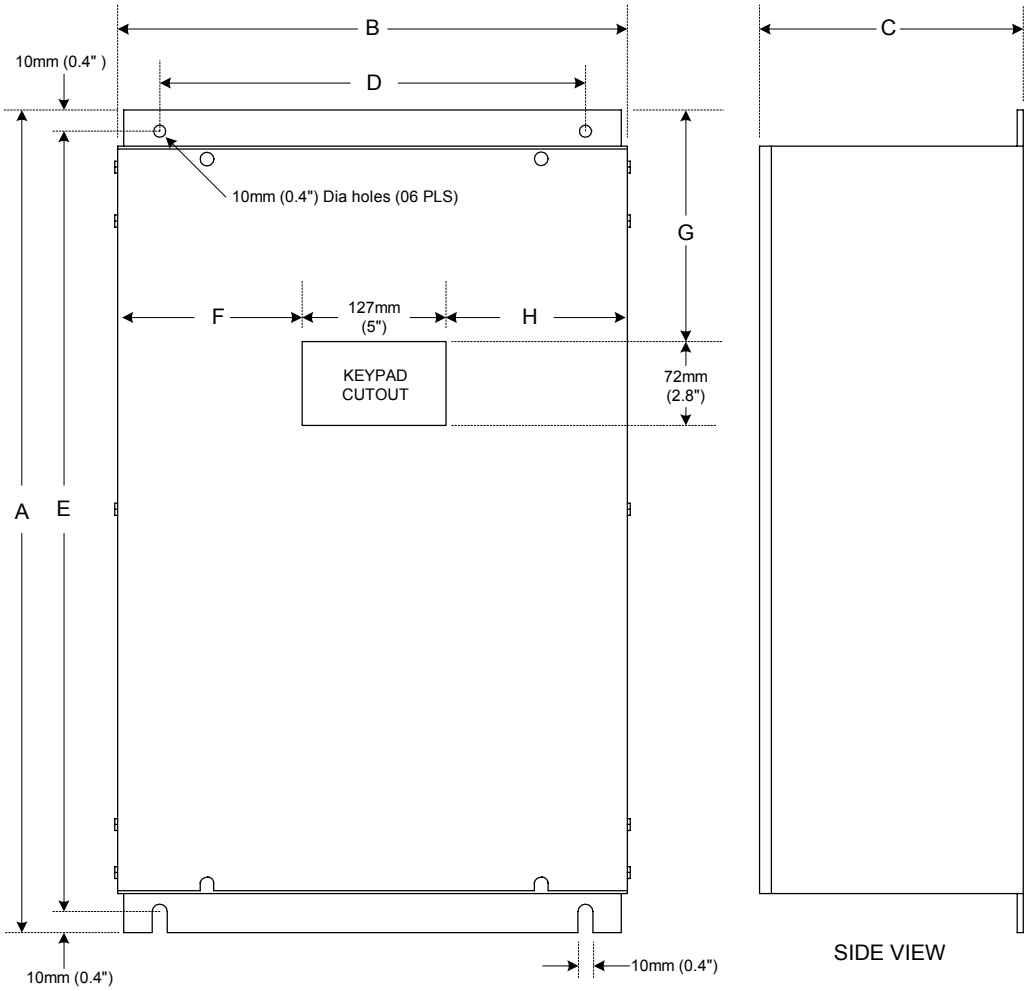
No.	Fault Name	Causes & Countermeasures
1	**Over Current Fault**	If fault comes during stop condition, 1. The power module(s) in the main circuit may be damaged. Switch off the power supply and check the power module(s). 2. There may be loose connection or improper connection of current sensor cable or shorting in the cable. Switch off the power supply and remove the cable. Check again. If no fault is observed, there can be a problem in cable or connection. Check the cable on both the sides for proper crimping. Insert the cable properly and check again. If still problem persist, replace the cable. 3. Current sensor may have failed. Switch off the power supply and remove current sensor. Check again. If no fault is observed identify the damaged current sensor and replace it. 4. The fault may be from Driver Board side. Switch off the power supply and remove the FRC in case of wire interface. Check the cable on both the sides for proper crimping. Insert the cable properly and check again. If the fault persists, proceed for the next step. In case of fiber optic interface, remove all the fiber optic cables, check them and insert them again properly. Check again. If the fault persists, proceed for the next test. 5. IGBT Gate Driver board may have problem. Replace the IGBT Gate Driver board and check again. Take anti-static precautions while changing the board. If fault occurs during acceleration when the Spindle is connected, 1. Make sure that the parameters are set properly. Abnormal setting of V/F, Torque Boost, Acceleration time, Speed search function related

		parameters and current limit may result in over current or damage to the power devices. 2. Increase the acceleration time (*A201* / *A203*). 3. Reduce torque boost settings (*A501*) If fault occurs during normal run with load condition, 1. A sudden change in the load or short circuit may have occurred at output. Reduce the load fluctuation and/ or any short circuit condition at the output. 2. If the current fluctuation is observed, adjust the DTC gain *B111* such that the fluctuation disappears. 3. One or more current sensor may be partially damaged. Measure the voltage at pin-3, 7 and 11 of connector J12 with respect to 4,J8 in PCA-2014A. When the measured output current is balance, the voltage level at these pins should be approx. equal. If any output observed uncommon, replace the respective current sensor and check again. 4. Check the value of snubber capacitors mounted on the IGBT and replace if found abnormal. 5. IGBT driver may have problem. If fault occurs during deceleration, 1. Increase the deceleration time (*A202* / *A204*). 2. Abnormal setting of DC braking parameters can result in over current fault during deceleration. Reduce the dc braking start frequency (*A306*) and dc braking time (*A308*) settings if used.
2	**Timed Over Current Fault**	1. The AC DRIVE may have overloaded. Ensure that Spindle current data are properly set in *B103*. Reduce the load or increase the Spindle and AC DRIVE capacity 2. If this occurs at low speed, reduce the torque boost settings (*A501* / *A502*) or DC braking settings (*A307* / *A308*)
3	**Adjustable Over Current Fault**	1. The Spindle current data are set incorrectly. Set correct Spindle current data in *B103*. 2. The adjustable over current settings are too low. Increase the adjustable over current level (*B302*). 3. The output current is too high. Reduce the Spindle load. 4. Disable the feature by setting 300% in *B302.*
4	**Under Current Fault**	1. Under Current Limit *B304* is set too low. 2. Disable the feature by setting 0% in *B304*.
5	**Current Sensor Fail**	1. Loose connection of hall current sensor cable connected at J12 of PCA-2014A. Switch off the unit and remove the cable. Check for proper crimping of cable on both sides. If found abnormal, replace the cable and check again. 2. One or more current sensor has failed. Remove connector J12 and reset the fault. If the fault can be reset, find out which current sensor has failed. 3. If after removing connector J12, the problem persists, replace PCA-2014A

6	**Over Voltage Fault**	1. The power supply voltage may have risen above 800Vdc. Reduce the voltage to within the specified range. 2. The speed may be fluctuating. Adjust *B109* to prevent the hunting of Spindle. 3. If the fault is coming during deceleration, the load GD^2 may be too large. Set the ramp down time according to the load GD^2. 4. Loose connection of dc bus voltage feedback at J9 of PCA-2014A. Ensure proper connections. 5. Check the value of snubber capacitors mounted on the IGBT and replace if found abnormal.
7	**Under Voltage Fault**	1. DC Bus voltage may have fallen below the under voltage level. A drop in voltage, phase dropout or power supply failure may have occurred. Check the power supply system and correct if necessary.
8	**Charging Fault**	1. The dc bus voltage didn't reach to predefined voltage level within 5 sec after power up. - Soft charge resistor may be open. - One or more phases may have failed. - Dc bus voltage feedback may be missing. Ensure proper connection of dc bus voltage feedback at J9.
9	**Output Phase Loss**	1. There may be a single phasing of the Spindle. Disconnect and check the Spindle. 2. One or more output cables are open or loose connected. Check the output connections and correct it. 3. There may be problem in current sensors. 4. Disable the feature using *C307.*
10	**Reference Missing**	1. Analog current input reference (4-20mA) to the unit is below 3mA. Check the voltage level at FSI terminal of PCA-2014A
11	**External Fault**	1. The signal for the external fault is present at the PSI. Check and correct it. 2. If the signal is not present, remove the selection of the external fault with the help of Mode-C parameters. 3. There may be a problem in PCA-2014A. Remove the control board PCA-2014A.
12	**Temperature Fault**	1. A trouble may have occurred in the cooling blower. Replace it if necessary. 2. The ambient temperature may have risen. Lower the ambient temperature (less than 50 °C (122°F)). 3. The carrier frequency may be set too high. 4. Thermistor is not connected or loosely connected at J13. Disconnect the thermistor and ensure that the thermistor shows resistance greater then 2.2kohm but less then 60kohm. Reconnect thermistor properly.
13	**Spindle Hot/Short**	1. The Thermistor might be failed OR The temperature of the Spindle is crossing the upper level.
14	**Emergency Stop**	1. The signal for the emergency stop input is present at the PSI. Check and correct it. 2. If the signal is not present, remove the selection for emergency stop with the help of Mode-C parameters. 3. There may be a problem in PCA-2014A. Remove the control board PCA-2014A.
15	**EEPROM Fault**	1. Data received from the EEPROM is incorrect or out of range. On fault reset, default values will be stored in the EEPROM. Ensure proper earth connection to the unit and inside the unit. 2. If again fault occurs after power recycling, replace PCA-2014A.
16	**Ground Fault**	1. A ground fault may have occurred in the output line or Spindle. Check that any output is not shorted with the ground. Partially damaged output cables can also lead to this condition.

		2. One or more current sensor may have problem. Remove the current sensor feedback and check. 3. If still fault persists, replace PCA-2014A; otherwise replace the problematic current sensor.
17	**Communication Loss**	1. Check the communication cable between master (LCD Display unit) and slave (Main control unit). 2. Disable the fault using *C405*. This will allow the inverter to run in case of communication loss between the PCA-2014A DSP control board and PCA-2012 LCD display board. 3. There may be problem in display board PCA-2012. Replace the display board PCA-2012 and check again. 4. There may be problem in control board PCA-2014A. If +5V supply or +3.3V supply is not coming then also this fault will come. Check the power supply unit and if found problem replace it or replace the DSP control board PCA-2014A and check again.
18	**Output Current Unbalance**	1. Check the setting of *B313*. Correct the setting if it is too low. 2. Go through the below steps and if it does not help, disable it by setting 0% to *B313*. If fault occurs during acceleration when the motor is connected, 1. Make sure that the parameters are set properly. Abnormal setting of Acceleration time, Speed search function related parameters and current limit may result in output current unbalance. 2. Increase the acceleration time (*A201* / *A203*). If fault occurs during normal run with load condition, 1. A sudden change in the load may have occurred at output. Reduce the load fluctuation at the output. 2. If the current fluctuation is observed, adjust the DTC gain *B109* such that the fluctuation disappears. 3. One or more current sensor may be partially damaged. Measure the voltage at pin-3, 7 and 11 of connector J12 with respect to 4,J8 in PCA-2014A. When the measured output current is balance, the voltage level at these pins should be approx. equal. If any output observed uncommon, replace the respective current sensor and check again. 4. Check the motor connection with inverter and at motor terminal. If any connection is open or loose, correct it. If fault occurs during deceleration, 1. Increase the deceleration time (*A202* / *A204*).

Appendix-D: Outline Dimensions



Model	Dimensions in mm (inch)								Weight in kg (lb)
	A	B	C	D	E	F	G	H	
AMT 1P5	469 (18.5)	250 (9.8)	262 (10.3)	196.5 (7.7)	438.5 (17.3)	62 (2.4)	111 (4.4)	62 (2.4)	17 (37.5)
AMT 2P2									
AMT 4P0									
AMT 5P5									
AMT 7P5									
AMT 011									
AMT 015	585 (23.0)	250 (9.8)	300 (11.8)	196.5 (7.7)	565 (18.1)	61.5 (2.4)	186 (7.3)	61.5 (2.4)	29 (63.9)
AMT 018									
AMT 022									
AMT 030	700 (27.5)	322 (12.7)	365 (14.4)	217 (8.5)	680 (26.8)	97.5 (3.8)	144 (5.7)	97.5 (3.8)	40 (88.2)
AMT 037									