PDL ELECTRONICS LTD

Leaders in AC Motor Control

MICRODRIVE V TECHNICAL MANUAL
PART NO. 4201-242 REV A

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IMPORTANT NOTES

SAFETY WARNINGS:

– It is the installer's responsibility to ensure the configuration and installation of the Microdrive V Series meets the requirements of any site specific, local and national electrical regulations.

– The Microdrive V Series operates from HIGH VOLTAGE, HIGH ENERGY ELECTRICAL SUPPLIES. Stored charge is present after switch off.

– Due to the high leakage currents inherent to AC drives, earth connection of both the motor and the Microdrive V Series is essential before connection to the supply. The Microdrive V Series must be permanently connected to the supply.

– For safety reasons, normal operation of the Microdrive V Series requires front covers/doors to be in place and secured closed.

– Do not attempt to isolate the motor while the Microdrive V Series is running.

– Some parameter settings may cause the Microdrive V Series to start automatically after power failure.

– Motor overspeed operation may be limited by mechanical constraints.

RELIABILITY WARNINGS:

– Always screen control wiring.

– Ensure that the Microdrive V Series is not mounted in an adverse environment.

SERVICING WARNINGS:

– Service only by qualified personnel.

– Always isolate and allow to discharge before servicing.

– Never replace ceramic fuses with glass types.

– Always wear safety glasses when operating with the cover removed.

– The Microdrive V Series contains static sensitive printed circuit boards. Use static safe procedures when handling these boards.

– Never work on live equipment alone.

– Observe all recommended practices.

NOTES:

– It is the responsibility of the end user/purchaser to ensure that operators understand how to use this equipment safely. Please read this manual thoroughly.

DEDICATION TO QUALITY

AC Motor Control Products can dramatically improve your process control, productivity and energy efficiency, but only if they are working correctly.

That is why we at PDL Electronics go to great lengths in our design and manufacturing, to ensure that our products operate correctly first time, every time.

An extensive research and development investment ensures that this product is one of the most technically advanced in the world, with built-in strength and robustness to suit your application and environment.

Our AS/NZS ISO 9001 certification gives you the confidence in our internationally recognised, independently certified Quality Assurance program. All staff are actively involved in continuous improvement programs with a customer focus.

The components that go into our products are selected from the best in the world - and must pass our rigorous and demanding test program.

Finally, every new drive design is run through a rigorous test program, including full load operation at above rated temperature, under the most demanding load conditions.

Our dedication to quality makes the PDL Electronics product, regardless of price, less expensive than other controllers in the long run.

COMPREHENSIVE SUPPORT PROGRAM

The PDL Electronics customer support program demonstrates our confidence in our Quality Assurance system. We have total faith in our products and their reliability, and so provide a comprehensive warranty.

Fully trained engineers and technicians, with a wealth of experience and easy access to information, can assist in solving any of your drive application projects.

Our service staff are available for commissioning, after sales service, and repairs, 24 hours a day, seven days a week.

We select capable and highly qualified representatives to act as our distributors and service agents. Only after passing PDL Electronics' intensive training program are they accredited for repair or on-selling of our products.

To further support our products and customers, we run a series of comprehensive training programs focusing on self maintenance and application advice. These are available on-site and at our Head Office.

REVISION HISTORY

Date:	Revision:	Description:
14.03.01	A	Created and issued.

CONTENTS

FIGURES

SYMBOLS USED

Caution, risk of electric shock *ISO 3864, No. B.3.6*

Caution (refer to accompanying documents) *ISO 3864, No. B.3.1*

Three-phase alternating current *IEC 617-2, No. 02-02-06*

Direct Current *IEC 417, No. 5031*

Protective Earth (PE) Terminal *IEC 417 No. 5019*

Earth (ground) Terminal *IEC 417 No. 5017*

Induction motor, three phase, squirrel cage *IEC 617-2, No. 06-08-01*

1. SPECIFICATION

1.1 SCOPE

This specification describes the Microdrive V Series of AC Motor Speed Controller systems and presents their electrical and mechanical features.

1.1.1 THE MICRODRIVE V SERIES SYSTEM

The Microdrive V Series is a modular high power range of low voltage AC Motor Speed Controllers which integrates true sensorless vector control algorithms with the latest homogenous IGBT power and 32 bit RISC microprocessor technologies.

The Microdrive V Series delivers outstanding motor control performance in an exceptionally small package size.

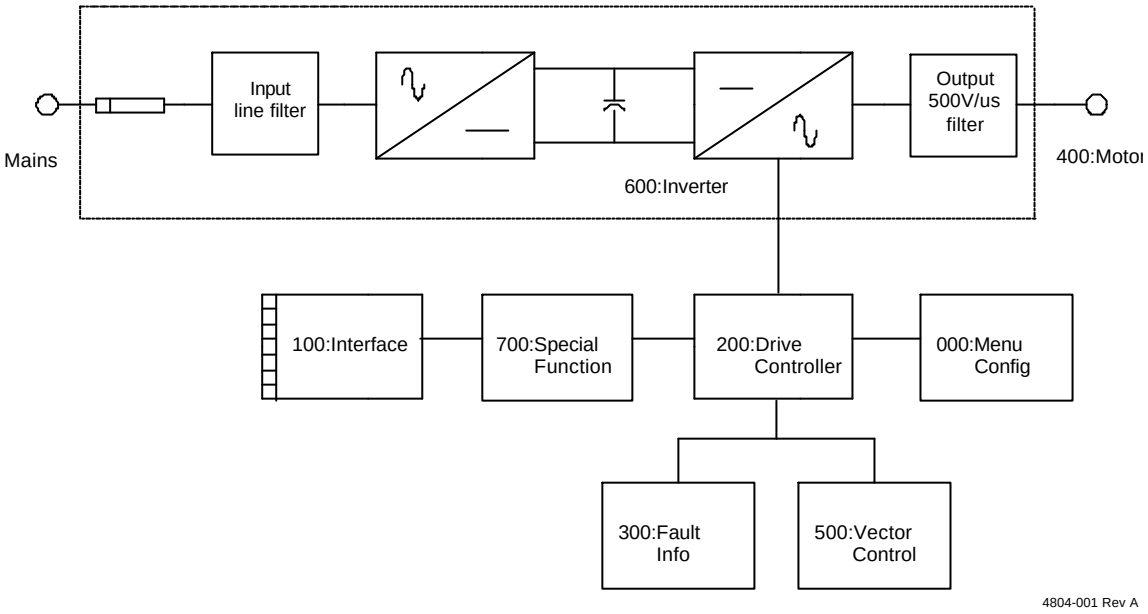

Figure 1.1: Microdrive V Series Block Diagram

1.1.2 MODELS AVAILABLE

Model	Output Current @50°C, 2kHz @40°C, 4kHz (150% O/L)*	Output Current @40°C, 2kHz @30°C, 4kHz (125% O/L)*	Overload Current	Typical Motor Rating (150% O/L)	Typical Motor Rating (125% O/L)
MV170C20	170A	204A	255A	90kW	110kW
MV250C20	250A	300A	375A	132kW	160kW
MV300C20	300A	360A	450A	160kW	200kW
MV450C20	450A	540A	675A	250kW	315kW
MV600C20	600A	720A	900A	355kW	425kW
MV750C20	750A	900A	1125A	450kW	500kW
MV900C20	900A	1080A	1350A	500kW	630kW
* 2kHz switching frequency @ 610:SWFREQ=LOW; * 4kHz switching frequency @ 610:SWFREQ=HIGH					

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Figure 1.2: Available Model Range

1.2 SYSTEM DESCRIPTION

The Microdrive V Series benefits from the use of the latest electronic technologies in association with today's most advanced motor control theory.

1.2.1 COMPONENTS

- Semiconductor fuse protection
- AC line reactors for reduced harmonic distortion and immunity to mains disturbances
- Rectifier incorporating solid state charging control for improved reliability
- Inverter Grade Electrolytic Capacitors
- Homogenous IGBTs for improved paralleling
- Output dV/dt limiting filters
- 32 bit RISC Microprocessor necessary for true sensorless vector algorithms

1.2.2 CONSTRUCTION

- IP20 environmental protection
- Modular structure minimising spares holding requirements
- Modular structure permitting subsequent up-scaling or down-scaling
- Surface or through panel mount to simplify provision for cooling airflow
- Panel width of <250mm per 150A (180A @ 40°C) to minimise switchboard and installation costs

1.2.3 DIGITAL CONTROL AND DIAGNOSTICS

The Microdrive V Series incorporates digital control. A remote mountable keyboard and display incorporates a four line, eighty character back lit display with status information presented in plain language. Two LEDs provide immediate indication of Microdrive V status.

1.2.4 CONFIGURABLE INTERFACING AND CONTROL

The Microdrive V Series provides facilities for highly configurable interfacing. Analogue inputs and analogue outputs can be programmed individually for voltage or current (4-20mA) control. Fully isolated digital inputs may be configured for active high or active low operation from +24 or +12V.

Two high speed digital outputs and three change over power relays each may be programmed to signal one of many conditions.

Special function modules permit user configuration of all control inputs and outputs.

1.2.5 TRUE SENSORLESS VECTOR CONTROL

A very advanced form of sensorless vector (also known as sensorless field oriented) control, trade-named Vectorque, is incorporated.

Unlike normal voltage/frequency controllers, Vectorque directly controls the current and torque of an induction motor. This facility eliminates the characteristic low speed instability sometimes exhibited by traditional control methods and provides many other advantages - speed is controlled more precisely and transient overloads are absorbed without causing trips.

The Vectorque true sensorless vector implementation in the Microdrive V Series incorporates parameter insensitive algorithms which avoid such problems altogether. Vectorque algorithms have only become practical through the use of a very powerful 32 bit RISC microprocessor.

An encoder feedback mode is provided for very high accuracy speed control (closed loop).

1.2.6 MODULAR MECHANICAL DESIGN

The Microdrive V Series is unique in adopting a modular approach to mechanical construction. This permits ready change of size (add or remove modules) at a later date while minimising spares holding requirements since the same components are used in all models.

1.2.7 RADIO FREQUENCY SUPPRESSION

The Microdrive V Series includes radio interference suppression meeting the requirements of CISPR11 (AS/NZS 2064:1997) level A, suitable for industrial environments. The Microdrive V Series carries C tick EMC certification recognised in Australia and New Zealand.

1.2.8 SPECIAL OPTIONS

The following special options are available:

- Dynamic Brake option - Can be interfaced with PDL B140 external dynamic brake controller. External power resistors are supplied to order.
- Regenerative / Unity Power Factor / Software Option - Microdrive V Series may be supplied together with a full four quadrant regenerative inverter / rectifier for applications requiring much braking or very low harmonic distortion of the supply.
- Harmonic Reduction Options - Several options exist for the reduction of harmonic distortion of the supply in high power applications - contact your supplier. Refer to Section 11 - Mains Harmonic Reduction for details of 12 pulse options for the Microdrive V Series.
- Bearing Protection - AC drives may increase risk to motor bearings. Various solutions exist including special bearing filters. Refer Section 10- Bearing Filters - Protecting Motor Bearings.

1.3 GENERAL REQUIREMENTS

1.3.1 STANDARDS

AC Motor Control Products can dramatically improve your process control, productivity and energy efficiency, but only if they are working correctly.

Which is why we at PDL Electronics go to great lengths in our design and manufacturing, to ensure that our products operate correctly first time, every time.

An extensive research and development investment ensures that this product is one of the most technically advanced in the world, with built-in strength and robustness to suit your application and environment.

Our AS/NZS ISO 9001 certification gives you the confidence of our international, independently certified Quality Assurance program. All staff are actively involved in continuous improvement programs with a customer focus.

The components that go into our products are selected from the best in the world - and must pass our rigorous and demanding test program.

Finally, every new Microdrive V design is run through a rigorous test program, including full load operation at above rated temperature, under the most demanding load conditions.

Our dedication to quality makes the PDL Electronics product, regardless of price, less expensive than other controllers in the long run.

1.3.2 COMPONENTS AND MATERIALS

All materials and parts comprising the Microdrive V Series are new and in current production, and to ensure maximum reliability, are used well within the parameters recommended by the supplier.

1.4 TECHNICAL DATA

1.4.1 INPUT

Nominal Input Voltage	380-480 Vac
Phases	3
Voltage Tolerance	-20/+5%
Frequency	50/60Hz (DC option)
Input Current	≤Output Current
Displacement Factor (COS∅)	≥0.95
Distortion Factor	≤0.88
Interruption Ride Through	> 2 seconds
Power connection (bottom entry)	≤MV600C20, single cable; ≤MV750C20, dual cables
Main fan supply	1∅,230Vac +/- 5%, <1A/module

1.4.2 OUTPUT

Output Voltage	0 - V_{in}
Slew rate-dV/dt	≤500V/µs
Output Frequency	0-100Hz
Continuous Current	0 - 100% rated
Current Overload	50°C/2kHz; 40°C/4kHz ratings - 150%, 30s (refer to Section 2.1.4)
Re-rated	40°C/2kHz; 30°C/4kHz ratings - 125%, 30s (refer to Section 2.1.4)
Efficiency at rated load	>97% @ 2kHz switching; > 96.5% @ 4kHz switching
Control Method	True Sensorless Vector

Power connection (bottom entry)	≤MV600C20, single cable; ≥MV750C20, dual cables

1.4.3 ENVIRONMENTAL

Enclosure	IP20
Temperature	0-30°C, 4kHz, 125% overload 0-40°C, 2kHz, 125% overload 0-40°C, 4kHz, 150% overload 0-50°C, 2kHz, 150% overload
Altitude	1000m; above 1000m @ -1%/ 100m to 3000m max

Current Ratings: Refer to Figure 1.2: Available Model Range

1.4.4 PROTECTION

Inverter	full thermal, voltage and short circuit
Motor	dV/dt filter included, thermal, ground, phase loss, PTC, short circuit

1.4.5 INTERFACE SUMMARY

(See also Figure 1.5 for further control interface details)

Analogue Inputs	2 x -10 to +10V / 4-20mA inputs
Analogue Outputs	2 x -10 to +10V / 4-20mA outputs
Digital Inputs	6 x fully isolated; 24/12V; active high or low
High Speed Outputs	2 x Open Collector
Relay	3 x 1A, 230V change over
Auxiliary 24V Supply	24V +/- 20%; 100mA max
Potentiometer Supply	+/- 15V; 4k7 per line

1.4.6 CONTROL PANEL

Type	removable
Distance	3m
Connection	9 way D
Display	four line, eighty character, alpha-numeric, back lit
Led Indication	run, ok (not faulted)
Keyboard	eight key; stop/start
Information	3 level outline structure, plain language

1.4.7 ENCODER FEEDBACK

RS422 differential encoder inputs; 2 Channel quadrature signal 500-4096ppr

1.4.8 SERIAL CONNECTION

Isolated RS 485	Option
RS232	
DeviceNet	Option

Refer to the Microdrive V Series Serial Communications Technical Manual (PDL part no. 4201-245) for information about serial and fieldbus communications.

1.4.9 ELECTROMAGNETIC COMPATIBILITY

AS/NZS 2064:1997	Level A
CISPR11	Level A

1.4.10 DIMENSIONS

Model	Height	Width	Cut Out	Depth	Weight	Gland Plate Width	Airflow	Power Loss	
	mm	mm	mm	mm	kg	mm	m^3/min	kW	
								2kHz	4kHz
MV170C20	1260	248	218	440	85	198	6	3.4	4.1
MV250C20	1260	488	458	440	170	438	18	5.0	6.0
MV300C20	1260	488	458	440	170	678	18	6.0	7.2
MV450C20	1260	728	698	440	255	918	24	9.0	10.8
MV600C20	1260	968	938	440	340	1158	30	12	14.4
MV750C20	1260	1208	1178	440	425	1398	36	15	18
MV900C20	1260	1448	1418	440	425		42	18	21.6

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Figure 1.3: Overall dimensions, weight and airflow requirements

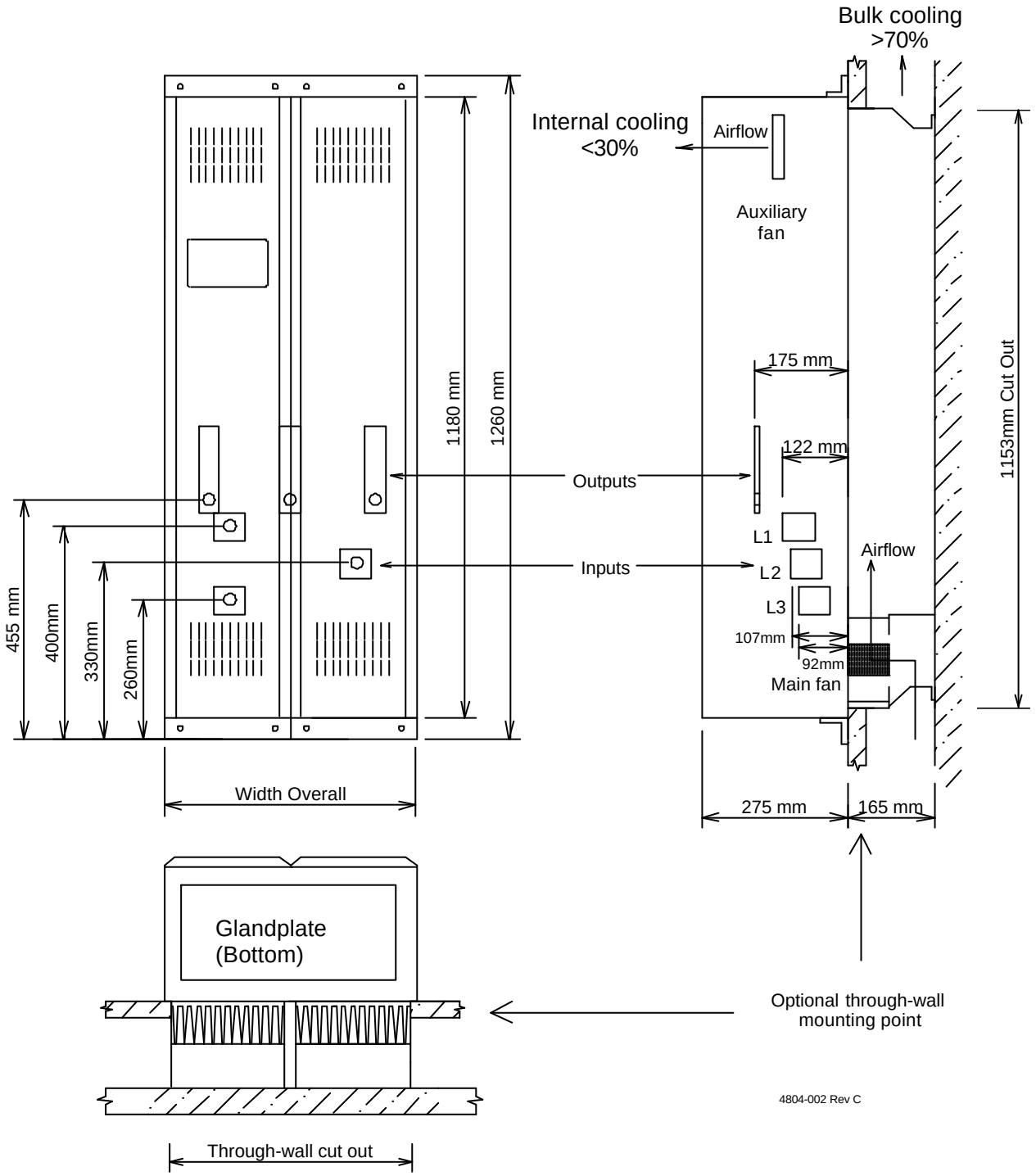

Figure 1.4: Dimensional Details - Microdrive V 170-900A Series.

1.4.11 INTERFACE DETAIL

Figure 1.5: Control Interface Specification for 36 Terminal Control Board

2. APPLICATION OF THE MICRODRIVE V SERIES

2.1 IMPORTANT MICRODRIVE V SERIES CONCEPTS

To achieve best results from the Microdrive V Series it is important that the user grasp the key issues discussed in this section. Please read this section carefully before proceeding - key concepts, if missed here, will make understanding operation and commissioning more difficult than necessary.

2.1.1 SENSORLESS VECTOR CONTROL

Sensorless vector control provides the ease of connection of simpler variable frequency drives (only three wires, no encoder) together with a performance close to encoder based vector drives.

Similar to DC Drive control, Vector control essentially permits the independent control of torque producing current (equivalent to armature current) and magnetising current (equivalent to field current) in a standard induction motor. Having achieved independent control over these currents, high performance speed and torque operation becomes possible. The Microdrive V permits such control at all speeds, including near zero, without the need for any separate form of speed feedback sensor. Special techniques allow speed control at full torque through zero speed.

From the users perspective, the type of control is transparent. The Microdrive V Series is simply used as a high performing motor speed and torque controller.

Vectorque sensorless vector control is applicable at frequencies of 100Hz or less.

Note that Vectorque should not be applied to motors rated less than 30% of the Microdrive V rating.

2.1.2 ENCODER VECTOR CONTROL

For applications requiring precise speed control especially near zero speed Vectorque closed loop Vector control mode which utilises speed feedback is provided. The rotor speed feedback is derived from a shaft mounted quadrature encoder.

This mode of control is recommended when very high speed regulation is required and when the Microdrive V is required to operate in torque control at or about zero speed. Eg: winder/unwinders. This control is recommended for high performance hoists and winches.

As with sensorless control, closed loop vector control is applicable to frequencies of 100Hz or less, and with single motors at ratings not less than 30% of the Microdrive V rating.

2.1.3 V/HZ MODE

V/Hz mode is included only for special applications and should not be applied in normal applications. Special applications include operation of motors much smaller than the Microdrive V rating (ie. <30%), and operation of parallel motors of different types or with unbalanced loads. Some features of Vectorque are not available in V/Hz mode.

2.1.4 DUAL RATINGS

The Microdrive V Series is rated for both 40°C and 50°C operation (at 2kHz switching frequency). At 40°C the Microdrive V Series is rated to provide 20% additional current over the 50°C rating. The overload rating remains constant at both temperatures, providing 50% above the continuous 50°C rating and 25% above the continuous 40°C rating.

The increased continuous rating at 40°C is often useful in applications which do not require particularly dynamic operation or do not enter the overload region. Pumps and fans are typical of such applications, though many others exist.

2.1.5 PERCENTAGE VALUES ARE MOTOR REFERENCED

Values, other than where given actual units (A, V etc) are generally shown as a percentage of the actual motor rating that has been entered (percent of motor rated current, percent of motor rated torque etc). Note that percent speed is given as a ratio of the synchronous speed of the motor as Vectorque corrects for slip errors.

2.1.6 KEYBOARD AND DISPLAY

The keyboard and display module is an intelligent controller connecting to the Microdrive V through a standard 9 way D connecting cable. The module may be remotely mounted up to 3m with the standard cable.

The four line LCD display is largely programmable. The top line is fixed and shows status information about the Microdrive V, including Local/Remote indication at the end of the line ie. “L” or “R”. The second, third and fourth lines can be programmed to show any of several preset meters (eg. SPEED, CURRENT, POWER) or either of two user defined meters (see 030:LCD DISPLAY in Section 4 of the manual for details). The fourth line doubles as the menu display line. Simply press the down arrow key to access the menu system if line four currently displays a meter.

Arrow keys, +, - and enter or cancel keys permit navigation and adjustment of the menu system (See Figure 2.1). Stop and start push buttons permit local control of the Microdrive V. They are always active, though subject to the status of external interface controls.

Stop (0) also provides a reset for any fault conditions which may be latched and displayed on the top line of the display.

2.1.7 MENU SCREENS AND CONTROL CONFIGURATION

The menu screens of the Microdrive V Series appear in line 4 of the display and are arranged using the block outline presented in Figure 2.3. Each of these blocks contains a group of modules and each module in turn contains parameters and configuration connections.

In summary, modules are grouped as:

000:Menu Config	contains edit locks, keyboard refs. and meter selections.
100:Interface	contains set up of all low voltage inputs and outputs
200:Controller	contains all set up of the basic motor controller
300:Fault Info	contains fault history and auto reset controls
400:Motor	contains set up of motor nameplate information etc
500:Vector Control	contains vector control parameters
600:Inverter	contains inverter user options and factory calibrations
700:Special Functions	contains a range of user selectable functions

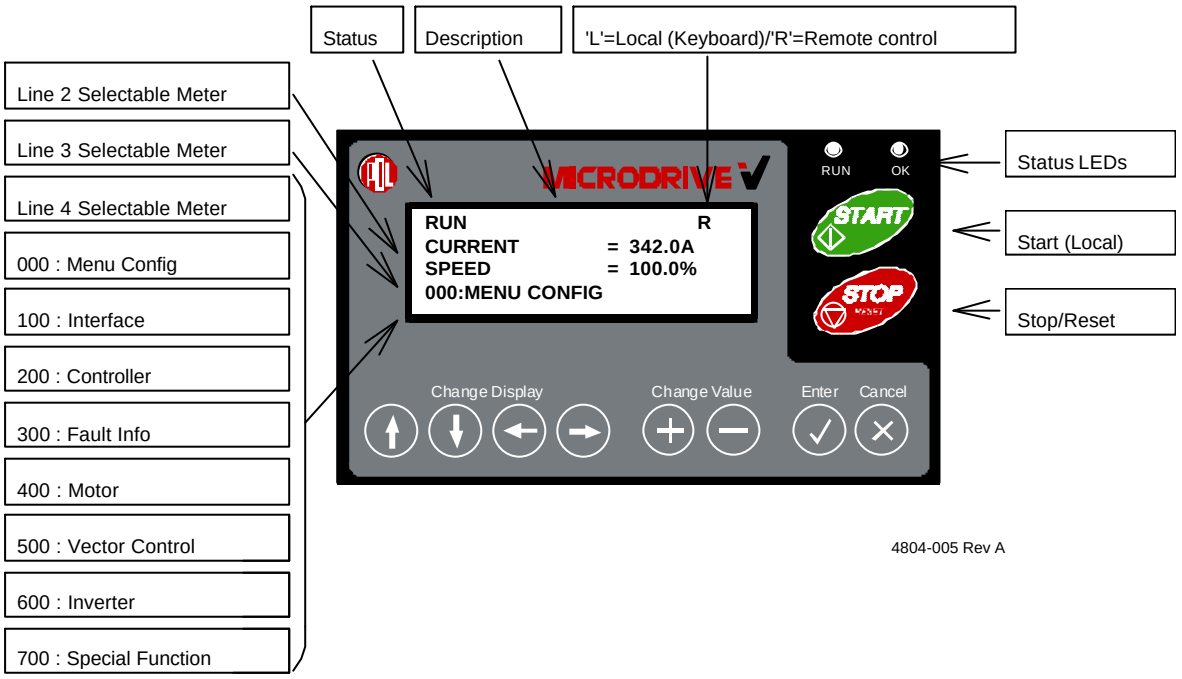

Figure 2.1: Keyboard and Display

Two LEDs provide immediate status indication and the function of each is explained in the following table.

RUN LED	DESCRIPTION	OK LED	DESCRIPTION
OFF	Not running, no run command active.	OFF	Microdrive V control electronics not powered.
ON	Running, run command active.	ON	No faults have been detected.
FLASH	Temporarily stopped due to low mains voltage, run command active. Will restart if mains voltage returns while the Microdrive V control electronics is still powered from residual DC bus voltage.	FLASH	A fault exists which has tripped the drive. The description field on the top line of the display will state which fault has occurred.

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Figure 2.2: Functions of the status LEDs on the keyboard.

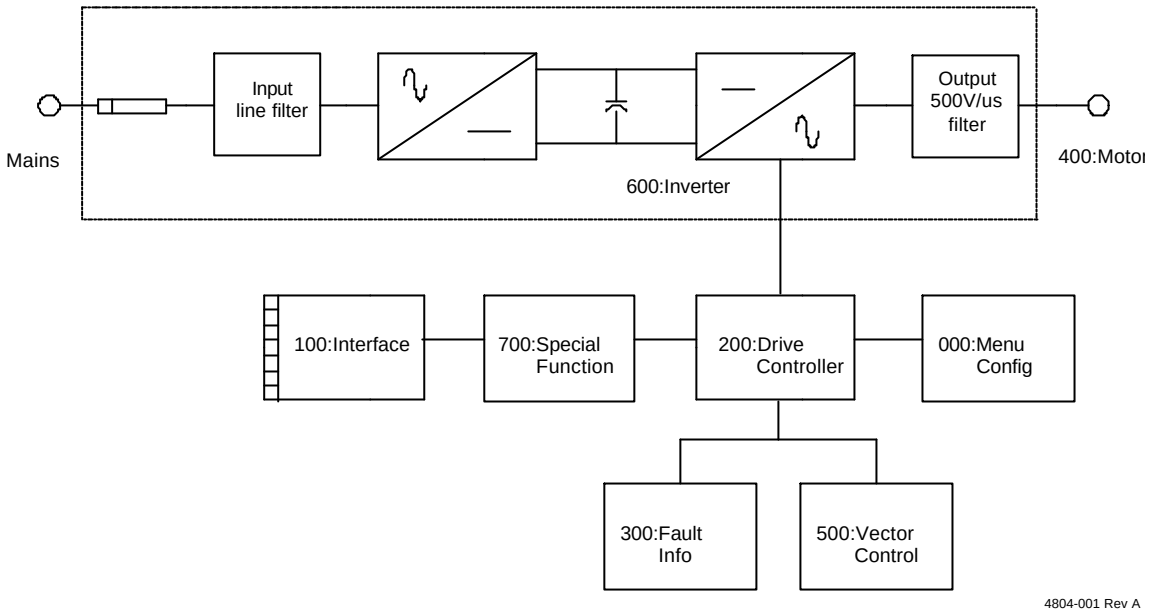

Figure 2.3: Microdrive V Series Block Diagram

2.2 MENU STRUCTURE AND OPERATION

The basis of the menu system is the use of a three deep "outline" structure to provide simple and familiar navigation (like computer file handling) through the many programmable aspects of the Microdrive V Series. A three digit code before each item in the list defines which module each item belongs to. A brief experiment with the keyboard is all that is required for most users to quickly grasp the principles of operation. The following explanations are provided for reference if needed. A complete listing of all display lines can be found in Section 4.

At the first level (Module Group level), the menus are arranged in a vertical list of eight module groups (Figure 2.4). The vertical arrow keys are used to scroll up and down through such a list. Items from first level menus are shown with a digit followed by two zeros (eg "400:MOTOR").

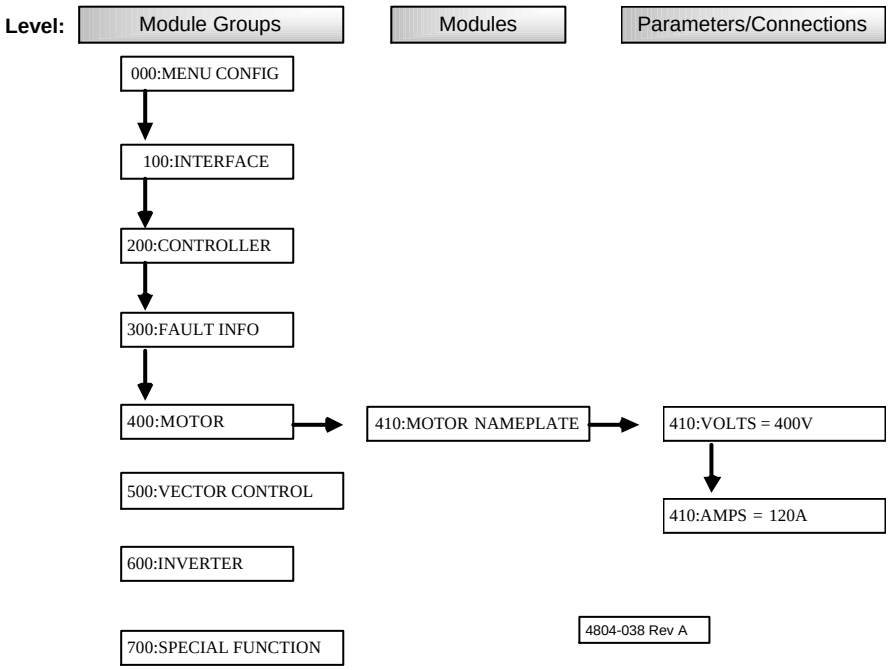

Figure 2.4: Menu navigation example - setting motor nameplate current

The second level (Module level) is entered by the use of the right arrow key. A list of modules is presented and navigation through this list may be made again by the use of the vertical arrows. Items in second level menus are located by the second digit (eg "410:MOTOR NAMEPLATE"). To return to higher level menus, push the left arrow key.

The third and final level (Data level) is selected by using the right arrow key again, as the example in Figure 2.4 illustrates. Changes to parameters or module connections are performed at this level (levels one and two provide headings only). Third level displays also start with a three digit address in order to identify which module they belong to and are followed by the label of the parameter or module connection.

2.3 MICRODRIVE V SERIES CONFIGURATION OVERVIEW

The Microdrive V Series treats the variety of different functions as separate "configuration modules". For example, accessing the analogue output 1 module from the interface group in the menu permits the programming of current or voltage output, the definition of output scaling, as well as the specification of the controlling source (eg. speed, torque etc). Each module is presented in the same format and each consists of the following elements (listed in the menu in this order):

Parameters — '=' These are the settings or adjustments for the particular controls of the module eg. selecting NORMAL start mode for the Microdrive V.

210:STRMDE=NORMAL

Destination Ports — '<-' Destination ports are software connectors which consume signals (such as the speed reference input). They may be fed from source ports which produce signals (such as digital input 1). An example of a connection between source and destination ports would be digital input 1 connecting to the start input (see Figure 2.5). This connection carries the signal from the digital input to the start input (the direction of the arrow on the Microdrive V LCD display always shows direction of data flow). There can be only one connection to a destination port.

210:START <-150DIGIP1

Source Ports — '->' Source ports are software connectors which produce signals (such as the run indicator). They may feed into destination ports which consume signals (such as relay output 1). An example of a connection between source and destination ports would be the run indicator connecting to relay output 1 (see Figure 2.5). This connection carries the signal from the run indicator to relay output 1 (the direction of the arrow on the Microdrive V LCD display always shows direction of data flow).

There can be more than one connection to a source port as Figure 2.5 illustrates.

210:RUN ->160RELOP1

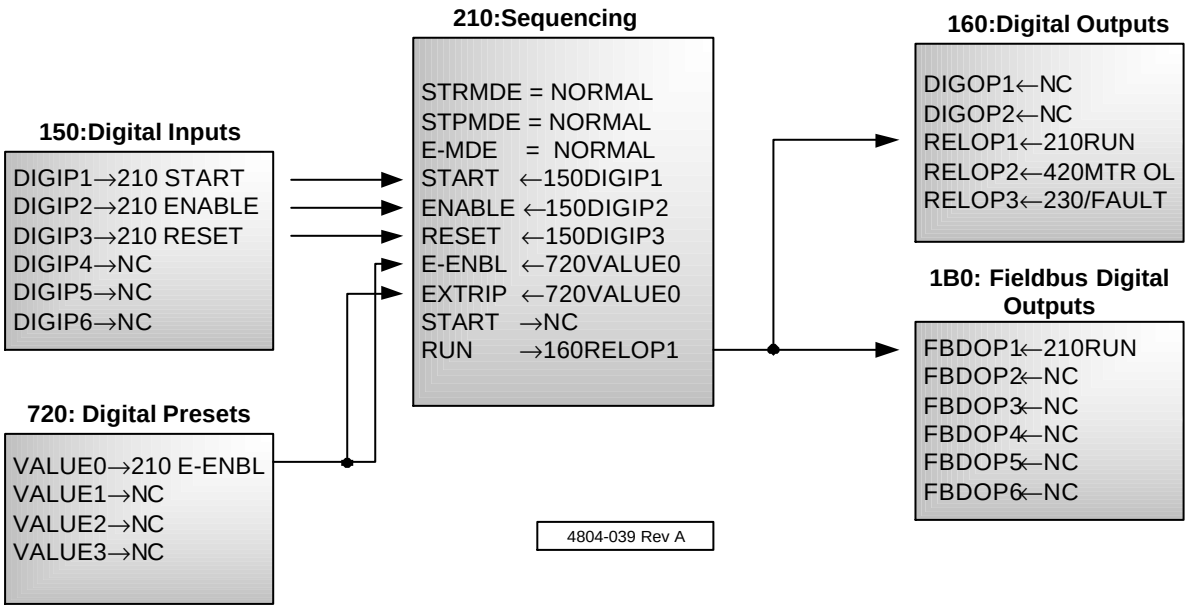

Figure 2.5: Example configuration for simple speed control (part of the default setup)

Modules which are required for a particular application may be connected together to achieve the required control over the controller. Figure 2.7 illustrates how interface modules and Microdrive V modules are connected together for simple speed control in the factory default configuration. The analogue input 1 module is configured as a voltage input scaled for -10 to +10V control and it's source port is connected to the speed reference input ie. "220:SPDREF<-110ANAIP1".

Where additional functions are needed, these are incorporated as special functions (eg motorised potentiometer), usually to be inserted between the interface and the controller. Special functions may be cascaded and (with care) quite sophisticated configurations created by the commissioning engineer.

2.4 CONFIGURATION MODULES

This section goes through the steps involved in adjusting parameters and in creating connections between modules.

2.4.1 PARAMETERS

Parameters display an equal sign "=" between the parameter label and its value and this is followed by the parameter's unit of measure (eg. "220:ACCEL1= 60s").*

```
RUN                                    R
CURRENT          =   342.0A
SPEED            =   100.0%
220:ACCEL1       =    60.0s
```
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Adjusting a parameter value

Adjustment of the value of a parameter is achieved by pressing the "+" or "-" keys. While adjusting the value of a parameter, the equal sign becomes an underscore "_" to indicate that the parameter is being adjusted.

```
RUN                                    R
CURRENT          =   342.0A
SPEED            =   100.0%
220:ACCEL1       _    30.0s
```
4804-041 Rev A

Accepting or cancelling an adjustment

When the desired value or option is displayed, pressing the "Enter" key will accept the adjustment which has been made. At this point the underscore will revert to an equal sign and the change will now be reflected in the Microdrive V's operation. Alternatively, to abandon an adjustment press the "Cancel" key.

```
RUN                                    R
CURRENT          =   342.0A
SPEED            =   100.0%
220:ACCEL1       =    30.0s
```
4804-042 Rev A

Fine-tuning with Microdrive V Series running

Another feature of the Microdrive V Series keyboard module is that fine-tuning of parameters can be made while the Microdrive V is running by holding down the "Enter" key while pressing the "+" or "-" keys. This allows changes made to the parameter to be instantly reflected in the operation of the Microdrive V.

Resetting module parameters

A module's parameters can be reset to factory defaults by pressing "Enter" at the "RESET PRMTRS?" option located at the bottom of the module's menu list. The user lock must be unlocked.** Connections between modules are not affected by a module reset.

```
RUN                                    R
CURRENT          =   342.0A
SPEED            =   100.0%
220:RESET PRMTRS ?
```
4804-043 Rev A

* Module ports have a meter below each which displays the value of the signal at that port and this uses the equal sign. These meters are not parameters so cannot be adjusted.

** See 010:USER in Section 4 for details on the user lock.

"Metering" a port

The location in the menu immediately below each port is it's "meter" which displays the signal value at that port. This will be a percentage for analogue ports and TRUE or FALSE for digital ports. It is read-only so cannot be adjusted.

```
RUN                                    R
CURRENT          =   342.0A
SPEED            =   100.0%
220:SPDREF       =   100.0%
```
4804-044 Rev A

2.4.2 DESTINATION PORTS

Destination ports are identified by a left arrow "←" after the title field. The data field shows which source port it is connected to and the arrow shows the direction of signal flow. In the default configuration illustrated in Figure 2.7, the speed reference is being fed a signal from analogue input 1.

NOTE: It is not possible to have more than one connection to an individual destination port because there would be a conflict. This simply means that a destination port can only 'listen' to one signal at a time.

```
RUN                                    R
CURRENT          =   342.0A
SPEED            =   100.0%
220:SPDREF ← 110ANAIP1
```
4804-045 Rev A

Unconnected ports

If no connection exists then "NC" will appear in the data field. A "no connection" has a FALSE value for digital inputs and 0.0 for analogue inputs.

```
OFF                                    R
CURRENT          =        0.0A
SPEED            =        0.0%
220:SPDREF ← NC
```
4804-046 Rev A

2.4.3 SOURCE PORTS

Source ports are identified by a right arrow "©" after the title field. The data field shows which destination port(s) it is connected to and the arrow shows the direction of signal flow. In the example illustrated in Figure 2.5, the run indicator is being fed to relay output 1 and fieldbus digital output 1.

NOTE: It is possible to have more than one connection to an individual source port because these ports produce signals. This simply means that the source port is 'talking' to more than one destination port at a time.

```
RUN                                    R
CURRENT          =    342.0A
SPEED            =    100.0%
210:RUN          → 160RELOP1
```
4804-047 Rev A

Viewing multiple connections

If more than one connection to a source port has been made then each can be viewed in turn in the data field by pressing the right arrow key "©" eg. if relay output 1 and fieldbus digital output 1 are both connected to the 210:RUN indicator (as in Figure 2.5) then 160:RELOP1 will be the first to be displayed and 1B0:FBDOP1 will appear next.

```
RUN                                    R
CURRENT          =    342.0A
SPEED            =    100.0%
210:RUN          → 1B0FBDOP1
```
4804-048 Rev A

2.4.4 MAKING PORT CONNECTIONS

The procedure for creating the kind of Microdrive V configuration illustrated in Figure 2.5 is quite straight forward but a little different to the traditional approach taken by some drive manufacturers. Rather than presenting the user with a long selection list of possible connections, the connection method employed in the Microdrive V Series simply requires the user to select the start and end points of the connection by navigating through the menu system using the arrow keys (explanation follows).

Unlocking the connection configuration

Before making a connection the configuration modules must be unlocked. This requires stopping the Microdrive V (if it is running) and navigating to parameter 010:CONFIG. Press the "-" key, then "Enter" to unlock the configuration. The status line will now indicate that the Microdrive V is in configuration mode, allowing changes to the connections between modules to be made.

NOTE: the Microdrive V will not accept a start command while in the configuration mode. Line 3 shows "LOCK CONFIG TO RUN" as a reminder to re-lock the connection configuration after use.

```
OFF              CONFIG              R
CURRENT          =        0.0A
LOCK CONFIG TO RUN
010:CONFIG=UNLOCK
```
4804-049 Rev A

Making Connections

1) To initiate a connection change, go to the source or destination port that you wish to start the connection from and press the "+" or "-" key. The arrow after the port's title will then change to an underscore character "_" to confirm that the connection can be changed. *

```
OFF              CONFIG              R
CURRENT          =        0.0A
CONNECTING PORT..
220:SPDREF_110ANAIP1
```
4804-050 Rev A

NOTE: Any existing connection to a destination port will be replaced by a new connection being made (destination ports can only have one source (to avoid contention)). Any existing connection to a source port will not be altered by adding the additional connection (source ports may feed multiple destination ports). Line 3 shows "CONNECTING PORT..." while a connection is being made. While in connecting mode, other functions are disabled.

2) Use arrow keys and menu structure to find the other port of the connection (for a handy list of all available ports see Section 5). Any port may be connected to any other port providing they are both of a compatible type ie. digital to digital, analogue to analogue, source to destination, destination to source. Section 5 and Section 12 list the signal type for each port.

```
OFF              CONFIG              R
CURRENT          =        0.0A
CONNECTING PORT..
180:FBAIP1 → NC
```
4804-051 Rev A

3) Press "Enter" to make the new connection (or "Cancel" to leave the configuration unchanged). The position in the menu will now jump back to the start point and will display the connection.

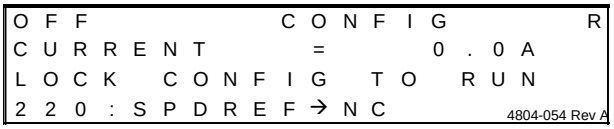
```
OFF              CONFIG              R
CURRENT          =        0.0A
LOCK CONFIG TO RUN
220:SPDREF ←180FBAIP1
```
4804-052 Rev A

4) Lock the configuration when all connections have been made. This will allow the Microdrive V to be restarted.

```
OFF              READY               R
CURRENT          =        0.0A
SPEED            =        0.0%
010:CONFIG=LOCK
```
4804-053 Rev A

Disconnecting Connections

To disconnect a connection to a destination port, press the “+” or “-” key followed directly by the “ENTER” key. “NC” (No Connection) will appear in the data field. A “no connection” inputs a FALSE value for digital destination ports and 0.0% for analogue destination ports.



Connections cannot be disconnected at a source port - the relevant destination port must be selected and the disconnection made from this point.

2.5 DEFAULT CONFIGURATION

2.5.1 DESCRIPTION

The factory default configuration of the Microdrive V Series is summarised in the following two figures. The default control configuration provides analogue voltage (-10 to +10V) speed control with three-wire start/stop/ reset and analogue output (-10 to +10V) of speed and motor current.

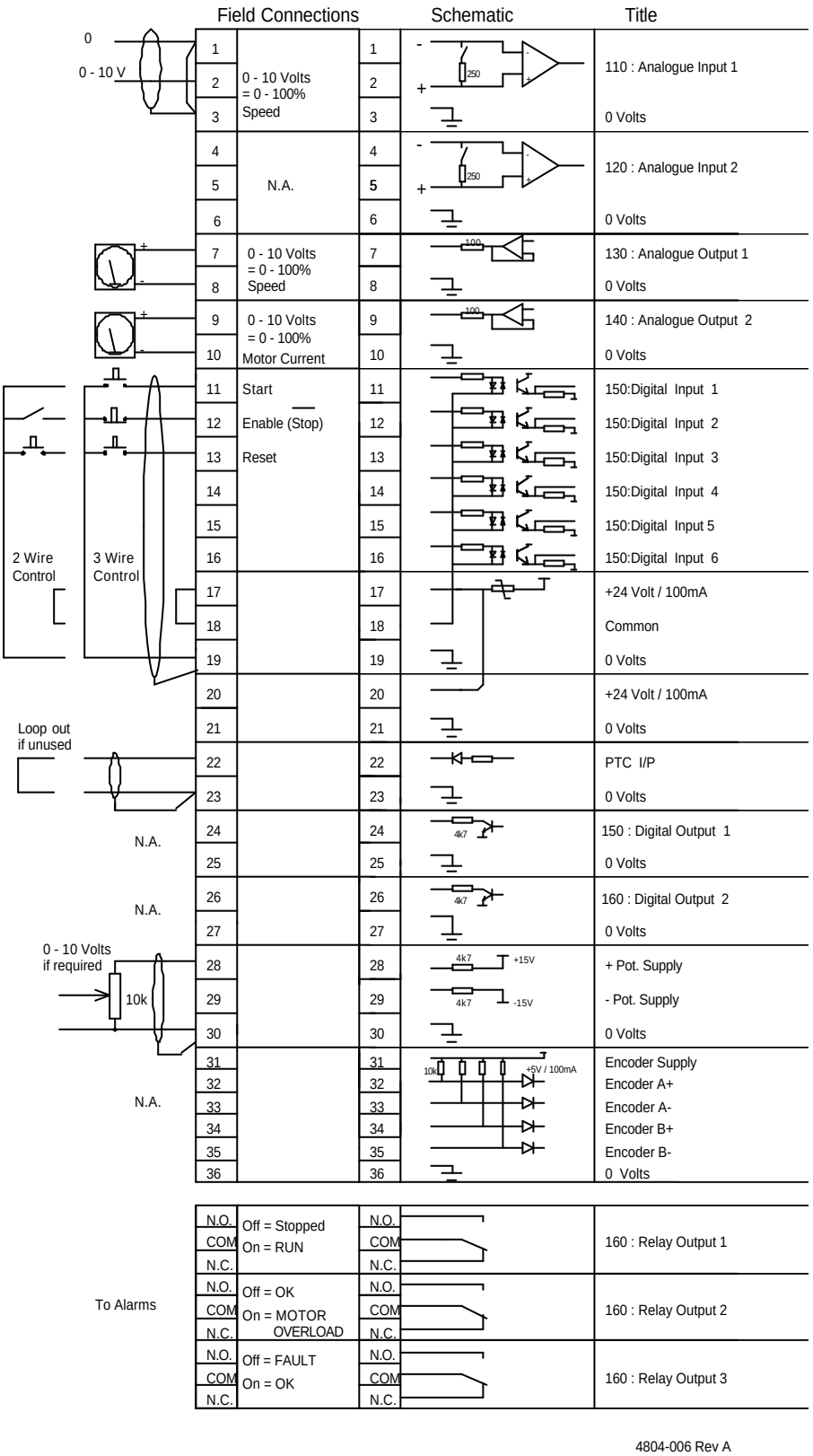


Figure 2.6: Default Interface Configuration for 36 Terminal Control Board

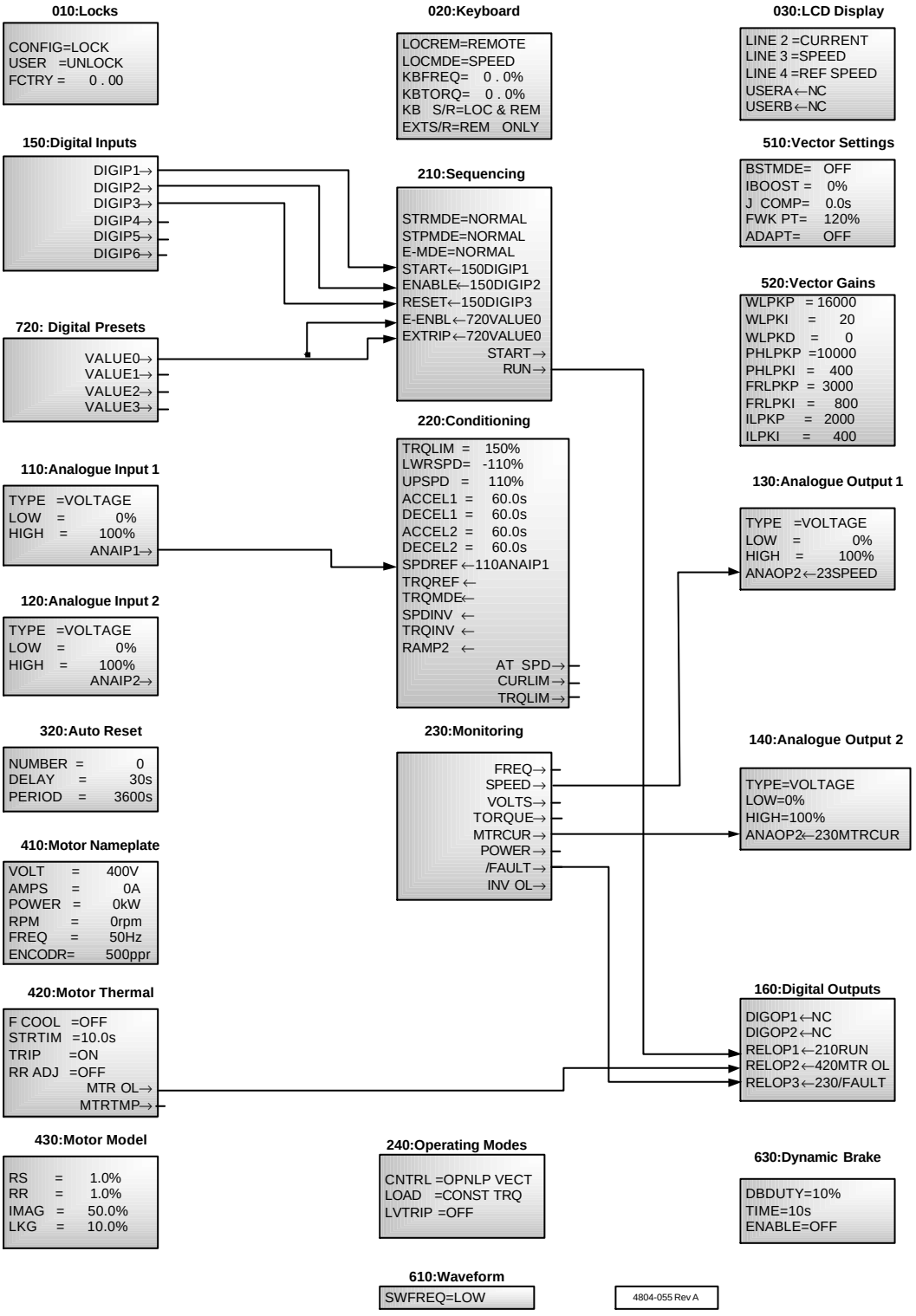


Figure 2.7: Default Control Configuration

Refer to Section 4 for a detailed explanation of each module and its parameters.

2.6 MOTOR DERATING

Figure 2.8 shows recommended derating of motors (without special cooling provision) connected to the Microdrive V Series. At low speeds torque derating is required due to reduced efficiency of motor cooling fans. Above rated speed insufficient fluxing voltage is available, and available torque per ampere drops inversely.

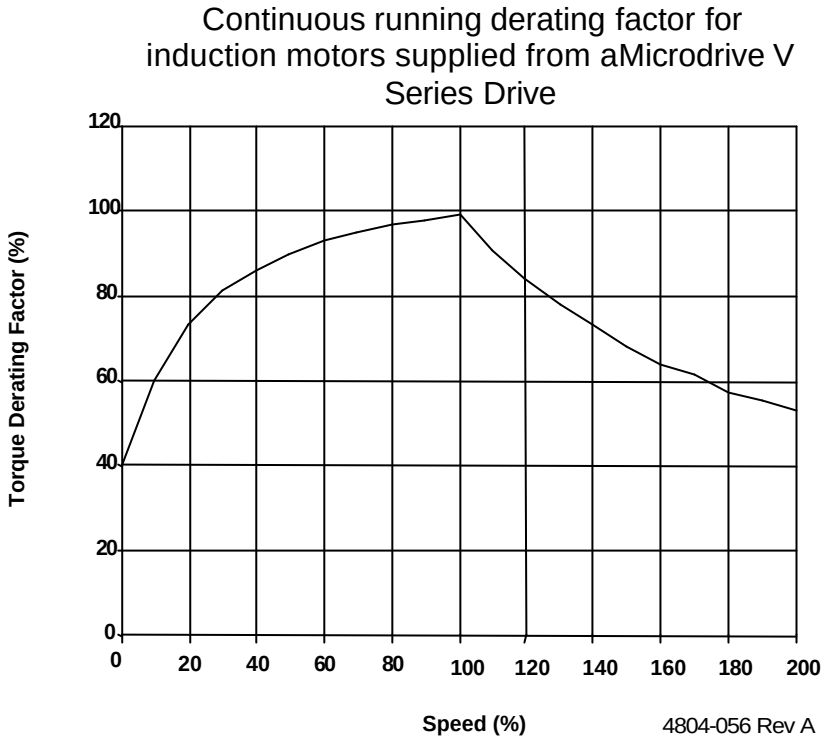


Figure 2.8: Microdrive V Series Typical Motor Derating Curve

3. INSTALLATION AND COMMISSIONING

3.1 MECHANICAL INSTALLATION

3.1.1 MOUNTING

The Microdrive V Series is supplied with brackets for surface mounting. The same mounting brackets can be repositioned centrally to permit through wall mounting. Through wall mounting permits the main air stream to be placed external to an electrical switchboard, eliminating the need for additional switchboard cooling. Refer to Figure 1.4 for dimensions.

3.1.2 COOLING

Cooling airflows in the Microdrive V Series must not be impeded. If mounting internally in a switchboard, sufficient airflow must be provided (See Section 1.4.10 for power loss and airflow information).

Two methods are available to the installer .

* Through wall mounting - if through wall mounted, care must be taken to allow for remaining losses of about 30% in the switchboard itself. Additional air flow exhausting from the top of the switchboard is usually required.
* The Microdrive V fan has sufficient power to draw and exhaust its cooling air requirements as long as ducting is not restrictive. This can eliminate the need for additional air supply. Make provision for air inlet into the switchboard and duct exhaust air outside the switchboard away from the inlet.

The main cooling fans require a separate 230Vac power supply to be provided to the main fan terminals. Fan load current does not exceed 1A per Microdrive V Series module.

In all cases check that the necessary high volume of air exhausts at the top of each Microdrive V Series module and cooling is adequate during commissioning.

3.2 ELECTRICAL INSTALLATION

3.2.1 EMC (ELECTROMAGNETIC COMPATIBILITY)

Electromagnetic compatibility refers to the safe and reliable operation of both the Microdrive V Series and other equipment sharing the same electromagnetic operating environment.

To assure EMC and radio interference levels are achieved, it is important that installation is carried out exactly according to the instructions of this manual.

3.2.2 CONTROL (SIGNAL) CABLING

Normal control cabling practice applies. Controls should be screened and earthed at the Microdrive V end only. Control cable should be run at least 300mm away from power cables (especially power output cables from AC Drives) and, where necessary, should cross power cables only at right angles.

3.2.3 EARTHING

The Microdrive V Series must be solidly bonded to power supply earth before energising. Potentially high leakage currents necessitate a permanent connection between Microdrive V chassis and mains earth.

Mains power earth must be connected to the PE terminal.

Motor earth must be made directly from motor chassis to Microdrive V motor earth terminal (ME) - preferably via the motor cable screen bonded at both ends. Where maximum radio suppression is required, screened three core cables must be used and the cable screen must be well bonded to the motor frame and connected directly to the Microdrive V Series ME terminal - it must not be connected elsewhere en-route.

3.2.4 POWER CABLING

Power Cabling requirements are summarised in Figure 3.1: Power Connection Details.

Microdrive V Series models up to MV600C20 are designed for connection with single input and output cables. Models MV750C20 and above have dual termination points designed for connection to paralleled cable runs.

Cable entry is made through a gland plate at the bottom of the Microdrive V.

The Microdrive V Series has very effective RFI filtering built in as standard.

In sensitive applications, and where output cables run with other output cables or near mains supply cables, a screened three-core motor cable is recommended. Such a cable must be solidly and directly bonded to both the motor and Microdrive V Series chassis to be effective.

3.2.5 MAIN 230VAC FAN SUPPLY

Microdrive V Series require a 230Vac +/- 5% 50Hz supply (<1A per module) to operate main (rear) cooling fans. It is most important to ensure that rear cooling fans operate and can provide the necessary bulk air for proper cooling when installing and commissioning the Microdrive.

It is useful in some applications to be able to disable the cooling fans when the Microdrive V is stopped. Details showing how to accomplish this are included in Section 8 - Microdrive V Series Fan On/Off Control.

3.2.6 ENCODER

An encoder (pulse tachometer) is required for the closed loop vector control mode. It is important that the encoder is suitable for this type of application. It must be connected directly to the shaft of the motor, be securely mounted and have an adequate mechanical coupling which is tolerant to shaft missalignment and vibration.

The electical interface must match the Microdrive V encoder interface. This is 5V differential RS422 compatible signals. The maximum frequency of the pulses must not exceed 150kHz. The encoder signal wires must be screened and segregated from the Microdrive V power lines by at least 0.2m. The encoder zero volts and screen must only be connected to the 0V input at the encoder terminals on the Microdrive V.

The A and B channels must be connected in the correct order to match the direction of the Microdrive V phase sequence. For positive speed indication A pulses must lead B pulses by 90degrees.

3.2.7 MOTOR BEARING PROTECTION

AC Drives can place motor bearings at increased risk due to flow of induced currents. Refer to Section 10 - Bearing Filters - Protecting Motor Bearings.

Risks can be minimised by ensuring the motor and load earths are made as recommended in this section.

Refer to Section 10: Bearing Filter Installation if installing bearing protection filters

Notes:

1 - Supply

* All local Electrical Safety Regulations must be obeyed.
* External isolation and supply protection as required
* Power Factor correction is not required. The Microdrive V Series provides cos f> 0.95.

2 - Main Fan Supply:

* A 230Vac 50Hz main fan supply must be provided to operate main (rear) cooling fans.

3 - Supply Cabling

* No special requirements are placed on input cables
* Microdrive V Series chassis must be solidly bonded to electrical earth (using one PE terminal only) before energising (high levels of earth leakage currents can flow)
* Input is not phase sensitive

4 - Control Cabling

* All control cabling should be screened, the screen connected at Microdrive V end only
* Control cables should run separately to power cables (preferably by at least 300mm)
* Control cables should cross power cables only where absolutely necessary and at right angles

5 - Output Cabling

* Output isolation (if required) should only be operated off load (ie with Microdrive V stopped).
* Symmetrical three-cored screened cables are preferred. The cable screen should be solidly bonded to both motor frame and Microdrive V motor earth (ME) terminal only (not anywhere else).

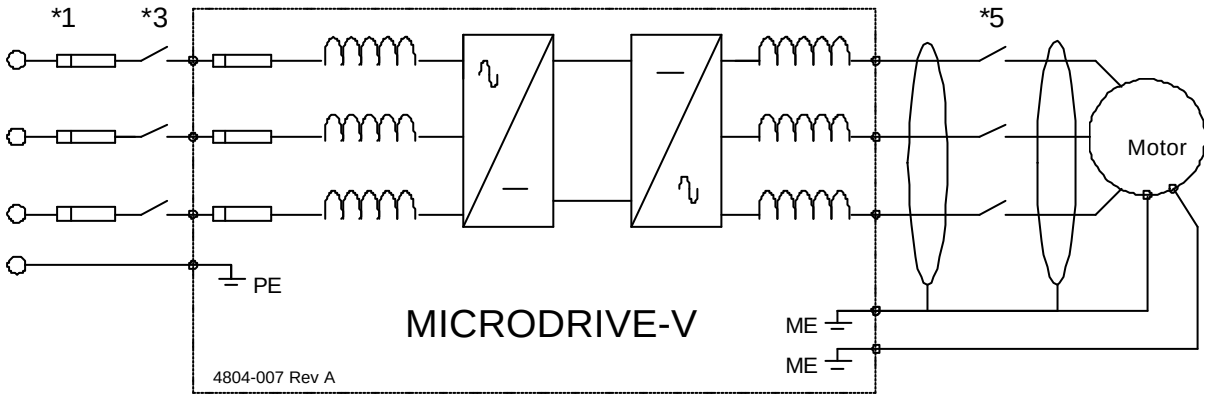


Figure 3.1: Power Connection Details

* If motor and load frames are electrically isolated, but electrically connected via shafts, install an isolated coupling in the shafts or bond motor and load using a wide flat (25mm) conductor such as braid or copper foil using the most direct connecting route (don't rely on common earth connections back to switch boards).
* Some regulations may require an earth to be run in addition to using the cable screen. If required this earth should run externally to the screened cable.
* Power factor correction capacitors must not be connected to Microdrive V Series output.
* If facility for electrical bypass of the motor to mains is required, the Microdrive V Series output must be isolated from the motor first (the Microdrive V Series output must never be connected to mains supply).

3.3 COMMISSIONING

For convenience Section 6 presents a suggested commissioning schedule.

3.3.1 SAFETY WARNING

- It is the installer's responsibility to ensure the configuration and installation of the Microdrive V Series meets the requirements of any site specific, local and national electrical regulations.
- The Microdrive V Series operates from HIGH VOLTAGE, HIGH ENERGY ELECTRICAL SUPPLIES. Stored charge is present after switch off.
- Due to the high leakage currents inherent to AC drives, earth connection of both the motor and the Microdrive V Series is essential before connection to the supply. The Microdrive V Series must be permanently connected to the supply.
- For safety reasons, normal operation of the Microdrive V Series requires front covers/doors to be in place and secured closed.
- Do not attempt to isolate the motor while the Microdrive V Series is running.
- Some parameter settings may cause the Microdrive V Series to start automatically after power failure.
- Motor overspeed operation may be limited by mechanical constraints.

3.3.2 INSTALLATION INSPECTION

*** Mechanical**

Check that the mechanical mounting of the Microdrive V is adequate.

*** Thermal**

Check that airflow paths are free and are able to carry the required air flow (refer to Figure 1.3: Overall dimensions, weight and airflow requirements). Check that thermal design caters for potential heat loss (approx. 70% of motor load at the rear cooling path, 30% (max) at front cooling path - see Figure 1.4).

*** Electrical**

Check the electrical installation of cables, crimps and lugs making sure that sizing is appropriate. Check at the Microdrive V input, output and motor terminals.

Check that the main fan supply is connected.

Check that the earthing has been carried out correctly according to the instructions in Figure 3.1.

Ensure that no loose material, swarf or moisture has entered the Microdrive V.

3.3.3 ENERGISING THE MICRODRIVE V

Warning: The Microdrive V Series is powered from high energy electrical supplies. Suitably qualified staff must inspect and approve the installation prior to powering the Microdrive V. Safety is the responsibility of the commissioning engineer. Safety should never be compromised.

Ensure mechanical safety by

- making sure all staff are clear of connected machinery
- if necessary, decoupling the motor shaft
- if possible, isolating the motor while programming the Microdrive V
- open the PTC circuit - this will always prevent the Microdrive V starting, regardless of set up.

Turn the power on. The display should illuminate. Internal fans should exhaust air at the top front of the Microdrive V, while main (rear) fans should exhaust bulk cooling air at the top rear of each module (check).

If the PTC circuit has been opened the display will indicate a motor PTC fault.

3.3.4 USING THE MICRODRIVE V SERIES IN ITS "STANDARD CONFIGURATION"

When received ex factory, the Microdrive V Series has been fully reset to default condition (see Section 2.5). Often the Microdrive V can be used in this configuration, or with only a few simple adjustments. For more information about any parameter or setting refer to the relevant screen detail in Section 4.

The standard configuration sets the Microdrive V up with a very standard set of inputs and outputs (refer to Figure 2.6).

The standard configuration is set up for voltage inputs and outputs (+/- 10V = -100 to +100% which means 0 to +10V = 0 to 100%). If current (4-20mA) input or output is required, the analogue channels can be reprogrammed using the appropriate interface

programming screens (100:INTERFACE).

Standard parameters are preset:-

acceleration	220:ACCEL1= 60.0 seconds
deceleration	220:DECEL1= 60.0 seconds
upper speed limit	220:UPSPD = 110% of rated motor speed
lower speed limit	220:LWRSPD= -110% of rated motor speed

If negative speed (ie. reverse) is not desired, it is a good idea to set 220:LWRSPD to 0%.

Normal start (ramp from zero speed) and stop (ramp to zero speed) are set.

For those familiar with earlier generation drives and used to having to set up "boost" controls, note that normal Vectorque control does not need boost adjustment.

A current boost is available in a special boost mode. In all other modes this boost control has no function.

Motor nameplate (410:MOTOR NAMEPLATE) details must be entered correctly to ensure motor protection and provide correct operation. Following entry of the motor parameters, the option is given to "410:CALCULATE MODEL?". It is important to accept this option (press the Enter key) at this point to have the motor model parameters automatically calculated from the nameplate data entered. Check that the automatically calculated values are sensible vs Set up guide for motor model parameters (Section 4).

For standard motors and applications, these are usually the only parameters which must be set prior to operation of the Microdrive V.

Warning: Vectorque must not be used with motors rated at less than 1/3 of the Microdrive V current rating (for test purposes with small motors V/Hz mode can be used - set 240:CNTRL =V/Hz). Attempts to trial very small motors in Vectorque mode will result in excessive motor current and damage to the motor.

3.3.5 MASTER RESET

If necessary the Microdrive V Series can be fully reset to the ex-factory state using the master reset screen 040:RESET (but note motor parameters (410:MOTOR NAMEPLATE) and local control parameters (020:LOCAL CONTROL) and calibration parameters (620:CALIBRATION) are not reset).

WARNING: If ALL parameters reset to default values on power up having previously been adjusted to user-defined values(prior to powering down), there has probably been a novram failure. Please call your service agent.

3.3.6 LOCAL OR REMOTE CONTROL

Operation may be achieved from the local keyboard controls if required. Change screen 020:LOCREM= to LOCAL to obtain local control. In local control, the speed reference is taken from the keyboard setting (020:KBFREQ=.....). Stop and start are controlled purely from the keyboard controls - all external inputs can be disabled from the local control screens (but motor PTC remains active - this can be useful if wanting a completely assured lock out mechanism while setting up).

Change screen 020:LOCREM= to REMOTE to return to remote control.

3.3.7 ADVANCED SET UP

For more detailed setups, the user is referred to Section 2 detailing the concepts and methods employed in the Microdrive V Series, and Section 4, detailing the function, default setting, range and setup of each individual screen.

3.3.8 START UP SENSORLESS VECTOR MODE

Plan an approach which will allow the Microdrive V system to be exercised safely, always ensuring the Microdrive V can be stopped immediately if necessary.

Remove Motor Isolation.

Reset any fault indications (push 0 button to reset faults).

Confirm front exhaust air and rear top bulk air flows are present before proceeding.

Start the Microdrive V in an appropriate mode of operation which permits observation of operation. Check direction of motor shaft rotation and that motor currents are correct.

If the control mode is closed loop vector ensure the encoder is connected with the correct phase sequence. If the motor will not accelerate beyond a few percent speed despite large currents flowing the encoder or motor may be connected in the wrong phase sequence.

With care, check operation at higher speeds or torque. Check accelerations and decelerations are appropriate.

Always check that motor currents and speeds are as expected.

If any faults are reported, refer to Section 3.5: Latched Fault Indications to determine cause and suggested solution.

If starting problems are encountered, in open loop vector control or V/Hz mode 430:MOTOR module parameters may need to be trimmed.

If possible operate the motor at no load. The initial current at zero speed reference should be much the same as that at higher (>25%) speed with no load. If it is significantly larger reduce 430:IMAG (magnetising current) and if it is smaller increase this parameter.

If the motor fails to accelerate under light load the stator resistance parameter 430:RS may be set too high. This would not be expected following "auto-calibration". This problem would also be associated with torque or current limit, high current despite low load and surging. Reduce the Rs parameter until the surging and excess current stops.

If the motor fails to accelerate with load applied the

stator resistance parameter may be too low. The Microdrive V will indicate torque or current limit but with no surging. Increasing the stator resistance will normally permit full torque to be available.

If increasing Rs does not improve the start performance under load or the Microdrive V surges starting into load the magnetising current parameter may need to be increased.

If insufficient starting torque is generated, refer to Section 4.1: Set up guide for model parameters.

In open loop vector mode if spin start is used, but is not operating correctly, 430:IMAG or 430:RS may be set incorrectly - refer to Section 4.1: Set up guide for model parameters.

With high starting torque loads indications of motor overload and torque limit are not unusual - these are warnings that the motor will overheat if operation at the level of load is prolonged and that the Microdrive V has trimmed acceleration or frequency to reduce torque respectively. The warnings are provided for information only - no change to set up is necessarily required.

If poor starting torque is available with closed loop vector control it is possible that 430: RR or 430:IMAG is incorrectly set. 430: IMAG may be adjusted in closed loop vector control in the same manner that it is set with open-loop vector control (described above) providing 510:ADAPT is enabled (set to ON). If it is not (510:ADAPT=OFF) and the operating mode is closed loop vector then the Microdrive V should be run between 50% and 100% speed at no load and 430:IMAG adjusted such that the output rms line to line voltage (available on the LCD display) is given by the rated rms line to line voltage for the motor multiplied by the %speed/100. (eg: 200V for a 400V motor running at 50% speed).

Closed loop vector control will not work with RR set to 0. The value for 430:RR derived by the auto-calculation function is usually very accurate. When adjusting this parameter ensure that the 420:RR ADJ parameter is set to OFF otherwise the system will tend to modify the value during commissioning making tuning difficult. After tuning is complete 420:RR ADJ may be re-enabled to adjust for temperature variation if so desired.

3.4 OVERLOAD WARNINGS

Overload warnings appear in the type field of the LCD display (centre, top line). They appear as long as the overload condition exists and are usually a warning that a trip (a latched fault) is imminent.

OVERLOAD DISPLAY AND DESCRIPTION	POSSIBLE CAUSE	POSSIBLE SOLUTION
MOTOR OL Motor thermal model indicates that motor will have reached maximum temperature	Motor current exceeds thermal capacity according to motor thermal model. Not immediately dangerous but will trip motor protection if overload persists.	Check motor and load conditions. Check motor model settings. Overload will occur below rated motor current at low speed unless force cooled.
TRQ LIMIT Torque limit	Torque is being limited by the drive because the torque limit set too low, or load torque is too high. Torque limit will occur on deceleration in order to prevent excessive bus voltage during regeneration. If 430:RS is too high, TRQ LIMIT may occur under no load at startup.	Check load. Reduce acceleration rate. Check torque limit setting 220:TRQLIM. Reduce decleration rate. Lower 430:RS (refer Section 4.1: Set up guide for model parameters.)
CRNT LIM Current limit	Gross over current of output.	Check for cable short circuit or motor faults. Check control and setup of motor (esp. high 430:RS) refer Section 4.1: Set up guide for model parameters.
SREF LIM	Speed reference is being limited by the drive because the speed limit parameter is incorrectly set or the reference value exceeds the range defined by the speed limits. Will only indicate if speed control mode is currently selected and the Microdrive V is running.	Increase the speed limit range or reduce the reference setpoint if the limit affects correct operation.
INV OL Inverter overload	Inverter current exceeds inverter continuous rating. Not immediately dangerous, but will trip inverter protection if overload exceeds 50% duty for more than 30 seconds.	Check motor and load condition. Review set up of Drive.

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Figure 3.1: Limit indications on LCD display

3.5 LATCHED FAULT INDICATIONS

Fault indications are presented alphabetically together with description, cause and solution where appropriate. A log of the ten most recent faults is listed in module 310:FAULT LOG under the 300:FAULT INFO module grouping.

Faults may be locally reset by pressing the stop '0' button or may be remotely reset by closing the reset input.

Fault Display and Description:

BRAKE OL Brake thermal model indicates that brake resistor will have reached maximum temperature.
Possible Cause:
Operation of brake resistor beyond specification. Incorrect set up of brake model.
Possible Solution:
Check load braking conditions.
Check brake model settings.

BRK DESAT Brake transistor overload.
Possible Cause:
Gross overload of brake circuit (e.g. short circuit in brake cabling), internal fault.
Possible Solution:
Check brake resistor cabling. If fault persists call service agent.

DCV HIGH DC bus volts excessive
Possible Cause:
Excessive regeneration through overhauling load or too fast deceleration. Overshoot in speed loop. Earth fault on output.
Possible Solution:
Check load.
Check deceleration rate (220: DECEL) and extend if necessary. Reduce 430:RR or 520: WLPKI (refer Section 4.1: Set up guide for model parameters.)
Check for earth faults in output circuit.

GROUND Earth fault on output
Possible Cause:
Earth fault
Possible Solution:
Check output circuit for failure to earth.

DC RIPPLE Excess DC bus voltage ripple.
Possible Cause:
Loss of an input or output phase.
Possible Solution:
Check input circuit for blown fuses or open circuit faults.
Check output circuit for open circuit faults.

CRNT TRIP Over current trip
Possible Cause:
Gross overcurrent of output.
Possible Solution:
Check for cable short circuit or motor faults.
Check control and setup of motor (esp. high 430:RS) refer Section 4.1: Set up guide for model parameters.

INTERNAL Internal fault detected.
Possible Cause:
Internal circuit fault.
Possible Solution:
Call service agent if fault persists.

INV OL Microdrive V has been overloaded.
Possible Cause:
Inverter thermal model has tripped the protection due to timed excessive current.
Possible Solution:
Check motor and load condition.
Review set up of Microdrive V.

INV THERM Internal trip on excessive heatsink temperature
Possible Cause:
Excessively hot ambient temperature.
Cooling air blockage or fan failure.
Possible Solution:
Check environment is not excessively hot.
Check and clean air path and fan.
Replace fan if necessary.

LOW MAINS Mains supply low.
Possible Cause:
Electrical supply low fault.
Possible Solution:
Check mains supply; disable low voltage trip option (240:LVTRIP).

LVDC LOW Fault in internal low voltage supplies.
Possible Cause:
Electronic Failure.
Possible Solution:
If fault persists call service agent.

MOTOR OL Motor thermal model has calculated that motor will have reached maximum winding temperature.
Possible Cause:
Operation at excessive current for given speed and cooling conditions. Incorrect set up of motor model.
Possible Solution:
Check motor and load conditions.
Check motor model settings.

MOTOR PTC Motor PTC circuit has tripped.
Possible Cause:
Excessive motor winding temperatures.
Break in PTC circuit.
Possible Solution:
Check motor and load conditions.
Check PTC circuit.

OVER SPD Microdrive V has exceeded 110% of maximum speed setting.
Possible Cause:
Incorrect set up. Over driving load.
Speed control overshoot.
Speed run-away in torque control.
Possible Solution:
Check load and set up. Tune speed controller and/or reduce acceleration rates.
Check load and torque reference settings.

USER

Possible Cause:

Input to 210:EXTRIP has been, or is false.
External trip circuit has been, or is, open.

Possible Solution:

Close external trip circuit.
Check configuration of 210:EXTRIP - See Section 4, Details of configuration Modules.

U+ DESAT (also U-, V+, V, W+, W-) Output transistor overload.

Possible Cause:

Gross overload of output (e.g short circuit in motor cabling), internal fault.

Possible Solution:

Check output cabling. If fault persists (especially with motor disconnected) call service agent.

FBUS LOST

Possible Cause:

170:FBTRIP is TRUE and no field bus detected.

Possible Solution:

Set 170: FBTRIP to FALSE or restore Field Bus. Refer to Microdrive V Serial Coomunications Technical Manual (PDL Part No. 4201-245) for more complete information about the operation of serial and fieldbus communications.

KB LOST

Possible Cause:

Loss of communication between keyboard and display module and the controller in Local mode.

Possible Solution:

Check connection and cabling between keyboard and display module and the controller.
Replace keyboard and display module.

4. DETAILS OF CONFIGURATION MODULES

This section lists all of the Microdrive V Series information in the order in which it is listed in the Microdrive V menu. Microdrive V Series parameters relate to software version 7.0 or later.

A number of icons have been used to help illustrate the tree structure layout of the menu.

🗁 Open folder
This item is a menu heading. The items which follow are contained within this sub-menu.

🗀 Closed folder
This item is a menu heading. There are items contained within this sub-menu not listed immediately below.

= Equal sign
This item is a module parameter.

🡐 Destination Port
This item is a module destination port.

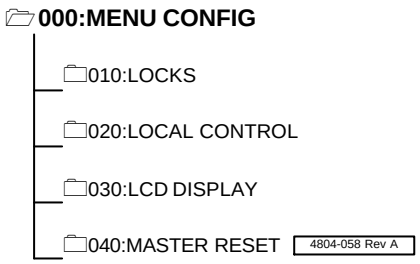
➔ Source Port
This item is a module source port.

✓ Tick
This item is subject to User/ Config/Master reset.

× Cross
This item is NOT subject to User/Config/Master reset.

N/A Not Applicable
User/Config/Master reset is not applicable to this item.

000:MENU CONFIG



DESCRIPTION: Modules which define the operation and appearance of the menu and the LCD display are located in this module group.

010:LOCKS

DESCRIPTION: Locking the Microdrive V parameters and connections is controlled from the lock controls in this module. The connection configuration, all Microdrive V parameters and factory calibration constants are locked by the CONFIG, USER and FCTRY locks respectively.

010: CONFIG=

Description	For safety reasons connections between modules can only be made with the Microdrive V disabled. After stopping the Microdrive V and unlocking the configuration (010:CONFIG=UNLOCK), all start signals are disabled so changes to configuration connections can be performed without the possibility of accidentally starting the Microdrive V. Connection changes are stored in non-volatile RAM as they are made. Once the necessary changes have been made, the configuration should be locked to enable operation of the Microdrive V.
Default	LOCK
Range/Type	unlock, lock
User Lock	N/A
Config Lock	N/A
Master Reset	N/A

010:USER =

Description	All Microdrive V parameters and connections can be locked by the user to prevent unintentional changes to the Microdrive V configuration.
Default	UNLOCK
Range/Type	unlock, lock
User Lock	N/A
Config Lock	N/A
Master Reset	N/A

010:FCTRY =

Description	Factory calibration constants are unlocked by entering the correct password code (not user accessible).
Default	0.00
Range/Type	0.00 to 655.35
User Lock	N/A
Config Lock	N/A
Master Reset	N/A

020:LOCAL CONTROL

DESCRIPTION: Local control makes it possible for the Microdrive V Series to be conveniently controlled from the LCD display. Located in the Local Control module are speed and torque reference values, as well as a parameter to switch between speed and torque modes of operation.

020:LOCREM=

Description	When local mode is selected the local/ remote indicator on the LCD display (ie. the right-most character on the top line) will change from “R” to “L”. In local mode the speed and torque reference inputs to the Controller. Conditioning module are ignored ie.220:SPDREF, 220:TRQREF. The 210:START input is always ignored. See 020:EXTS/R to determine when the 210:ENABLE, 210:E-ENBL and 210:RESET inputs are ignored. In remote mode the start key on the keyboard is disabled. See 020:KB S/R to determine when the keyboard stop key is ignored.
Default	REMOTE
Range/Type	remote, local
User Lock	✓
Config Lock	×
Master Reset	×

020:LOCMDE=

Description	Switches between speed or torque control when in local control.
Default	SPEED
Range/Type	speed, torque
User Lock	✓
Config Lock	×
Master Reset	×

020:KBFREQ=

Description	Keyboard speed reference - used when in local control speed mode.
Default	0.0%
Range/Type	-200.0 to +200.0%
User Lock	✓
Config Lock	×
Master Reset	×

020:KBTORQ=

Description	Keyboard torque reference - used when in local control torque mode.
Default	0.0%
Range/Type	-300.0 to +300.0%
User Lock	✓
Config Lock	×
Master Reset	×

020:KB S/R=

Description	Keyboard stop/reset enabled in LOCAL only or in LOCAL and REMOTE modes.
Default	LOC & REM
Range/Type	LOC ONLY, LOC & REM
User Lock	✓
Config Lock	×
Master Reset	×

020:EXTS/R=

Description	External stop/reset (module 210) enabled in REMOTE only or in LOCAL and REMOTE modes.
Default	REM ONLY
Range/Type	REM ONLY, LOC & REM
User Lock	✓
Config Lock	×
Master Reset	×

030:LCD DISPLAY

DESCRIPTION: The Microdrive V Series 4-line, 20-character LCD display permits easy-to-read displaying of speed, current, output voltage etc. Although the top line is dedicated to displaying the status of the Microdrive V, the information displayed on lines two, three and four is user selectable.

030:LINE2 =

Description	Selects which meter is to be displayed on line 2 of the LCD display.
Default	CURRENT
Range/Type	*
User Lock	✓
Config Lock	×
Master Reset	✓

030:LINE3 =

Description	Selects which meter is to be displayed on line 3 of the LCD display.
Default	SPEED
Range/Type	*
User Lock	✓
Config Lock	×
Master Reset	✓

030:LINE4 =

Description	Selects which meter is to be displayed on line 4 of the LCD display. Line 4 is also used for menu navigation so is located in the menu above 000:MENU CONFIG.
Default	REF SPEED
Range/Type	*
User Lock	✓
Config Lock	×
Master Reset	✓

030:USER A<-

Description	Destination port: Displays the value of any analogue or digital source port when "USER A" is the selected meter in 030:LINE2, 030:LINE3 or 030:LINE4.
Default	NC
Range/Type	analogue/digital
User Lock	✓
Config Lock	×
Master Reset	✓

030:USER B<-

Description	Destination port: Displays the value of any analogue or digital source port when "USER B" is the selected meter in 030:LINE2, 030:LINE3 or 030:LINE4.
Default	NC
Range/Type	analogue/digital
User Lock	✓
Config Lock	×
Master Reset	✓

* frequency (output, Hz), current (output, A), speed (% synchronous), ref speed (% synchronous), torque (% motor rated), ref torque (% motor rated), bus volts (VDC), output volts (output, Vrms), power (electrical output, kW) , motor tmp (% motor rated temperature), kWh (kW hours), inv on (Microdrive V on-time, hours), motor run (motor run-time, hours), user A, user B

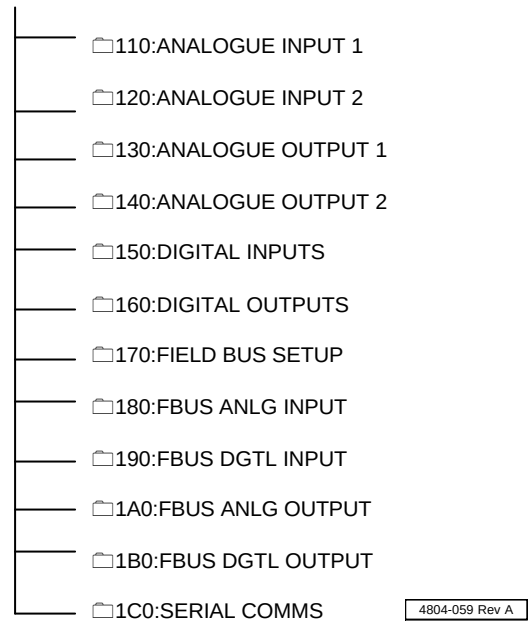
040:MASTER RESET

DESCRIPTION: The master reset module contains the master reset command which will re-initialise Microdrive V parameters and connections to factory defaults.

040:RESET (ENTER)?

Description	The master reset command will re-initialise Microdrive V parameters and connections to factory defaults. Parameters NOT affected by the master reset are the inverter calibration constants (620:CALIBRATION), the motor nameplate data (410:MOTOR NAMEPLATE) and the local control data (020:LOCAL CONTROL).
Default	N/A
Range/Type	N/A
User Lock	✓
Config Lock	✓
Master Reset	N/A

100:INTERFACE



DESCRIPTION: Modules which define the control interface for the Microdrive V are located in this module group. They define the scaling and interconnection of digital and analogue inputs and outputs (for 4-20mA, +/-10V, switched input, relay output, open collector output and fieldbus i/o).

Please refer to the Microdrive V Series Serial Communications Technical Manual (PDL part no. 4201-245) for more complete information about the operation of serial and fieldbus communications.

110:ANALOGUE INPUT 1

DESCRIPTION: Parameters which control the operation of analogue input 1 only are contained in this module. Selection between 4-20mA and +/-10V can be made and the input can be scaled to cover any sub-range within the total analogue range for the Microdrive V Series of +/-400%.

110:TYPE =

Description	Selects between 4-20mA (current) orÿ+/-10V (voltage).
Default	VOLTAGE
Range/Type	voltage, current
User Lock	✓
Config Lock	×
Master Reset	✓

110:LOW =

Description	Sets the analogue percentage which should correspond to the lowest electrical level i.e. 4mA or -10V.
Default	0%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

110:HIGH =

Description	Sets the analogue percentage which should correspond to the highest electrical level i.e. 20mA or +10V.
Default	100%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

110:ANAIP1->

Description	Source port: Analogue Input 1
Default	220SPDREF
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

120:ANALOGUE INPUT 2

DESCRIPTION: Parameters which control the operation of analogue input 2 only are contained in this module. Selection between 4-20mA and +/-10V can be made and the input can be scaled to cover any sub-range within the total analogue range for the Microdrive V Series of +/-400%.

120:TYPE =

Description	Selects between 4-20mA (current) or +/-10V (voltage).
Default	VOLTAGE
Range/Type	voltage, current
User Lock	✓
Config Lock	×
Master Reset	✓

120:LOW =

Description	Sets the analogue percentage which should correspond to the lowest electrical level i.e. 4mA or -10V.
Default	0%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

120:HIGH =

Description	Sets the analogue percentage which should correspond to the highest electrical level i.e. 20mA or +10V.
Default	100%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

120:ANAIP2->

Description	Source port: Analogue Input 2
Default	220TRQREF
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

130:ANALOGUE OUTPUT 1

DESCRIPTION: Parameters which control the operation of analogue output 1 only are contained in this module. Selection between 4-20mA and +/-10V can be made and the output can be scaled to cover any sub-range within the total analogue range of +/-400%

130:TYPE =

Description	Selects between 4-20mA (current) or +/-10V (voltage).
Default	VOLTAGE
Range/Type	voltage, current
User Lock	✓
Config Lock	×
Master Reset	✓

130:LOW =

Description	Sets the analogue percentage which should correspond to the lowest electrical level i.e. 4mA or -10V.
Default	0%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

130:HIGH =

Description	Sets the analogue percentage which should correspond to the highest electrical level i.e. 20mA or +10V.
Default	100%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

130:ANAOP1<-

Description	Destination port: Analogue Output 1
Default	230SPEED
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

140:ANALOGUE OUTPUT 2

DESCRIPTION: Parameters which control the operation of analogue output 2 only are contained in this module. Selection between 4-20mA and +/-10V can be made and the output can be scaled to cover any sub-range within the total analogue range of +/-400%.

140:TYPE =

Description	Selects between 4-20mA (current) or +/-10V (voltage).
Default	VOLTAGE
Range/Type	voltage, current
User Lock	✓
Config Lock	×
Master Reset	✓

140:LOW =

Description	Sets the analogue percentage which should correspond to the lowest electrical level i.e. 4mA or -10V.
Default	0%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

140:HIGH =

Description	Sets the analogue percentage which should correspond to the highest electrical level i.e. 20mA or +10V.
Default	100%
Range/Type	-400 to +400%
User Lock	✓
Config Lock	×
Master Reset	✓

140:ANAOP2<-

Description	Destination port: Analogue Output 2
Default	230MTRCUR
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

150:DIGITAL INPUTS

DESCRIPTION: Source ports for the control board mulitfunction digital inputs.

150:DIGIP1->

Description	Source port: Digital input 1.
Default	210START
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

150:DIGIP2->

Description	Source port: Digital input 2.
Default	210ENABLE
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

150:DIGIP3->

Description	Source port: Digital input 3.
Default	210RESET
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

150:DIGIP4->

Description	Source port: Digital input 4.
Default	220TRQMDE
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

150:DIGIP5->

Description Source port: Digital input 5.
Default 220SPDINV
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

150:DIGIP6->

Description Source port: Digital input 6.
Default 220TRQINV
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

160:DIGITAL OUTPUTS

DESCRIPTION: Destination ports for digital outputs.

160:DIGOP1<-

Description Destination port: Open collector digital output 1
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

160:DIGOP2<-

Description Destination port: Open collector digital output 2
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

160:RELOP1<-

Description Destination port: Relay output 1
Default 210RUN
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

160:RELOP2<-

Description Destination port: Relay output 2
Default 420MTR OL
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

160:RELOP3<-

Description Destination port: Relay output 3
Default 230/FAULT
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

170:FIELD BUS SETUP

DESCRIPTION: This module determines the operation of the fieldbus connection (if present). Its primary purpose is to detect the loss of the fieldbus and to take the appropriate action as required by the application.

170:ENABLE=

Description Module enable/disable switch. Disable this module if no fieldbus connection is required.
Default FALSE
Range/Type false, true
User Lock ✓
Config Lock ✓
Master Reset ✓

170:FBTRIP=

Description Selects whether the Microdrive V should trip if a loss of the fieldbus is detected.
Default FALSE
Range/Type false, true
User Lock ✓
Config Lock ✓
Master Reset ✓

170:FBLOSS->

Description Source port: Fieldbus Loss Error.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

180:FBUS ANLG INPUT

DESCRIPTION: Source ports for the fieldbus analogue inputs are grouped together in this module.

180:FBAIP1->

Description Source port: Fieldbus Analogue Input 1.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

180:FBAIP2->

Description Source port: Fieldbus Analogue Input 2.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

180:FBAIP3->

Description Source port: Fieldbus Analogue Input 3.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

180:FBAIP4->

Description Source port: Fieldbus Analogue Input 4.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

180:FBAIP5->

Description Source port: Fieldbus Analogue Input 5.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

180:FBAIP6->

Description Source port: Fieldbus Analogue Input 6.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

190:FBUS DGTL INPUT

DESCRIPTION: Source ports for the fieldbus digital inputs are grouped together in this module.

190:FBDIP1->

Description Source port: Fieldbus Digital Input 1.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

190:FBDIP2->

Description Source port: Fieldbus Digital Input 2.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

190:FBDIP3->

Description Source port: Fieldbus Digital Input 3.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

190:FBDIP4->

Description Source port: Fieldbus Digital Input 4.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

190:FBDIP5->

Description Source port: Fieldbus Digital Input 5.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

190:FBDIP6->

Description Source port: Fieldbus Digital Input 6.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

1A0:FBUS ANLG OUTPUT

DESCRIPTION: Destination ports for the fieldbus analogue outputs are grouped together in this module.

1A0:FBAOP1<-

Description Destination port: Fieldbus Analogue Output 1.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

1A0:FBAOP2<-

Description Destination port: Fieldbus Analogue Output 2.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

1A0:FBAOP3<-

Description Destination port: Fieldbus Analogue Output 3.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

1A0:FBAOP4<-

Description Destination port: Fieldbus Analogue Output 4.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

1A0:FBAOP5<-

Description Destination port: Fieldbus Analogue Output 5.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

1A0:FBAOP6<-

Description	Destination port: Fieldbus Analogue Output 6.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

1B0:FBUS DGTL OUTPUT

DESCRIPTION: Destination ports for the fieldbus digital outputs are grouped together in this module.

1B0:FBDOP1<-

Description	Destination port: Fieldbus Digital Output 1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1B0:FBDOP2<-

Description	Destination port: Fieldbus Digital Output 2.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1B0:FBDOP3<-

Description	Destination port: Fieldbus Digital Output 3.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1B0:FBDOP4<-

Description	Destination port: Fieldbus Digital Output 4.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1B0:FBDOP5<-

Description	Destination port: Fieldbus Digital Output 5.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1B0:FBDOP6<-

Description	Destination port: Fieldbus Digital Output 6.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1C0:SERIAL COMMS

DESCRIPTION: From within this serial communications module the address of the Microdrive V can be specified and the status of the serial communications interface can be viewed. Source ports for the serial communications analogue and digital inputs are grouped together in this module. Please refer to the Microdrive V Series Serial Communications Technical Manual (PDL Part no. 4201-245) for more complete information about the operation of serial and fieldbus communications.

NOTE: In applications where the Microdrive V is to be actively controlled via the serial communications interface it is strongly recommended that only the analogue and digital source ports provided in this module be used. The value of these ports can be regularly updated without changes being stored in non-volatile memory every time a value changes. This is important because the lifetime of the non-volatile memory in the Microdrive V Series is limited to 106 data changes.

1C0:STATUS=

Description	Status of the serial communications interface. Refer to the section "Microdrive V serial communiations parameter status index numbers" in the Serial Communications Technical Manual (PDL Part no. 4201-245) for the meanings of the different status messages displayed.
Default	
Range/Type	READ ONLY
User Lock	N/A
Config Lock	N/A
Master Reset	N/A

1C0:ADDRSS=

Description	Microdrive V address used on the serial communications line. The first digit designates the drive group (1-9) and the second digit designates the drive within that group (1-9).
Default	11
Range/Type	11 to 99
User Lock	✓
Config Lock	✓
Master Reset	✓

1C0:SCAIP1->

Description	Source port: Serial communications Analogue Input 1.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

1C0:SCAIP2->

Description	Source port: Serial communications Analogue Input 2.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

1C0:SCAIP3->

Description	Source port: Serial communications Analogue Input 3.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

1C0:SCDIP1->

Description	Source port: Serial communications Digital Input 1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

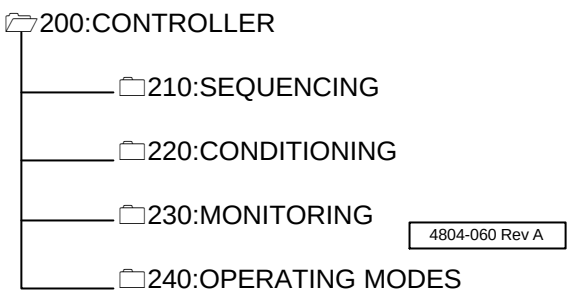
1C0:SCDIP2->

Description	Source port: Serial communications Digital Input 2.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

1C0:SCDIP3->

Description	Source port: Serial communications Digital Input 3.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

200:CONTROLLER



DESCRIPTION: The Controller performs the core motor control functions of the Microdrive V Series and is divided into three modules according to function. These modules can be seen in Figure 2.7 which also shows the default settings of Controller parameters in these modules as well as default connections to and from the Controller modules.

210:SEQUENCING

DESCRIPTION: The start, stop and reset destination ports of this module control the Microdrive V (when in Remote control, not Local (020:LOCREM)). Vectorque sensorless vector control has made spin start and spin stop modes possible without the need for speed feedback signals from a shaft speed encoder. An explanation of these start and stop modes while operating under either speed or torque control follows in 210:Start Mode and 210:Stop Mode.

210:STRMDE=

Description	Start Mode determines whether the frequency is ramped up at the preset acceleration rate 1) (normal) from zero or 2) (spin) from the motor's present speed.*
Default	NORMAL
Range/Type	normal, spin
User Lock	✓
Config Lock	×
Master Reset	✓

210:STPMDE=

Description	Stop Mode determines how the motor will be stopped after a standard stop command - whether 1) (normal) the frequency is ramped down at the preset deceleration rate or 2) (spin) the motor spins to rest with Microdrive V running for quick restart or 3) (coast) the motor coasts to rest with Microdrive V stopped.*
Default	NORMAL
Range/Type	normal, spin, coast
User Lock	✓
Config Lock	×
Master Reset	✓

210:E-MDE =

Description: Emergency stop mode determines how the motor will be stopped after an emergency stop command - whether 1) (normal) the frequency is ramped down at the preset deceleration rate (220:DECEL1) or 2) (spin) the motor spins to rest with Microdrive V running for quick restart or 3) (coast) the motor coasts to rest with Microdrive V stopped.* Refer to 210:E-ENBL below for details of emergency stop operation.
Default: NORMAL
Range/Type: normal, spin, coast
User Lock: ✓
Config Lock: ×
Master Reset: ✓

210:START <-

Description: Destination port: Microdrive V Start input (positive edge triggered).
Default: 150DIGIP1
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

210:ENABLE<-

Description: Destination port: Microdrive V Enable input (must be TRUE for Microdrive V to run). A FALSE input will clear the start latch. This port disables the Microdrive V when in REMOTE control or when the external stop-reset inputs are enabled in LOCAL control (020:EXTS/R=LOC & REM).
Default: 150DIGIP2
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

210:RESET <-

Description: Destination port: Microdrive V Fault Reset input (positive edge triggered).
Default: 150DIGIP3
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

210:E-ENBL<-

Description: Destination port: Emergency stop input (must be TRUE for Microdrive V to run in LOCAL or REMOTE modes). A FALSE input will cause the Microdrive V to stop in the manner set by the 210:E-MDE parameter. Displays E-Stop
Default: 720VALUE0
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

210:EXTRIP<-

Description: Destination port: External trip input (negative edge triggered). This input will trip the Microdrive V displaying a 'USER' generated fault. This input must be TRUE for the Microdrive V to run.
Default: 720VALUE0
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

210:START ->

Description: Source port: Microdrive V Start Acknowledge output (TRUE while Microdrive V running, FALSE while Microdrive V stopping or stopped).
Default: NC
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

210:RUN ->

Description: Source port: Microdrive V Run Acknowledge output (TRUE while Microdrive V running and while stopping, FALSE when stopped).
Default: 160RELOP1
Range/Type: digital
User Lock: ✓
Config Lock: ✓
Master Reset: ✓

* Spin start is not available in V/Hz. See 210:START MODE and 210:STOP MODE for details of start/stop operation under speed or torque modes.

210:Start Mode

NORMAL

Speed Control: Zero shaft speed is assumed. There is up to a 0.5 second delay as the Microdrive V applies fixed current to the motor to bring the motor flux level up. Frequency is then ramped from zero up to the reference level at the preset acceleration rate. Consequently if the shaft is spinning at startup the Microdrive V will effectively be applying a braking torque. This will cause the motor speed to reduce until it reaches the inverter frequency from which point it will accelerate.

Torque Control: Sufficient current is applied to produce the level of torque set by the reference input 220:TRQREF. Rotor speed is assumed to be zero.

SPIN

Speed Control: The spin-start mode accelerates the motor from its present speed. The Microdrive V applies current at zero torque to identify the shaft speed. After this the frequency is ramped from the present

shaft speed to the reference level according to the preset acceleration ramp rates.#*

Torque Control The spin-start mode accelerates the motor from its present speed. The Microdrive V applies current at zero torque to identify the shaft speed. After approximately one second the reference torque level is applied. #*

\# In low inertia systems the shaft may rotate at zero speed in spin start. If this is a problem, use NORMAL start mode.

* Spin start is not applicable to V/Hz mode. The Microdrive V controller will revert to NORMAL start.

210: Stop Mode

NORMAL

Speed Control The frequency is ramped down to zero at the preset deceleration rate.

Torque Control A small drag torque is applied allowing the load to decelerate the motor. The Microdrive V knows the shaft speed as it decelerates, permitting an instantaneous transition into acceleration from the present speed if required. The shaft will coast to rest below 10% speed.

SPIN

Speed Control A small drag torque is applied allowing the load to decelerate the motor. The Microdrive V knows the shaft speed as it decelerates, permitting an instantaneous transition into acceleration from the present speed if required. The shaft will coast to rest below 10% speed.

Torque Control A small drag torque is applied allowing the load to decelerate the motor. The Microdrive V knows the shaft speed as it decelerates, permitting an instantaneous transition into acceleration from the present speed if required. The shaft will coast to rest below 10% speed.

COAST

Speed Control The Microdrive V applies no power to the motor, allowing the motor to coast to rest as if no Microdrive V were connected.

Torque Control The Microdrive V applies no power to the motor, allowing the motor to coast to rest as if no Microdrive V were connected.

If the drag torque which is applied causes too much deceleration select the COAST stop mode. SPIN stop permits the inverter to be restarted at any point during the stopping process without the need for spin start. The speed display remains accurate even without encoder feedback during the spin stop process.

220:CONDITIONING

DESCRIPTION: Speed and torque control signals are input to the Conditioning module and are processed together with the start/stop sequencing logic to control the operation of the Microdrive V. A number of limits (acceleration, deceleration, upper and lower speed limits, maximum torque limits) set boundaries to the area of operation of the controller.

220:TRQLIM=

Description	Sets the limit for maximum positive and negative torque magnitude.
Default	150%
Range/Type	0 to 300%
User Lock	✓
Config Lock	×
Master Reset	✓

220:LWRSPD=

Description	Sets the lower limit for speed.
Default	-110%
Range/Type	-200% to 220:UPSPD
User Lock	✓
Config Lock	×
Master Reset	✓

220:UPSPD =

Description	Sets the upper limit for speed.
Default	110%
Range/Type	220:LWRSPD to +200%
User Lock	✓
Config Lock	×
Master Reset	✓

220:ACCEL1=

Description	Sets the ramp-rate group 1 accelerating limit for the controller. Set as required by process. Avoid unnecessarily high acceleration.*
Default	60.0s
Range/Type	0.1 to 3000 seconds
User Lock	✓
Config Lock	×
Master Reset	✓

220:DECEL1=

Description	Sets the ramp-rate group 1 decelerating limit for the controller. Set as required by process. Avoid unnecessarily high deceleration.
Default	60.0s
Range/Type	0.1 to 3000 seconds
User Lock	✓
Config Lock	×
Master Reset	✓

220:ACCEL2=

Description	Sets the ramp-rate group 2 accelerating limit for the controller. Set as required by process. Avoid unnecessarily high acceleration.*
Default	60.0s
Range/Type	0.1 to 3000 seconds
User Lock	✓
Config Lock	×
Master Reset	✓

220:DECEL2=

Description	Sets the ramp-rate group 2 decelerating limit for the Microdrive V. Set as required by process. Avoid unnecessarily high deceleration.
Default	60.0s
Range/Type	0.1 to 3000 seconds
User Lock	✓
Config Lock	*
Master Reset	✓

220:SPDREF<-

Description	Destination port: Speed reference.
Default	110ANAIP1
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

220:TRQREF<-

Description	Destination port: Torque reference.
Default	120ANAIP2
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

220:TRQMDE<-

Description	Destination port: Torque/speed mode selector (FALSE for speed mode; TRUE for torque mode).
Default	150DIGIP4
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

220:SPDINV<-

Description	Destination port: TRUE inverts the sign of the remote control speed reference.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

220:TRQINV<-

Description	Destination port: TRUE inverts the sign of the remote control torque reference.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

220:RAMP2 <-

Description	Destination port: TRUE selects ramp-rate group 2 acceleration/deceleration limits for the Microdrive V controller. FALSE selects ramp-rate group 1 acceleration/ deceleration limits for the Microdrive V controller.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

220:AT SPD->

Description	Source port: At speed setpoint indicator.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

220:CURLIM->

Description	Source port: Current limit indicator.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

220:TRQLIM->

Description	Source port: Torque limit indicator.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

* Value is the time for a 100% change in speed.

230:MONITORING

DESCRIPTION: The Controller Monitoring module outputs a number of useful control variables: Microdrive V output frequency, shaft speed, applied voltage, motor torque, current, electrical power and a fault indicator. These may be used for control purposes, linked to appropriate interfaces or shown on the LCD display.

230:FREQ ->

Description	Source port: Microdrive V output frequency.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

230:SPEED ->

Description	Source port: Motor speed.
Default	130ANAOP1
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

230:VOLTS ->

Description	Source port: Microdrive V output voltage.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

230:TORQUE->

Description Source port: Torque.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

230:MTRCUR->

Description Source port: Current as a percentage of rated motor current.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

230:POWER ->

Description Source port: Electrical output power.
Default NC
Range/Type analogue
User Lock ✓
Config Lock ✓
Master Reset ✓

230:FAULT->

Description Source port: Failsafe fault indicator ('/' indicates inverted logic) ie. TRUE = No Fault. Changes to FALSE for any Microdrive V trip condition.
Default 160RELOP3
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

230:INV OL->

Description Source port: Inverter overload indicator.
Default NC
Range/Type digital
User Lock ✓
Config Lock ✓
Master Reset ✓

240:OPERATING MODES

DESCRIPTION: The Controller Operating Modes module permits selection of a number of different operating modes for the Microdrive V.

240:CNTRL =

Description Selects 1)V/Hz or 2)Vectorque open loop or encoderless vector control mode or 3)Vectorque closed loop or encoder feedback mode. Limited torque features are available under V/Hz control. Spin start are only available under the Vectorque mode of operation.
Default OPNLP VEC
Range/Type V/Hz, opnlp vec, encdr vec
User Lock ✓
Config Lock ✓
Master Reset ✓

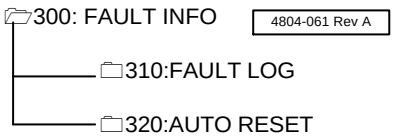
240:LOAD =

Description Selecting variable torque ("VAR TRQ") enables a special pump curve which provides reduced flux and noise at fractional speeds - suits centrifugal loads. Set to constant torque ("CONST TRQ") for all other loads.
Default CONST TRQ
Range/Type const trq, var trq
User Lock ✓
Config Lock ✓
Master Reset ✓

240:LVTRIP=

Description Forces Microdrive V to trip upon low mains voltage detection. Disable this option to allow ride-through during mains disturbances (Microdrive V output is disabled during low mains; spin start should be selected to restart on to spinning motor.
In V/Hz mode the motor will run down to zero speed on current limit).
Default OFF
Range/Type off, on
User Lock ✓
Config Lock ✓
Master Reset ✓

300:FAULT INFO



DESCRIPTION: This group has two modules - one which logs faults and another which provides control over auto-resetting behaviour whenever a fault occurs.

310:FAULT LOG

DESCRIPTION: By logging the nine most recent faults, this module enables the user to investigate the fault history of the Microdrive V. The fault log is stored in non-volatile RAM. Clearing the fault log can be performed by scrolling down to the parameter reset command at the bottom of the list and then pressing enter.

310:FAULT1=

Description Fault log entry number 1. (most recent)
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT2=

Description Fault log entry number 2.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT3=

Description Fault log entry number 3.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT4=

Description Fault log entry number 4.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT5=

Description Fault log entry number 5.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT6=

Description Fault log entry number 6.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT7=

Description Fault log entry number 7.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT8=

Description Fault log entry number 8.
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

310:FAULT9=

Description Fault log entry number 9. (least recent)
Default
Range/Type *
User Lock ✓
Config Lock N/A
Master Reset ✓

* See Section 3.5 for the list of all possible fault indications.

320:AUTO RESET

DESCRIPTION: Controls auto-reset option following a fault. Faults which will be auto-reset are: overcurrent trip (CRNT TRIP), high dc bus voltage (DCV HIGH), low mains voltage (LOW MAINS) and Inverter overload (INV OL).

320:NUMBER=

Description Sets the permissible number of auto-resets before the Microdrive V will remain tripped - manual reset is then required to continue operation.
Default 0
Range/Type 0 to 5
User Lock ✓
Config Lock ×
Master Reset ✓

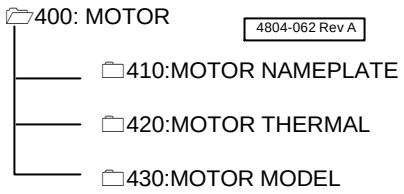
320:DELAY =

Description Sets the delay between when the fault occurs and when the next attempt to automatically reset will be made.
Default 30s
Range/Type 0 to 100 seconds
User Lock ✓
Config Lock ×
Master Reset ✓

320:PERIOD=

Description	The fault-free period after which the fault counter is reset.
Default	3600s
Range/Type	0 to 3600 seconds
User Lock	✓
Config Lock	×
Master Reset	✓

400:MOTOR



DESCRIPTION: Modules which relate to motor characteristics are listed in this grouping. It is essential that the nameplate values be entered and that the motor model be calculated. Motor thermal and motor model parameters do not usually need adjusting unless a special motor or forced cooling is used.

410: MOTOR NAMEPLATE

DESCRIPTION: The rated motor parameters as stated on the motor nameplate should be entered here. Unless a special motor or cooling method is used, these are the only motor parameters which must be entered at commissioning, but the calculate model option must be accepted.

410:VOLTS =

Description	Rated motor voltage.
Default	400V
Range/Type	50 to 1000V
User Lock	✓
Config Lock	×
Master Reset	×

410:AMPS =

Description	Rated motor current.
Default	0A
Range/Type	0 to 2000A
User Lock	✓
Config Lock	×
Master Reset	×

410:POWER =

Description	Rated motor power.
Default	0kW
Range/Type	0 to 1000kW
User Lock	✓
Config Lock	×
Master Reset	×

410:RPM =

Description	Rated motor speed.
Default	0rpm
Range/Type	0 to 65535rpm
User Lock	✓
Config Lock	×
Master Reset	×

410:FREQ =

Description	Rated motor supply frequency.
Default	50Hz
Range/Type	0 to 100Hz
User Lock	✓
Config Lock	×
Master Reset	×

410:ENCODR=

Description	Encoder pulse per revolution
Default	500ppr
Range/Type	0 to 4096ppr
User Lock	✓
Config Lock	×
Master Reset	×

410:CALCULATE MODEL?

Automatic calculation of motor model parameters (estimates motor parameters from nameplate data and enters them into module 430 automatically). Always accept this option unless precise motor model data is available to be entered into module 430 directly. Press the Enter key to activate this function.
If precise motor model data exists then enter this data directly into module 430.

420:MOTOR THERMAL

DESCRIPTION: Parameters in this module do not usually require adjustment by the user. Incorporated in the Microdrive V Series is thermal modelling of the motor, protecting it from overheating. Parameters in this module affect the model operation. Source port indicators provide information on the motor temperature and overload status.

420:F COOL=

Description	If the motor is being force cooled, select ON.
Default	OFF
Range/Type	off, on
User Lock	✓
Config Lock	×
Master Reset	✓

420:STRTIM=

Description	Maximum allowable DOL start duration of the motor.
Default	10.0s
Range/Type	0 to 60seconds
User Lock	✓
Config Lock	×
Master Reset	✓

420:TRIP =

Description	Allows the motor thermal model to trip the Microdrive V Series.
Default	ON
Range/Type	off, on
User Lock	✓
Config Lock	×
Master Reset	✓

420:RR ADJ =

Description	Allows the motor thermal model to adjust the rotor resistance parameter. This allows the variation in rotor resistance with temperature to be compensated. It is used to improve the speed regulation in open loop vector control or to improve the torque accuracy in closed loop vector control.
Default	OFF
Range/Type	off, on
User Lock	✓
Config Lock	×
Master Reset	✓

420:MTR OL->

Description	Source port: Motor thermal overload warning indicator. This indicates that the thermal model has detected that the motor is being overloaded and that the Microdrive V Series will soon trip. This indicator clears once the Microdrive V Series has tripped.
Default	160RELOP2
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

420:MTRTMP->

Description	Source port: Estimated motor temperature rise. 100% implies rated or design level temperature rise.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

430:MOTOR MODEL

DESCRIPTION: Parameters in this module do not usually require adjustment by the user. These parameters are motor parameters used in the Microdrive V Series control algorithms. The values which can be automatically calculated by "410:CALCULATE MODEL?" should provide satisfactory performance for most applications (but check model values are sensible vs Section 4.1: Set up guide for model parameters).

The motor model parameters define the critical motor electrical parameters required for Vectorque. Parameters are expressed in normalised notation and will not vary widely for most standard motors. Refer to Section 4.1: Set up guide for model parameters.

430:RS =

Description	Stator resistance (approx. equals one to two times rotor resistance). This parameter is important in high torque, low speed operation.*
Default	1.0%
Range/Type	0 to 10.0%
User Lock	✓
Config Lock	×
Master Reset	✓

430:RR =

Description	Rotor resistance (approx. equal to percentage slip).*
Default	1.0%
Range/Type	0 to 10.0%
User Lock	✓
Config Lock	×
Master Reset	✓

430:IMAG =

Description	Magnetising current.*
Default	50.0%
Range/Type	0 to 150.0%
User Lock	✓
Config Lock	×
Master Reset	✓

430:LKG =

Description	Leakage inductance.*
Default	10.0%
Range/Type	0 to 150.0%
User Lock	✓
Config Lock	×
Master Reset	✓

430:CALCULATE MODEL?

Automatic calculation of motor model parameters from the motor nameplate values entered in module 410. Press the Enter key to activate this function.

Refer to Section 4.1, for a guide to setting up motor model parameters manually.

NOTE: “410:CALCULATE MODEL?” uses the following formulae to automatically calculate motor model values. This function should be used to generate values unless more precise data about the motor parameters is available directly. However, check results are sensible (sometimes nameplate values for full load speed are quite nominal, or even erroneous, and will give non-sensible values for the motor model). Correct motor nameplate values are required to provide accurate model estimates.

4.1 SETUP GUIDE FOR MOTOR MODEL PARAMETERS

Parameter RS: Stator resistance

Setting

RS approximately equals 75% of the percentage motor slip at full load.

RS = 100 x Rpn x POWER / VOLTS2 *

where Rpn = Equivalent cold motor phase to neutral resistance in ohms. Note that Rpn = Line to line resistance/2.

Typical values are 1.5 - 2% @ 75kW, 1 -1.5% @ 150kW, 0.6 - 1.2% @ 300kW, .35 - .7% @ 450kW, .25 - .5% @ 630kW; higher values apply to multipole and lower efficiency machines

Effect on performance

For open loop vector and V/Hz the stator resistance has an important effect on peak torque especially at very low speed. If it is too small peak starting torque will be reduced. Increasing RS will increase starting torque, but If it is too high the Microdrive V will source high current limited only by the current limit, but be unable to run up to speed and may surge at low speed.

For most pump and fan applications, stator resistance is best set on the low side, since little starting torque is required. Rs = 0 is permissible in this case. The auto-calculate chooses a value for Rs which is deliberately likely to be lower than the ideal value to obviate possible stability problems associated with excessive Rs.

RS provides automatic boost in V/Hz mode, so must be set to realistic values (non-zero) in this mode.

RS will affect the ability to spin start especially with higher resistance machines. If the drive fails to spin start Rs is probably too small and must be increased.

RS will affect the accuracy of the parameter adaption in closed loop vector control. If very poorly set it will degrade the torque accuracy at low speeds with 510:ADAPT parameter ON. If set to OFF the RS parameter will have no effect on closed loop vector operation.

Parameter RR: Rotor resistance

Setting

RR approximately equals the percentage motor slip at full load.

With encoderless operation this parameter is not critical unless high accuracy is needed in the speed control.

A good estimate for RR is:

RR = 80 x [(1 - (poles x RPM)/(120 x FREQ)]*

where poles is the number of motor poles.

Typical values are 2 - 3% @ 75kW, 1.3 - 2% @ 150kW, 0.8 - 1.6% @ 300kW, .45 - .9% @ 450kW, .3 - .7% @ 630kW; higher values apply to multipole and lower efficiency machines

Effect on Performance

For open loop vector control or V/Hz control the rotor resistance primarily corrects for slip in the induction motor. If it is set too low then the shaft speed will be lower than the set-point under load. If it is set too high then the opposite will occur. Excessively high rotor resistance settings may cause surging at low speeds with light loads.

Usually it is best to err on the low side, as RR doesn’t affect torque significantly.

RR and IMAG define the fluxing and defluxing time period for the motor. Small RR values will force the inverter to delay a long time (several seconds) before the transistors can be re-enabled after a trip, low voltage detection or coast stop command.

Provides slip compensation in V/Hz mode.

RR has little effect on spin start.

With the closed loop vector control mode RR must be set correctly to ensure correct operation. The auto-calculated value is normally sufficiently accurate for most applications.

Parameter IMAG: Magnetising Current.

Setting

IMAG typically equals (approximately) the percentage no load current of the motor.

Typical values are:

- for 2 - 6 pole machines:

35 - 55% @ 75/150kW, 30 - 50% @ 150/300kW, 25 - 45% @ 450/630kW;

- for 6 - 10 pole machines:

50 - 75% @ 75/150kW, 45 - 65% @ 150/300kW, 45 - 65% @ 450/630kW;

- higher values typically apply to multipole and low efficiency machines

IMAG has greatest influence at low speed and is important to achieve correct operation at low speeds.

IMAG can be estimated as the no load current as a percentage of nameplate current, or, more accurately as

IMAG = 100 x Inl x 1.732 x VOLTS / POWER *

where Inl = rms no-load current in amps

No-load current can be read directly from the LCD display if the motor is run above 20% speed with less than 10% load.

IMAG can also be approximated from the nameplate data using: IMAG =100 x [(1/PF2 - 1)0.5] - LKG

where: PF = full load power factor of the motor

and LKG = the % leakage as given below.

Effect on Performance

The magnetising current parameter defines the magnetic field current in the motor at low speeds and defines the main (magnetising) inductance of the motor. If set too high the motor will operate at higher current than necessary and may surge at low speed with light load.

If it is set too low the motor may not support high torque load at low speed and may not start reliably.

Sets magnetising current in V/Hz mode, so must be set to a sensible value in this mode.

Parameter LKG: Leakage inductance.

Setting

This parameter is typically 10% to 20% in most standard motors and generally does not need adjustment from the default.

LKG = 628 x FREQ x L x POWER / VOLTS2 *

where L = total leakage inductance in henrys.

It can be approximated from:

LKG= 100 x AMPS / DOL_AMPS

where DOL_AMPS is the rms starting current for the motor.

Effect on Performance

Under normal operating conditions the leakage inductance parameter has little observable influence so can be left at the default setting.

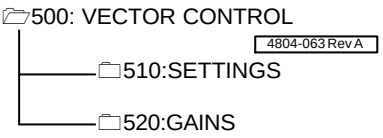
The leakage inductance parameter has a small effect on the dynamic performance of the vector control and the peak torque capability of the system.

If it is set to an excessively high level it may cause current trip at very high load and high speed.

Extreme settings may destabilise the control.

* POWER(Watts), VOLTS, AMPS, FREQ, RPM are the nameplate ratings of the motor.

500:VECTOR CONTROL



DESCRIPTION: Modules which relate to the vector controller are listed in this grouping but do not normally require user adjustment.

510:SETTINGS

DESCRIPTION: Vectorque allows some special adjustments to enhance performance.

In particular the operation at low speeds with constant torque loads can be enhanced using the Boost mode. This mode improves the smoothness of shaft rotation and permits full load to be supported with slow speed reversals.

510:BSTMDE =

Description	Required to support constant torque loads around zero speed. The current boost parameter (510:IBOOST) must be set to a high enough level to support the load.
Default	OFF
Range/Type	off, on
User Lock	✓
Config Lock	×
Master Reset	✓

510:IBOOST=

Description	Sets current (% of motor rated) through zero speed region. Set to the minimum safe required level to support the constant load near 0 speed. Excessive levels will needlessly heat the motor during near zero speed operation. Insufficient levels will not support the load torque.
Default	0%
Range/Type	0 to +250%
User Lock	✓
Config Lock	×
Master Reset	✓

510:J COMP=

Description	Motor inertia compensation, used to compensate for acceleration torque in boost mode (BSTMDE=ON). Equal to the estimated time it takes to accelerate the motor and load to rated speed with rated torque.
Default	0.0s
Range/Type	0 to 100 seconds
User Lock	✓
Config Lock	×
Master Reset	✓

510:FWK PT=

Description	Field weakening point. The motor excitation (magnetic field) is adjusted to keep the terminal voltage below this level in steady state operation. This point represents the transition to constant power. If insufficient dc bus voltage is available, field weakening will occur earlier ie. will override this setting.
Default	120%
Range/Type	80 to 150%
User Lock	✓
Config Lock	×
Master Reset	✓

510:ADAPT =

Description	Enables parameter adaption in closed loop vector control. When set to ON errors or changes in some motor parameters will be compensated for. When used in conjunction with 420:RR ADJ thermal variation in rotor resistance may be very accurately corrected. To work effectively the RS parameter should be accurately set.
Default	ON
Range/Type	off,on
User Lock	✓
Config Lock	×
Master Reset	✓

520:GAINS

DESCRIPTION: Not usually adjusted - consult the factory before adjusting any of these.

The Vector control system comprises several control loops to ensure high performance control. The default values have been selected to meet most normal conditions and standard motors. In general these do not need adjustment. However two loops may be adjusted to modify performance or improve control or to suit non-standard motors. These are the current control loop and the speed control loop. Vectorque has an inner control loop to control the current (torque) and an outer control loop to control the speed. Refer to Section 4.2, for a guide to adjusting key vector control gains.

520:WLPKP =

Description	Speed loop proportional gain.
Default	16000
Range/Type	0 to 32767
User Lock	✓
Config Lock	×
Master Reset	✓

520:WLPKI =

Description	Speed loop integral gain.
Default	20
Range/Type	20 to 32767
User Lock	✓
Config Lock	×
Master Reset	✓

520:WLPKD =

Description	Speed loop derivative gain.
Default	0
Range/Type	0 to 32767
User Lock	✓
Config Lock	×
Master Reset	✓

520:PHLPKP=

Description Flux loop proportional gain.*
Default 10000
Range/Type 0 to 32767
User Lock ✓
Config Lock ×
Master Reset ✓

520:PHLPKI=

Description Flux loop integral gain.*
Default 400
Range/Type 20 to 32767
User Lock ✓
Config Lock ×
Master Reset ✓

520:FRLPKP=

Description Frame loop proportional gain.*
Default 3000
Range/Type 0 to 32767
User Lock ✓
Config Lock ×
Master Reset ✓

520:FRLPKI=

Description Frame loop integral gain.*
Default 800
Range/Type 20 to 32767
User Lock ✓
Config Lock ×
Master Reset ✓

520:ILPKP =

Description Current loop proportional gain.
Default 2000
Range/Type 0 to 32767
User Lock ✓
Config Lock ×
Master Reset ✓

520:ILPKI =

Description Current loop integral gain.
Default 400
Range/Type 20 to 32767
User Lock ✓
Config Lock ×
Master Reset ✓
*Factory set - do not adjust.

4.2 SETUP GUIDE FOR VECTOR CONTROL GAINS

Parameter WLPKP: Speed loop proportional gain.

Setting Not usually adjusted - consult the factory.

Adjust to improve disturbance response or if speed control is unstable or poorly damped.

Reduce for low inertia load.

Increase for high inertia poorly damped load.

Effect on performance

If too high the motor will run roughly and be unstable.

If too low the motor will have a slow response and may have excessive overshoot on high inertia loads. This may cause bus overvoltage or overspeed trip as the control recovers from overshoot.

Parameter WLPKI: Speed loop integral gain.

Setting Not usually adjusted - consult the factory.

Adjust to improve disturbance response or if speed control is unstable or poorly damped or exhibits excessive overshoot in speed response.

Decrease for high inertia poorly damped load.

Increase to improve disturbance rejection with low inertia loads.

Effect on performance

If too high the motor speed will have excessive overshoot and may become oscillatory. This may cause bus overvoltage or overspeed trip as the control recovers from overshoot.

If too low the motor will have a slow response and poor disturbance rejection on low inertia loads.

Parameter ILPKP: Current loop proportional gain.

Setting Not usually adjusted - consult the factory.

Adjust to improve the current and torque step response or if current control is unstable.

Generally this is only adjusted when non-standard motors or motors with low leakage inductance are used.

Effect on performance

If too high the current will be unstable as evidenced by noisy operation and possibly current trips.

If too low the current response and torque response will be slow and the speed loop will need low gains.

Low gain will inhibit spin start speed capture at high speed. Increasing the gain will assist spin starting if a problem exists. Note: RS parameter has the dominant effect on spin start operation.

Parameter ILPKI: Current loop integral gain.

Setting Not usually adjusted - consult the factory.

Adjust to improve the current and torque step response or if current control is unstable.

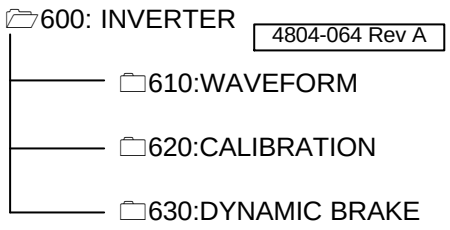
Generally this parameter is not adjusted.

Effect on performance

If too high the current will exhibit step response overshoot and poor damping.

If set too low the step response will be slow.

600:INVERTER



DESCRIPTION: This module group contains modules which affect the Microdrive V Series hardware.

610:WAVEFORM

DESCRIPTION: Inverter waveform module.

610:SWFREQ=

Description	Selects PWM switching frequency. NOTE: After changing this parameter the Microdrive V Series must be powered off then on again - the switching frequency is changed by this parameter at power-up only. Only low frequency selection is available with the 690V Microdrive V.
Default	LOW
Range/Type	low, high
User Lock	✓
Config Lock	×
Master Reset	✓

620:CALIBRATION

DESCRIPTION: This is the Inverter calibration module which contains factory set parameters for the inverter hardware. Adjustment is factory locked by the 010:FCTRY parameter and user adjustment is not permitted.

620:CTSCLE=

Description	Calibrates CTs to Microdrive V rating.
Default	N/A
Range/Type	0 to 65535
User Lock	×
Config Lock	×
Master Reset	×

620:RATING=

Description	Calibrates Inverter to correct current rating.
Default	N/A
Range/Type	0 to 2000A
User Lock	×
Config Lock	×
Master Reset	×

620:IVOLTs=

Description	Calibrates Inverter to correct voltage rating.
Default	N/A
Range/Type	440V, 690V
User Lock	×
Config Lock	×
Master Reset	×

620:TSTMDE=

Description	Test modes for factory use.
Default	N/A
Range/Type	Off, low bus, 50V
User Lock	×
Config Lock	×
Master Reset	×

620:VER =

Description	Software version number.
Default	N/A
Range/Type	READ ONLY
User Lock	×
Config Lock	×
Master Reset	×

630:DYNAMIC BRAKE

DESCRIPTION: Details of the brake resistor used for dynamic braking must be entered here for the Microdrive V Series to provide thermal modelling protection for the resistor.

630:DBDUTY=

Description	Rated duty cycle of the dynamic brake resistor.
Default	10%
Range/Type	10 to 100%
User Lock	✓
Config Lock	×
Master Reset	✓

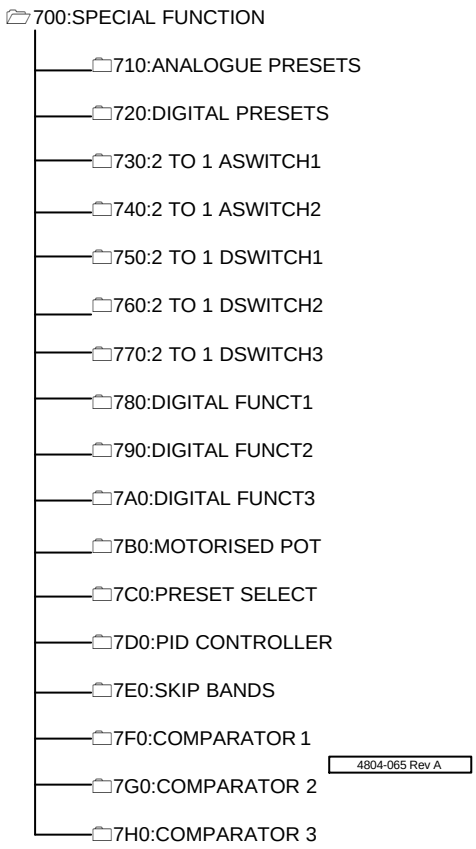
630:TIME =

Description	Time constant of the dynamic brake resistor.
Default	10s
Range/Type	1 to 500 seconds
User Lock	✓
Config Lock	×
Master Reset	✓

630:ENABLE=

Description	Enables operation of the dynamic brake. When enabled no regenerative torque limit is applied. When disabled the Microdrive V automatically reduces regenerating torque to prevent excessive bus voltage.
Default	OFF
Range/Type	off, on
User Lock	✓
Config Lock	×
Master Reset	✓

700:SPECIAL FUNCTION



DESCRIPTION: This module group contains modules which can be used to provide additional control over the Microdrive V Series.

710:ANALOGUE PRESETS

DESCRIPTION: Analogue source ports with user specified fixed values. Preset sources are useful when fixed reference levels are required.

710:VALUE1=

Description	Analogue Preset 1 Value
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

710:VALUE2=

Description	Analogue Preset 2 Value
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

710:VALUE3=

Description	Analogue Preset 3 Value
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

710:VALUE1->

Description	Source port: Analogue Preset 1
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

710:VALUE2->

Description	Source port: Analogue Preset 2
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

710:VALUE3->

Description	Source port: Analogue Preset 3
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

720:DIGITAL PRESETS

DESCRIPTION: Digital source ports with user specified fixed values. Preset sources are useful when fixed reference levels are required.

720:VALUE0=

Description	Digital Preset 0 Value (Permanently TRUE)
Default	TRUE
Range/Type	true
User Lock	N/A
Config Lock	N/A
Master Reset	N/A

720:VALUE1=

Description	Digital Preset 1 Value
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

720:VALUE2=

Description	Digital Preset 2 Value
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

720:VALUE3=

Description	Digital Preset 3 Value
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

720:VALUE0->

Description	Source port: Digital Preset 0
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

720:VALUE1->

Description	Source port: Digital Preset 1
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

720:VALUE2->

Description	Source port: Digital Preset 2
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

720:VALUE3->

Description	Source port: Digital Preset 3
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

730:2 TO 1 ASWITCH1

DESCRIPTION: This module is an analogue switch controlled by a digital connection (ie. an analogue multiplexer). It can be used to switch the source for the speed reference, for example, from one analogue source (such as the fieldbus) to another (such as 4-20mA analogue input).

730:IN0 <-

Description	Destination port: connects to Output if Select = FALSE.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

730:IN1 <-

Description	Destination port: connects to Output if Select = TRUE.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

730:SELECT<-

Description	Destination port: selects between IN0 and IN1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

730:OUTPUT->

Description	Source port: outputs either IN0 or IN1.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

740:2 TO 1 ASWITCH2

Same as 730:2 TO 1 ASWITCH1.

750:2 TO 1 DSWITCH1

DESCRIPTION: This module is a digital switch controlled by a digital connection (ie. a digital multiplexer). It can be used to switch the source from one digital source to another.

750:IN0 <-

Description	Destination port: connects to Output if Select = FALSE.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

750:IN1 <-

Description	Destination port: connects to Output if Select = TRUE.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

750:SELECT<-

Description	Destination port: selects between IN0 and IN1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

750:OUTPUT->

Description	Source port: outputs either IN0 or IN1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

760:2 TO 1 DSWITCH2

Same as 750:2 TO 1 DSWITCH1.

770:2 TO 1 DSWITCH3

Same as 750:2 TO 1 DSWITCH1.

780:DIGITAL FUNCT1

DESCRIPTION: This module is a digital function block and allows AND, OR or XOR logic operations to be performed. The two inputs and one output are independently invertible.

780:OP =

Description	Function Operation to be performed on the inputs IN0 & IN1.
Default	AND
Range/Type	and, or, xor
User Lock	✓
Config Lock	×
Master Reset	✓

780:INVIN0=

Description	Invert switch for input IN0.
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

780:INVIN1=

Description	Invert switch for input IN1.
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

780:INVOUT=

Description	Invert switch for the output.
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

780:IN0 <-

Description	Destination port: first input IN0.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

780:IN1 <-

Description	Destination port: second input IN1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

780:OUTPUT->

Description	Source port: the result of the logic operation.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

790:DIGITAL FUNCT2

Same as 780:DIGITAL FUNCT1.

7A0:DIGITAL FUNCT3

Same as 780:DIGITAL FUNCT1.

7B0:MOTORISED POT

DESCRIPTION: The motorised potentiometer module allows increment and decrement inputs to control the value of the module's analogue output. Typically this module would be used to allow the motor speed (for example) to be adjusted up or down with the use of two push-buttons. The output value is retained on power down.

7B0:ENABLE=

Description	Module enable/disable switch. Disable this module if the motorised potentiometer function is not required.
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

7B0:UPLIM =

Description	Upper limit for output.
Default	100.0%
Range/Type	7B0:LWRLIM to 400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7B0:LWRLIM=

Description	Lower limit for output.
Default	0.0%
Range/Type	-400.0 to 7B0:UPLIM
User Lock	✓
Config Lock	×
Master Reset	✓

7B0:TIME =

Description	Time for output to span range from LWRLIM to UPLIM.
Default	60s
Range/Type	1 to 3000s
User Lock	✓
Config Lock	×
Master Reset	✓

7B0:INC <-

Description	Destination port: Increase output level.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7B0:DEC <-

Description	Destination port: Decrease output level.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7B0:OUTPUT->

Description	Source port: the motorised pot output.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7C0:PRESET SELECT

DESCRIPTION: The preset select module outputs one of eight user preset values based on the states of three digital inputs. Typically this module would be used to allow the motor speed (for example) to be selected with the use of three switches.

7C0:VALUE1=

Description	Selectable preset value 1, output if SEL0, SEL1, SEL2=F,F,F
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE2=

Description	Selectable preset value 2, output if SEL0, SEL1, SEL2=F,F,T
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE3=

Description	Selectable preset value 3, output if SEL0, SEL1, SEL2=F,T,F
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE4=

Description	Selectable preset value 4, output if SEL0, SEL1, SEL2=F,T,T
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE5=

Description	Selectable preset value 5, output if SEL0, SEL1, SEL2=T,F,F
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE6=

Description	Selectable preset value 6, output if SEL0, SEL1, SEL2=T,F,T
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE7=

Description	Selectable preset value 7, output if SEL0, SEL1, SEL2=T,T,F
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:VALUE8=

Description	Selectable preset value 8, output if SEL0, SEL1, SEL2=T,T,T
Default	0.0%
Range/Type	-400.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7C0:SEL0 <-

Description	Destination port: Select input 0.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7C0:SEL1 <-

Description	Destination port: Select input 1.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7C0:SEL2 <-

Description	Destination port: Select input 2.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7C0:OUTPUT->

Description	Source port: the preset select output.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:PID CONTROLLER

DESCRIPTION: The PID (proportional, integral, derivative) controller module allows the Microdrive V Series to be used in applications requiring closed loop control. The module also incorporates integrator anti-windup.

7D0:ENABLE=

Description	Module enable/disable switch. Disable this module if no PID control is required.
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:MODE =

Description	Control mode: PI or PID controller. For IP control set KSP (below) to 0.0.
Default	PI
Range/Type	PI, PID
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:KP =

Description	Proportional gain.
Default	1.00
Range/Type	0.00 to 16.00
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:WITS =

Description	Product of the integral frequency (wi) and the sample time (Ts). For an wiTs of 0.1 and a 100% error (i.e. ref - feedback), the integral term will integrate at 10% per sample.
Default	0.001
Range/Type	0.000 to 0.100
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:WDTS =

Description	Product of the derivative frequency (wd) and the sample time (Ts). For an wdTs of 0.1 and a 10% change per sample in the feedback signal, the derivative term will equal 100%.
Default	0.10
Range/Type	0.01 to 0.10
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:UPLIM =

Description	Upper level to limit the output.
Default	400.0%
Range/Type	7D0:LWRLIM to 400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:LWRLIM=

Description	Lower level to limit the output.
Default	-400.0%
Range/Type	-400.0 to 7D0:UPLIM
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:KSP =

Description	Set-point weighting. Set to 1.0 for PI control, or 0.0 for IP.
Default	1.0
Range/Type	0.0 to 1.0
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:TS =

Description	Sample time (Ts) in milliseconds. Increase Ts for slow processes requiring integral control.
Default	10ms
Range/Type	10ms,100ms,1s,10s
User Lock	✓
Config Lock	×
Master Reset	✓

7D0:REF <-

Description	Destination port: input for the reference set-point signal.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:F/B <-

Description	Destination port: input for the feedback signal. The difference between the REF and F/B signals is the control error which is output to the ERROR source port .
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:OFFSET<-

Description	Destination port: input for offsetting the PID controller output. Normally this would be the speed reference signal and the PID controller would trim this value before being passed on to the speed reference input (220:SPDREF).
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:ENABLE<-

Description	Destination port: input for disabling the PID controller output. This has the same effect as setting UPLIM and LWRLIM to zero so the OUTPUT value equals the OFFSET input.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:OUTPUT->

Description	Source port: the PID controller output + offset.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:ERROR ->

Description	Source port: difference between the reference input (REF) and the feedback input (F/B).
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:UPIND ->

Description	Source port: TRUE when the PID OUTPUT is being clamped by the upper limit 7D0:UPLIM.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7D0:LWRIND->

Description	Source port: TRUE when the PID OUTPUT is being clamped by the lower limit 7D0:LWRLIM.
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

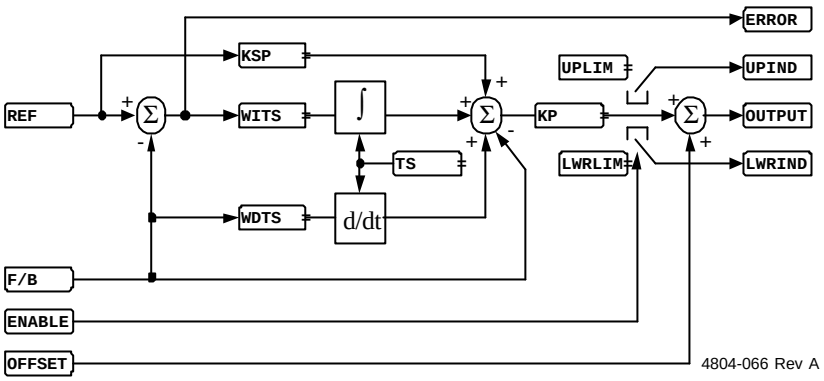


Figure 4.3: PID Controller special function module

7E0:SKIP BANDS

DESCRIPTION: The skip bands module eliminates specified values from a signal. Most commonly this module would be used to prevent a speed reference signal from requesting frequencies that may cause mechanical resonances to occur.

7E0:ENABLE=

Description	Module enable/disable switch. Disable this module if skip bands are not required.
Default	FALSE
Range/Type	false, true
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:VALUE1=

Description	Centre frequency for the first skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:BAND1 =

Description	Bandwidth for the first skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:VALUE2=

Description	Centre frequency for the second skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:BAND2 =

Description	Bandwidth for the second skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:VALUE3=

Description	Centre frequency for the third skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:BAND3 =

Description	Bandwidth for the third skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:VALUE4=

Description	Centre frequency for the fourth skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:BAND4 =

Description	Bandwidth for the fourth skip band.
Default	0.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7E0:INPUT <-

Description	Destination port: Input to the skip bands module.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7E0:OUTPUT->

Description	Source port: OUTPUT of the skip bands module after any INPUT value found to be within any of the four bands has been skipped.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

Skip bands specified in module 7E0 may acquire any positive VALUE (ie. centre frequency) and may have a BAND of any width. As the value of the INPUT increases through a skip band the output is held at the lower bound. Once the INPUT exceeds the upper bound the OUTPUT equals the INPUT value. For an INPUT decreasing through a skip band the OUTPUT is held at the upper bound until the INPUT value decreases to less than the lower bound.

The Microdrive V Series processes these specified bands, detecting overlapping bands, nested bands and bands which cover zero and converts these as appropriate as Figure 4.4 illustrates.

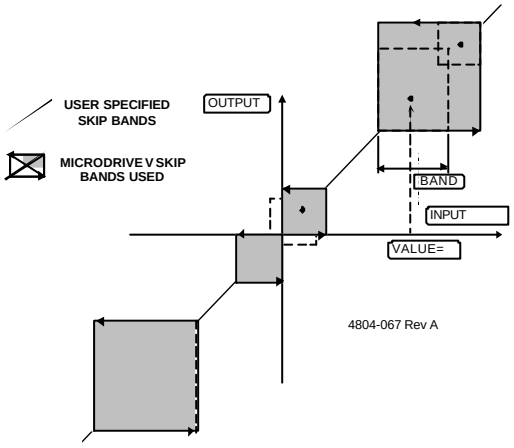


Figure 4.4: Skip bands special function module

7F0:COMPARATOR 1

DESCRIPTION: The comparator module compares two analogue input signals and outputs a digital signal to indicate which of the two is higher in value. A hysteresis band is also provided so that the output will be True when IN0 is greater than IN1 + BAND and False when IN0 is less than IN1 - BAND.

7F0:BAND =

Description	Hysteresis band for the comparator.
Default	5.0%
Range/Type	0.0 to +400.0%
User Lock	✓
Config Lock	×
Master Reset	✓

7F0:IN0 <-

Description	Destination port: first input IN0.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7F0:IN1 <-

Description	Destination port: first input IN1.
Default	NC
Range/Type	analogue
User Lock	✓
Config Lock	✓
Master Reset	✓

7F0:OUTPUT->

Description	Source port: True if IN0 > IN1 + BAND False if IN1 < IN0 - BAND
Default	NC
Range/Type	digital
User Lock	✓
Config Lock	✓
Master Reset	✓

7G0:COMPARATOR 2

Same as 7F0:COMPARATOR 1.

7H0:COMPARATOR 3

Same as 7F0:COMPARATOR 1.

5. INDEX OF CONFIGURATION MODULE PORTS

5.1 DESTINATION PORT INDEX

DESTINATION PORT	TYPE
030:LCD DISPLAY	
030:USER A<-	analogue/digital
030:USER B<-	analogue/digital
130:ANALOGUE OUTPUT 1	
130:ANAOP1<-	analogue
140:ANALOGUE OUTPUT 2	
140:ANAOP2<-	analogue
160:DIGITAL OUTPUTS	
160:DIGOP1<-	digital
160:DIGOP2<-	digital
160:RELOP1<-	digital
160:RELOP2<-	digital
160:RELOP3<-	digital
1A0:FBUS ANLG OUTPUT	
1A0:FBAOP1<-	analogue
1A0:FBAOP2<-	analogue
1A0:FBAOP3<-	analogue
1A0:FBAOP4<-	analogue
1A0:FBAOP5<-	analogue
1A0:FBAOP6<-	analogue
1B0:FBUS DGTL OUTPUT	
1B0:FBDOP1<-	digital
1B0:FBDOP2<-	digital
1B0:FBDOP3<-	digital
1B0:FBDOP4<-	digital
1B0:FBDOP5<-	digital
1B0:FBDOP6<-	digital
210:SEQUENCING	
210:START <-	digital
210:ENABLE<-	digital
210:RESET <-	digital
210:E-ENBL<-	digital
210:EXTRIP<-	digital
220:CONDITIONING	
220:SPDREF<-	analogue
220:TRQREF<-	analogue
220:TRQMDE<-	digital
220:SPDINV<-	digital
220:TRQINV<-	digital
220:RAMP2 <-	digital
730:2 TO 1 ASWITCH1	
730:IN0 <-	analogue
730:IN1 <-	analogue
730:SELECT<-	digital
740:2 TO 1 ASWITCH2	
740:IN0 <-	analogue
740:IN1 <-	analogue
740:SELECT<-	digital
750:2 TO 1 DSWITCH1	
750:IN0 <-	digital
750:IN1 <-	digital
750:SELECT<-	digital
760:2 TO 1 DSWITCH2	
760:IN0 <-	digital
760:IN1 <-	digital
760:SELECT<-	digital
770:2 TO 1 DSWITCH3	
770:IN0 <-	digital
770:IN1 <-	digital
770:SELECT<-	digital
780:DIGITAL FUNCT1	
780:IN0 <-	digital
780:IN1 <-	digital
790:DIGITAL FUNCT2	
790:IN0 <-	digital
790:IN1 <-	digital
7A0:DIGITAL FUNCT3	
7A0:IN0 <-	digital
7A0:IN1 <-	digital
7B0:MOTORISED POT	
7B0:INC <-	digital
7B0:DEC <-	digital
7C0:PRESET SELECT	
7C0:SEL0 <-	digital
7C0:SEL1 <-	digital
7C0:SEL2 <-	digital

7D0:PID CONTROLLER

7D0:REF <-	analogue
7D0:F/B <-	analogue
7D0:OFFSET<-	analogue
7D0:ENABLE<-	digital

7E0:SKIP BANDS

7E0:INPUT <-	analogue

7F0:COMPARATOR 1

7F0:IN0 <-	analogue
7F0:IN1 <-	analogue

7G0:COMPARATOR 2

7G0:IN0 <-	analogue
7G0:IN1 <-	analogue

7H0:COMPARATOR 3

7H0:IN0 <-	analogue
7H0:IN1 <-	analogue

5.2 SOURCE PORT INDEX

SOURCE PORT	TYPE

110:ANALOGUE INPUT 1

110:ANAIP1->	analogue

120:ANALOGUE INPUT 2

120:ANAIP2->	analogue

150:DIGITAL INPUTS

150:DIGIP1->	digital
150:DIGIP2->	digital
150:DIGIP3->	digital
150:DIGIP4->	digital
150:DIGIP5->	digital
150:DIGIP6->	digital

170:FIELD BUS SETUP

170:FBLOSS->	digital

180:FBUS ANLG INPUT

180:FBAIP1->	analogue
180:FBAIP2->	analogue
180:FBAIP3->	analogue
180:FBAIP4->	analogue
180:FBAIP5->	analogue
180:FBAIP6->	analogue

190:FBUS DGTL INPUT

190:FBDIP1->	digital
190:FBDIP2->	digital
190:FBDIP3->	digital
190:FBDIP4->	digital
190:FBDIP5->	digital
190:FBDIP6->	digital

1C0:SERIAL COMMS

1C0:SCAIP1->	analogue
1C0:SCAIP2->	analogue
1C0:SCAIP3->	analogue
1C0:SCDIP1->	digital
1C0:SCDIP2->	digital
1C0:SCDIP3->	digital

210:SEQUENCING

210:START ->	digital
210:RUN ->	digital

220:CONDITIONING

220:AT SPD->	digital
220:CURLIM->	digital
220:TRQLIM->	digital

230:MONITORING

230:FREQ ->	analogue
230:SPEED ->	analogue
230:VOLTS ->	analogue
230:TORQUE->	analogue
230:MTRCUR->	analogue
230:POWER ->	analogue
230:/FAULT->	digital
230:INV OL->	digital

420:MOTOR THERMAL

420:MTR OL->	digital
420:MTRTMP->	analogue

710:ANALOGUE PRESETS

710:VALUE1->	analogue
710:VALUE2->	analogue
710:VALUE3->	analogue

720:DIGITAL PRESETS

720:VALUE0->	digital
720:VALUE1->	digital
720:VALUE2->	digital
720:VALUE3->	digital

730:2 TO 1 ASWITCH1

730:OUTPUT->	analogue

740:2 TO 1 ASWITCH2

740:OUTPUT->	analogue

750:2 TO 1 DSWITCH1

750:OUTPUT->	digital

760:2 TO 1 DSWITCH2

760:OUTPUT-> digital

770:2 TO 1 DSWITCH3

770:OUTPUT-> digital

780:DIGITAL FUNCT1

780:OUTPUT-> digital

790:DIGITAL FUNCT2

790:OUTPUT-> digital

7A0:DIGITAL FUNCT3

7A0:OUTPUT-> digital

7B0:MOTORISED POT

7B0:OUTPUT-> analogue

7C0:PRESET SELECT

7C0:OUTPUT-> analogue

7D0:PID CONTROLLER

7D0:OUTPUT-> analogue

7D0:ERROR -> analogue

7D0:UPIND -> digital

7D0:LWRIND-> digital

7E0:SKIP BANDS

7E0:OUTPUT-> analogue

7F0:COMPARATOR 1

7F0:OUTPUT-> digital

7G0:COMPARATOR 2

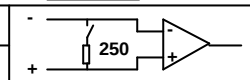
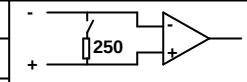
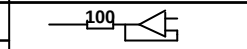
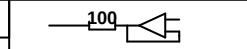
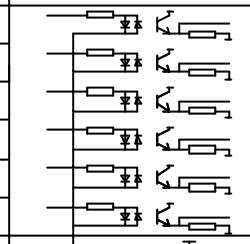
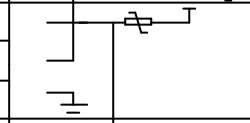
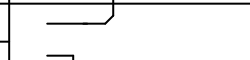
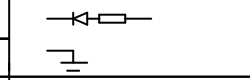
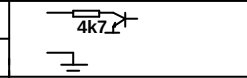
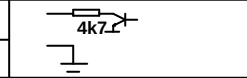
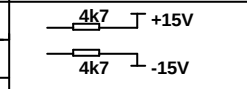
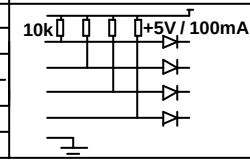
7G0:OUTPUT-> digital

7H0:COMPARATOR 3

7H0:OUTPUT-> digital

6. FORMS

6.1 INTERFACE CONFIGURATION RECORD

	Schematic	Title	Specifications
1		110 : Analogue Input 1	+/- 10 Volts; 4-20mA; Zin = 250R tolerance = +/- 2%
2			
3		0 Volts	
4		120 : Analogue Input 2	
5			
6		0 Volts	
7		130 : Analogue Output 1	+/- 10 Volts; 4-20mA; Zout = 100R Max. Vout = 12Volts tolerance = +/- 2% 25mA max. load
8		0 Volts	
9		140 : Analogue Output 2	
10		0 Volts	
11		150:Digital Input 1	12Vdc / 24Vdc Nominal threshold is 6V
12		150:Digital Input 2	
13		150:Digital Input 3	
14		150:Digital Input 4	
15		150:Digital Input 5	
16		150:Digital Input 6	
17		+24 Volt / 100mA	Link terminals 18-19 for active high. Link terminals 17-18 for active low.
18		Common	
19		0 Volts	
20		+24 Volt / 100mA	24V +/-4V 100mA max. Short circuit protected.
21		0 Volts	
22		PTC I/P	Suits standard PTC's or thermostats.
23		0 Volts	
24		150 : Digital Output 1	24 V; 1mA
25		0 Volts	
26		160 : Digital Output 2	
27		0 Volts	
28		+ Pot. Supply	
29		- Pot. Supply	
30		0 Volts	
31		Encoder Supply	
32		Encoder A+	
33		Encoder A-	
34		Encoder B+	
35		Encoder B-	
36		0 Volts	

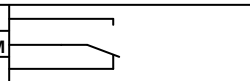
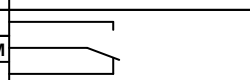
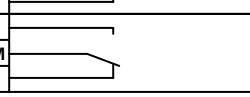
N.O.		160 : Relay Output 1	230 Vac; 1A 24 Vdc; 1A
COM			
N.C.			
N.O.		160 : Relay Output 2	
COM			
N.C.			
N.O.		160 : Relay Output 3	
COM			
N.C.			4804-008

Figure 6.1: 36 Terminal Control Board. Refer to Figure 2.6 for the default interface configuration and Figure 1.5 for the interface specifications and the physical layout of the terminals.

6.2 COMMISSIONING SCHEDULE

Customer: _____ Date/time: _____

Site: _____ Engineer: _____

Drive Size: _____ Drive Serial No: _____

Application: _____

Notes: _____

No.	Test	OK	Comments
	PRE-POWER		
1	visual checks	___	_____
1.1	no swarf/wire strands	___	_____
1.2	no physical damage	___	_____
1.3	clearances	___	_____
1.4	no conducting debris	___	_____
1.5	no insulation damage	___	_____
1.6	no interference	___	_____
1.7	pcb connections	___	_____
1.8	wires out of place	___	_____
1.9	no heat sink air path blockage	___	_____
1.10	good ventilation	___	_____
2	**POWER CONNECTIONS**		
2.1	L1, L2, L3 continuity input	___	_____
2.2	U, V, W continuity output	___	_____
2.3	tight connections	___	_____
2.4	washers used	___	_____
2.5	correct glanding	___	_____
2.6	filter opt. U,V,W in/out	___	_____
2.7	no short input to input	___	_____
2.8	no short input to gnd	___	_____
2.9	no short opt to gnd	___	_____
2.10	motor continuity	___	_____
2.11	Main fan 230Vac supply	___	_____
3	**EARTH CONTINUITY**		
3.1	earth to motor	___	_____
3.2	earth to supply	___	_____
3.3	earth to cable shield at drive	___	_____
3.4	cable shield to motor frame	___	_____
3.5	earth to filter if fitted	___	_____
3.6	earth to cabinet	___	_____

4 INITIAL POWER UP

4.1	check L1, L2, L3 voltages	___	_____
4.2	main fans blow bulk air at top rear of each module	___	_____
4.3	power tray fans exhaust at front	___	_____
4.4	EDM filter fans (if used)	___	_____
4.5	free bulk air path	___	_____

5 INITIAL SET UP

5.1	enter motor details	___	_____
5.2	set local speed to zero (020:KBFREQ= 0.0%)	___	_____
5.3	ensure mode = speed (020:LOCMDE=SPEED)	___	_____
5.4	select Open Loop (240:CNTRL =OPNLP VEC)	___	_____

6 INITIAL RUN (NO-LOAD IF POSSIBLE)

6.1	check motor free to rotate / no people near	___	_____
6.2	start and check that Microdrive V and motor run normally	___	_____
6.3	increase speed and check direction	___	_____
6.4	run at 5% 10% 25% 50% 100% (over if required)	___	_____
6.5	check output current (LCD display) also waveform, level & balance.	___	_____
6.6	check input current waveform level & balance	___	_____
6.7	check motor noise	___	_____
6.8	check motor vibration	___	_____
6.9	check motor voltage	___	_____
6.10	check motor stability	___	_____

7 AT LOAD

7.1	check input current waveform level & balance	___	_____
7.2	check output current waveform level & balance (LCD display)	___	_____
7.3	check EDM filter dc feedback currents (if used)	___	_____
7.4	run at full load > 10mins	___	_____
7.5	check temperature (if possible) of connections	___	_____
7.6	check hot start	___	_____

8 USER SETUP

8.1	set up user connections and functions as desired	___	_____
8.2	check digital inputs (in local)	___	_____
8.3	check digital outputs	___	_____
8.4	check analogue output scaling	___	_____
8.5	check analogue input scaling	___	_____
8.6	set Microdrive V in remote and check correct functioning	___	_____
8.7	set up LCD display line	___	_____
8.8	clear any logged faults	___	_____
8.9	set configuration locks	___	_____
8.10	record configuration in manual	___	_____
8.11	test user setup	___	_____

7. MICRODRIVE V SERIES RECOMMENDED SPARES

Personality Modules

The Microdrive V Series uses a Personality Module to store all user entered drive set up parameters as well as factory set model dependent calibration information. Each Microdrive V model has a different Personality Module, but personality modules of drives of the same model are identical until customer specific set up information is entered.

The Personality Module is located at the upper left hand side of the Control Board. Usually the Personality Module will be kept when a control board must be changed - in this way user set up is retained.

Spare control cards are supplied without a Personality Module fitted and can be applied to any size of drive.

Personality Modules are available as spare parts as follows:

Qty	Item No	Description
1	V022-604	Parameter Module - MV170C20
1	V023-604	Parameter Module - MV250C20
1	V024-604	Parameter Module - MV300C20
1	V025-604	Parameter Module - MV450C20
1	V026-604	Parameter Module - MV600C20
1	V027-604	Parameter Module - MV750C20
1	V028-604	Parameter Module - MV900C20

Spares - Microdrive V Series Models - MV170C20-MV900C20

Qty	Item No	Description
Ancillary Parts		
1	V000-621	Microdrive V Series Blanking Plate
1	V000-622	Microdrive V Series Panel Mount Display Surround Kit
Basic Maintenance Kit		
1	2941-001	160mm 230Vac main fan
1	2941-012	120mm 24Vdc fan
3	2451-002	315A 660V DIN semiconductor fuse (per module)
5	2401-029	1A 20x5mm 250Vac glass fuse
5	2401-033	2A 20x5mm 250Vac glass fuse
5	2401-060	6A 20x5mm 250Vac glass fuse
5	2404-020	2A 32x6.3mm 440Vac ceramic fast fuse
5	2404-100	10A 32x6.3mm 440Vac ceramic fast fuse
Basic Electronic Service Kit (plus above items)		
1	V000-610S	Control Electronics Spare
1	V000-611S	Power Electronics - Suits MV170C20 and above
1	V000-620S	Display Module Spare

8. MICRODRIVE V SERIES FAN ON/OFF CONTROL

Suggested wiring for applications in which it is desirable to disable the main fans when the Microdrive V Series is not running.

9. AUXILIARY POWER SUPPLY FOR CONTROL ELECTRONICS

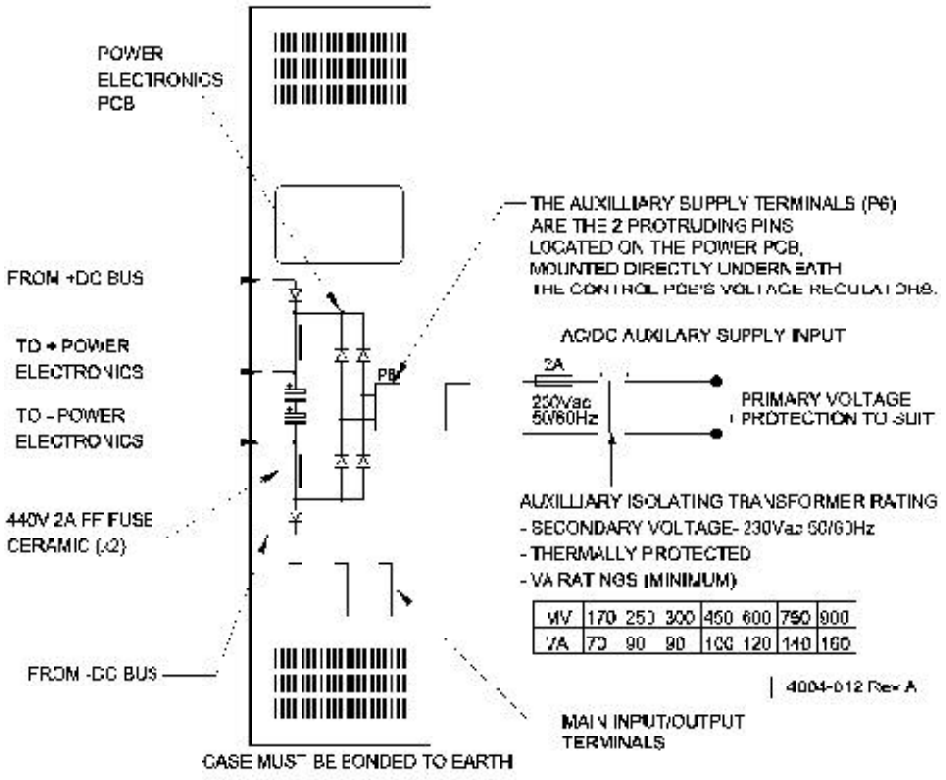
The Microdrive V Series control electronics may be powered separately to the main three-phase electronics.

In this case the display and control I/O will remain active in the absence of the main supply. Mains low voltage detection trip must be disabled set (240:LVTRIP=OFF) to avoid a corresponding trip condition (this is the default setting).

When powered from an auxiliary supply the Microdrive V will accept a start command but will enter a “wait” state. This is indicated by the flashing RUN LED on the display module. The Microdrive V will remain in this state until normal supply voltage is detected or will stop if a disable input is detected.

Sometimes an auxiliary supply may be implemented to permit automatic control of an input isolating contactor. In this case the Microdrive V Series start and run digital outputs should be OR’d together to provide a control signal for the input isolating contactor.

Note: Various other auxilliary supply possibilities exist, (230-440VAC, 350-660VDC) contact supplier.



W	170	250	300	450	600	750	900
VA	70	90	90	100	120	140	160

10. BEARING FILTERS - PROTECTING MOTOR BEARINGS

Common mode voltages present in the output waveforms of all PWM AC Motor Controllers pose some risk to motor bearings from unintentional flow of electrical current through the bearings (resulting in electrical discharge machining (EDM) of the bearings). Not all motors or installations are affected and it is not always possible to predict susceptibility, but risks do increase with larger size motors. Though three different mechanisms can be responsible, all risks can be minimised by appropriate methods, or the use of special common mode (bearing) filters.

Please consult PDL Electronics for futher information.

11. MAINS HARMONIC REDUCTION

11.1 12 PULSE MICRODRIVE V SERIES OPTION

PDL Electronics Ltd offers standard 12 pulse versions of its Microdrive V Series for harmonic sensitive applications. As the 12 pulse conversion requires adaption of the Microdrive V and supply of a special transformer, it is necessary to specify this option at the time of order.

Figure 11.1 shows the levels of harmonic current and the levels that they are typically reduced to when using the 12 pulse system (rated loads and normal system impedances are assumed).

Harmonic	6 pulse (typical Microdrive V)	MV300C20 (full 12 pulse)	MV450C20 (partial 12 pulse)	MV600C20 (full 12 pulse)	MV750C20 (partial 12 pulse)	MV900C20 (full 12 pulse)
5th	32%	0%	10.7%	0%	6.2%	0%
7th	10%	0%	3.0%	0%	1.8%	0%
11th	6.1%	5.2%	5.3%	5.2%	5.2%	5.2%
13th	3.4%	3.0%	3.0%	3.0%	2.9%	3.0%
17th	2.4%	0%	1.1%	0%	0.6%	0%
19th	1.9%	0%	0.8%	0%	0.5%	0%
23rd	1.1%	1.4%	1.2%	1.2%	1.2%	1.2%
25th	1.1%	1.1%	1.0%	1.1%	1.1%	1.0%
total THDi*	34%	6%	13%	6%	9%	6%
total THDv**	5.1%	2.0%	2.5%	2.0%	2.2%	2.0%

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Figure 11.1: Harmonic Current Levels in Microdrive V Series 12 Pulse Systems

* impedance balance imperfections between shifted and unshifted portions of the load will increase values recorded as zero (theoretical value), but will typically increase measured THDi by no more than 1%

** estimated for supply capacity twice motor kVA rating, and 5% impedance - this figure may vary markedly according to actual supply impedances

11.2 12 PULSE CONVERSION AND INSTALLATION

12 pulse conversion of the Microdrive V Series involves special adaptation of the Microdrive V Series rectifier assembly which is carried out during manufacture. The rectifiers, usually all operating in parallel, are split into two sections. One section is fed via the Microdrive V Series normal (internal) line reactors, the other via a separate phase shifting transformer. The transformer itself is simply fed from the same supply as the directly fed Microdrive V Series input. In this way, only normal three phase, three wire power and protection is required to be supplied by the user.

The transformer is sized appropriately to the number of Microdrive V Series modules it is driving. Transformer short circuit protection is provided by supply protection, while overload protection is achieved through the use of thermal switches embedded in each phase winding. The switches are normally closed and should be connected into the system protection (eg use the Microdrive V Series motor PTC input, allocate a separate stop digital input, or connect the sensors into a supervisory PLC system).

All six Microdrive V Series supply inputs and transformer connections are insensitive to phase orientation. Refer to Figure 11.3 for further installation details.

Typical transformer details are provided in Figure 11.2. Transformers are unenclosed and intended for switchboard installation. They are rated for class H temperature rise with convection cooling to 50 øC maximum ambient. Ensure cooling of the switchboard is adequate for the rated transformer dissipation.

No. Modules to be phase shifted	LxBxH	Weight	Loss
1	660x500x650	460kg	3000W
2	800x600x850	840kg	6000W
3			9000W

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Figure 11.2: Microdrive V Series Phase Shift Transformer Details

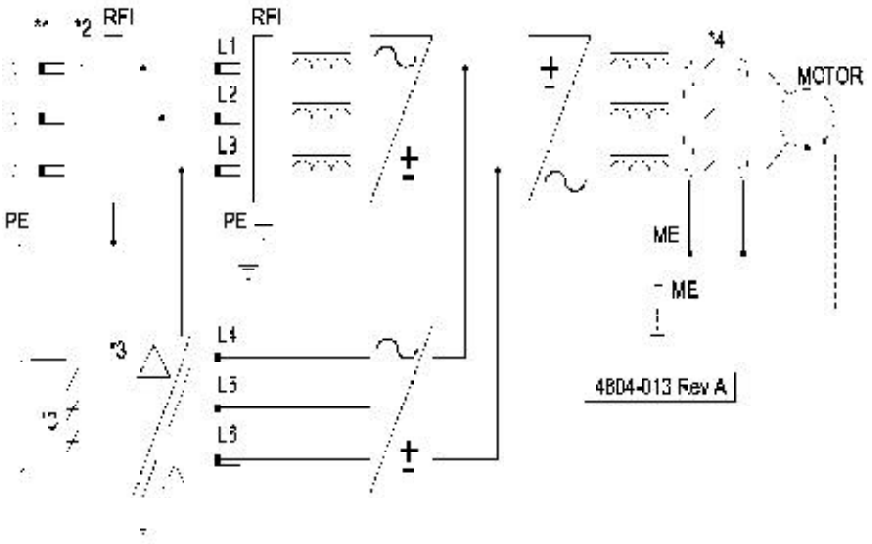

Figure 11.3: 12 Pulse Power Connection Details

Notes:

1 - Supply:

* All local Electrical Safety Regulations must be obeyed.
* External isolation and supply protection as required
* Power Factor correction is not required. The Microdrive V Series provides cos› > 0.95.

2 - Supply Cabling:

* No special requirements are placed on input cables
* Microdrive V Series chassis must be solidly bonded to electrical earth (using one PE terminal only) before energising the drive (high levels of earth leakage currents can flow from ac drives)
* Input is not phase sensitive
* A 230Vac main fan supply must be provided for main (rear) bulk air cooling fans

3 - Special Aspects of 12 Pulse Input:

* Transformer input short circuit protection to be supplied by supply protection.
* Transformer orientation is not phase sensitive
* Do not connect transformer neutral
* Transformer connects to Microdrive V Series inputs L4, L5, L6
* Connect transformer thermal switches to stop drive in event of overload
* Where a RFI suppression capacitor board is supplied separately, this should be connected directly at the switchboard mains input using short connecting leads
* The transformer shield and transformer frame should be connected together and directly to switchboard chassis bulk earth (as well as board PE)

4 - Output Cabling:

* Output isolation (if required) should only be operated off load (ie with Microdrive V stopped).
* Symmetrical three-cored screened cables are preferred. The cable screen should be solidly bonded to both motor frame and Microdrive V motor earth (ME) terminal only (not anywhere else).
* If motor and load frames are electrically isolated, but electrically connected via shafts, install an isolated coupling in the shafts or bond motor and load using a wide flat (25mm) conductor such as braid or copper foil using the shortest possible connecting route (don't rely on common earth connections back to switch boards).
* Some regulations may require an earth to be run in addition to using the cable screen. If required this earth should run externally to the screened cable.
* Power factor correction capacitors must not be connected to Microdrive V Series output.
* If facility for electrical bypass of the motor to mains is required, the Microdrive V Series output must be isolated from the motor first (the Microdrive V Series output must never be connected to mains supply).

12. CONFIGURATION MODULES QUICK REFERENCE

The following tables which outline the Microdrive V Series parameters relate to drive software version 7.0 or later.

DRIVE SIZE:_____ **SERIAL NO.:**_____

SOFTWARE REVISION:_____ **COMMISSIONING DATE:**_____

UPDATED:_____ **UPDATED:**_____

12.1 CONFIGURATION MODULES

🗁 **000:MENU CONFIG**

🗁 010:LOCKS	User	Default	Range/Type
010:CONFIG=	_____	LOCK	unlock, lock
010:USER =	_____	UNLOCK	unlock, lock
010:FCTRY =	_____	0.00	0.00 to 655.35

🗁 020:LOCAL CONTROL	User	Default	Range/Type
020:LOCREM=	_____	REMOTE	remote, local
020:LOCMDE=	_____	SPEED	speed, torque
020:KBFREQ=	_____	0.0%	-200.0 to +200.0%
020:KBTORQ=	_____	0.0%	-300.0 to +300.0%
020:KB S/R=	_____	LOC & REM	LOC ONLY, LOC & REM
020:EXTS/R=	_____	REM ONLY	REM ONLY, LOC & REM

🗁 030:LCD DISPLAY	User	Default	Range/Type
030:LINE2 =	_____	CURRENT	*
030:LINE3 =	_____	SPEED	*
030:LINE4 =	_____	REF SPEED	*
030:USER A<-	_____	NC	analogue/digital
030:USER B<-	_____	NC	analogue/digital

🗁 040:MASTER RESET

040:RESET (ENTER)?

Description

The master reset command will re-initialise drive parameters and connections to factory defaults. Parameters NOT affected by the master reset are the Microdrive V calibration constants (620:CALIBRATION), the motor nameplate data (410:MOTOR NAMEPLATE) and the local control data (020:LOCAL CONTROL).

* frequency (output, Hz), current (output, A), speed (% synchronous), ref speed (% synchronous), torque (% motor rated), ref torque (% motor rated), bus volts (VDC), output volts (output, Vrms), power (electrical output, kW) , motor tmp (% motor rated temperature), kWh (kW hours), inv on (Microdrive V on-time, hours), motor run (motor run-time, hours), user A, user B

🗁 **100:INTERFACE**

🗁 110:ANALOGUE INPUT 1	User	Default	Range/Type
110:TYPE =	_____	VOLTAGE	voltage, current
110:LOW =	_____	0%	-400 to +400%
110:HIGH =	_____	100%	-400 to +400%
110:ANAIP1->	_____	220SPDREF	analogue

120:ANALOGUE INPUT 2	User	Default	Range/Type
120:TYPE =		VOLTAGE	voltage, current
120:LOW =		0%	-400 to +400%
120:HIGH =		100%	-400 to +400%
120:ANAIP2->		220TRQREF	analogue
130:ANALOGUE OUTPUT 1	User	Default	Range/Type
130:TYPE =		VOLTAGE	voltage, current
130:LOW =		0%	-400 to +400%
130:HIGH =		100%	-400 to +400%
130:ANAOP1<-		230SPEED	analogue
140:ANALOGUE OUTPUT 2	User	Default	Range/Type
140:TYPE =		VOLTAGE	voltage, current
140:LOW =		0%	-400 to +400%
140:HIGH =		100%	-400 to +400%
140:ANAOP2<-		230MTRCUR	analogue
150:DIGITAL INPUTS	User	Default	Range/Type
150:DIGIP1->		210START	digital
150:DIGIP2->		210ENABLE	digital
150:DIGIP3->		210RESET	digital
150:DIGIP4->		220TRQMDE	digital
150:DIGIP5->		220SPDINV	digital
150:DIGIP6->		220TRQINV	digital
160:DIGITAL OUTPUTS	User	Default	Range/Type
160:DIGOP1<-		NC	digital
160:DIGOP2<-		NC	digital
160:RELOP1<-		210RUN	digital
160:RELOP2<-		420MTR OL	digital
160:RELOP3<-		230/FAULT	digital
170:FIELD BUS SETUP	User	Default	Range/Type
170:ENABLE=		FALSE	false, true
170:FBTRIP=		FALSE	false, true
170:FBLOSS->		NC	digital
180:FBUS ANLG INPUT	User	Default	Range/Type
180:FBAIP1->		NC	analogue
180:FBAIP2->		NC	analogue
180:FBAIP3->		NC	analogue
180:FBAIP4->		NC	analogue
180:FBAIP5->		NC	analogue
180:FBAIP6->		NC	analogue
190:FBUS DGTL INPUT	User	Default	Range/Type
190:FBDIP1->		NC	digital
190:FBDIP2->		NC	digital
190:FBDIP3->		NC	digital
190:FBDIP4->		NC	digital
190:FBDIP5->		NC	digital
190:FBDIP6->		NC	digital

1A0:FBUS ANLG OUTPUT	User	Default	Range/Type
1A0:FBAOP1<-	_____	NC	analogue
1A0:FBAOP2<-	_____	NC	analogue
1A0:FBAOP3<-	_____	NC	analogue
1A0:FBAOP4<-	_____	NC	analogue
1A0:FBAOP5<-	_____	NC	analogue
1A0:FBAOP6<-	_____	NC	analogue
1B0:FBUS DGTL OUTPUT	User	Default	Range/Type
1B0:FBDOP1<-	_____	NC	digital
1B0:FBDOP2<-	_____	NC	digital
1B0:FBDOP3<-	_____	NC	digital
1B0:FBDOP4<-	_____	NC	digital
1B0:FBDOP5<-	_____	NC	digital
1B0:FBDOP6<-	_____	NC	digital
1C0:SERIAL COMMS	User	Default	Range/Type
1C0:STATUS=	ok, range err, no prmtr, ovrun err, frame err, parity err, bcc err, confg lck, user lck, drive lck, fctry lck, bad port, read only		
1C0:ADDRSS=	_____	11	11 to 99
1C0:SCAIP1->	_____	NC	analogue
1C0:SCAIP2->	_____	NC	analogue
1C0:SCAIP3->	_____	NC	analogue
1C0:SCDIP1->	_____	NC	digital
1C0:SCDIP2->	_____	NC	digital
1C0:SCDIP3->	_____	NC	digital

200:CONTROLLER

210:SEQUENCING	User	Default	Range/Type
210:STRMDE=	_____	NORMAL	normal, spin
210:STPMDE=	_____	NORMAL	normal, spin, coast
210:E-MDE =	_____	NORMAL	normal, spin, coast
210:START <-	_____	150DIGIP1	digital
210:ENABLE<-	_____	150DIGIP2	digital
210:RESET <-	_____	150DIGIP3	digital
210:E-ENBL<-	_____	720VALUE0	digital
210:EXTRIP<-	_____	720VALUE0	digital
210:START ->	_____	NC	digital
210:RUN ->	_____	160RELOP1	digital
220:CONDITIONING	User	Default	Range/Type
220:TRQLIM=	_____	150%	0 to 300%
220:LWRSPD=	_____	-110%	-200% to 220:UPSPD
220:UPSPD =	_____	110%	220:LWRSPD to +200%
220:ACCEL1=	_____	60.0s	0.1 to 3000 seconds
220:DECEL1=	_____	60.0s	0.1 to 3000 seconds
220:ACCEL2=	_____	60.0s	0.1 to 3000 seconds
220:DECEL2=	_____	60.0s	0.1 to 3000 seconds
220:SPDREF<-	_____	110ANAIP1	analogue

220:TRQREF<-	_____	120ANAIP2	analogue
220:TRQMDE<-	_____	150DIGIP4	digital
220:SPDINV<-	_____	NC	digital
220:TRQINV<-	_____	NC	digital
220:RAMP2 <-	_____	NC	digital
220:AT SPD->	_____	NC	digital
220:CURLIM->	_____	NC	digital
220:TRQLIM->	_____	NC	digital
230:MONITORING	User	Default	Range/Type
230:FREQ ->	_____	NC	analogue
230:SPEED ->	_____	130ANAOP1	analogue
230:VOLTS ->	_____	NC	analogue
230:TORQUE->	_____	NC	analogue
230:MTRCUR->	_____	NC	analogue
230:POWER ->	_____	NC	analogue
230:/FAULT->	_____	160RELOP3	digital
230:INV OL->	_____	NC	digital
240:OPERATING MODES	User	Default	Range/Type
240:CNTRL =	_____	OPNLP VEC	V/Hz, Opnlp Vec, Encdr Vec
240:LOAD =	_____	CONST TRQ	const trq, var trq
240:LVTRIP=	_____	OFF	off, on

300:FAULT INFO

310:FAULT LOG	User	Default	Range/Type
310:FAULT1=	_____		*
310:FAULT2=	_____		*
310:FAULT3=	_____		*
310:FAULT4=	_____		*
310:FAULT5=	_____		*
310:FAULT6=	_____		*
310:FAULT7=	_____		*
310:FAULT8=	_____		*
310:FAULT9=	_____		*
320:AUTO RESET	User	Default	Range/Type
320:NUMBER=	_____	0	0 to 5
320:DELAY =	_____	30s	0 to 100 seconds
320:PERIOD=	_____	3600s	0 to 3600 seconds

* See section 0 for the list of all possible fault indications.

400:MOTOR

410:MOTOR NAMEPLATE	User	Default	Range/Type
410:VOLTS =	_____	400V	50 to 1000V
410:AMPS =	_____	0A	0 to 2000A
410:POWER =	_____	0kW	0 to 1000kW
410:RPM =	_____	0rpm	0 to 65535rpm
410:FREQ =	_____	50Hz	0 to 100Hz
410:ENCODR =	_____	500	0 to 4096ppr

420:MOTOR THERMAL	User	Default	Range/Type
420:F COOL=		OFF	off, on
420:STRTIM=		10.0s	0 to 60seconds
420:TRIP =		ON	off, on
420:RR ADJ=		OFF	off, on
420:MTR OL->		160RELOP2	digital
420:MTRTMP->		NC	analogue
430:MOTOR MODEL	User	Default	Range/Type
430:RS =		1.0%	0 to 10.0%
430:RR =		1.0%	0 to 10.0%
430:IMAG =		50.0%	0 to 150.0%
430:LKG =		10.0%	0 to 150.0%

500:VECTOR CONTROL

510:SETTINGS	User	Default	Range/Type
510:BSTMDE=		OFF	off, on
510:IBOOST=		0%	0 to +250%
510:J COMP=		0.0s	0 to 100 seconds
510:FWK PT=		120%	80 to 150%
510:ADAPT=		OFF	off, on
520:GAINS	User	Default	Range/Type
520:WLPKP =		16000	0 to 32767
520:WLPKI =		20	20 to 32767
520:WLPKD =		0	0 to 32767
520:PHLPKP=		10000	0 to 32767
520:FRLPKP=		3000	0 to 32767
520:FRLPKI=		800	20 to 32767
520:ILPKP =		2000	0 to 32767
520:ILPKI =		400	20 to 32767

600:MICRODRIVE V

610:WAVEFORM	User	Default	Range/Type
610:SWFREQ=		LOW	low, high
620:CALIBRATION	User	Default	Range/Type
620:CTSCLE=		N/A	0 to 65535
620:RATING=		N/A	0 to 2000A
620:IVOLTS=		N/A	440V, 690V
620:TSTMDE=		N/A	off, low bus, 50V
620:VER =		N/A	READ ONLY
630:DYNAMIC BRAKE	User	Default	Range/Type
630:DBDUTY=		10%	10 to 100%
630:TIME =		10s	1 to 500 seconds
630:ENABLE=		OFF	off, on

700:SPECIAL FUNCTION

710:ANALOGUE PRESETS	User	Default	Range/Type
710:VALUE1=		0.0%	-400.0 to +400.0%
710:VALUE2=		0.0%	-400.0 to +400.0%

710:VALUE3=	_____	0.0%	-400.0 to +400.0%
710:VALUE1->	_____	NC	analogue
710:VALUE2->	_____	NC	analogue
710:VALUE3->	_____	NC	analogue
720:DIGITAL PRESETS	User	Default	Range/Type
720:VALUE0=	_____	TRUE	true
720:VALUE1=	_____	FALSE	false, true
720:VALUE2=	_____	FALSE	false, true
720:VALUE3=	_____	FALSE	false, true
720:VALUE0->	_____	NC	digital
720:VALUE1->	_____	NC	digital
720:VALUE2->	_____	NC	digital
720:VALUE3->	_____	NC	digital
730:2 TO 1 ASWITCH1	User	Default	Range/Type
730:IN0 <-	_____	NC	analogue
730:IN1 <-	_____	NC	analogue
730:SELECT<-	_____	NC	digital
730:OUTPUT->	_____	NC	analogue
740:2 TO 1 ASWITCH2	User	Default	Range/Type
740:IN0 <-	_____	NC	analogue
740:IN1 <-	_____	NC	analogue
740:SELECT<-	_____	NC	digital
740:OUTPUT->	_____	NC	analogue
750:2 TO 1 DSWITCH1	User	Default	Range/Type
750:IN0 <-	_____	NC	digital
750:IN1 <-	_____	NC	digital
750:SELECT<-	_____	NC	digital
750:OUTPUT->	_____	NC	digital
760:2 TO 1 DSWITCH2	User	Default	Range/Type
760:IN0 <-	_____	NC	digital
760:IN1 <-	_____	NC	digital
760:SELECT<-	_____	NC	digital
760:OUTPUT->	_____	NC	digital
770:2 TO 1 DSWITCH3	User	Default	Range/Type
770:IN0 <-	_____	NC	digital
770:IN1 <-	_____	NC	digital
770:SELECT<-	_____	NC	digital
770:OUTPUT->	_____	NC	digital
780:DIGITAL FUNCT1	User	Default	Range/Type
780:OP =	_____	AND	and, or, xor
780:INVIN0=	_____	FALSE	false, true
780:INVIN1=	_____	FALSE	false, true
780:INVOUT=	_____	FALSE	false, true
780:IN0 <-	_____	NC	digital
780:IN1 <-	_____	NC	digital
780:OUTPUT->	_____	NC	digital

790:DIGITAL FUNCT2	User	Default	Range/Type
790:OP =		AND	and, or, xor
790:INVIN0=		FALSE	false, true
790:INVIN1=		FALSE	false, true
790:INVOUT=		FALSE	false, true
790:IN0 <-		NC	digital
790:IN1 <-		NC	digital
790:OUTPUT->		NC	digital
7A0:DIGITAL FUNCT3	User	Default	Range/Type
7A0:OP =		AND	and, or, xor
7A0:INVIN0=		FALSE	false, true
7A0:INVIN1=		FALSE	false, true
7A0:INVOUT=		FALSE	false, true
7A0:IN0 <-		NC	digital
7A0:IN1 <-		NC	digital
7A0:OUTPUT->		NC	digital
7B0:MOTORISED POT	User	Default	Range/Type
7B0:ENABLE=		FALSE	false, true
7B0:UPLIM =		100.0%	7B0:LWRLIM to 400.0%
7B0:LWRLIM=		0.0%	-400.0 to 7B0:UPLIM
7B0:TIME =		60s	1 to 3000s
7B0:INC <-		NC	digital
7B0:DEC <-		NC	digital
7B0:OUTPUT->		NC	analogue
7C0:PRESET SELECT	User	Default	Range/Type
7C0:VALUE1=		0.0%	-400.0 to +400.0%
7C0:VALUE2=		0.0%	-400.0 to +400.0%
7C0:VALUE3=		0.0%	-400.0 to +400.0%
7C0:VALUE4=		0.0%	-400.0 to +400.0%
7C0:VALUE5=		0.0%	-400.0 to +400.0%
7C0:VALUE6=		0.0%	-400.0 to +400.0%
7C0:VALUE7=		0.0%	-400.0 to +400.0%
7C0:VALUE8=		0.0%	-400.0 to +400.0%
7C0:SEL0 <-		NC	digital
7C0:SEL1 <-		NC	digital
7C0:SEL2 <-		NC	digital
7C0:OUTPUT->		NC	analogue
7D0:PID CONTROLLER	User	Default	Range/Type
7D0:ENABLE=		FALSE	false, true
7D0:MODE =		PI	PI, PID
7D0:KP =		1.00	0.00 to 16.00
7D0:WITS =		0.001	0.000 to 0.100
7D0:WDTS =		0.10	0.01 to 0.10
7D0:UPLIM =		400.0%	7D0:LWRLIM to 400.0%
7D0:LWRLIM=		-400.0%	-400.0 to 7D0:UPLIM
7D0:KSP =		1.0	0.0 to 1.0

7D0:TS =	_____	10ms	10ms,100ms,1s,10s
7D0:REF <-	_____	NC	analogue
7D0:F/B <-	_____	NC	analogue
7D0:OFFSET<-	_____	NC	analogue
7D0:ENABLE<-	_____	NC	digital
7D0:OUTPUT->	_____	NC	analogue
7D0:ERROR ->	_____	NC	analogue
7D0:UPIND ->	_____	NC	digital
7D0:LWRIND->	_____	NC	digital
🗁 7E0:SKIP BANDS	User	Default	Range/Type
7E0:ENABLE=	_____	FALSE	false, true
7E0:VALUE1=	_____	0.0%	0.0 to +400.0%
7E0:BAND1 =	_____	0.0%	0.0 to +400.0%
7E0:VALUE2=	_____	0.0%	0.0 to +400.0%
7E0:BAND2 =	_____	0.0%	0.0 to +400.0%
7E0:VALUE3=	_____	0.0%	0.0 to +400.0%
7E0:BAND3 =	_____	0.0%	0.0 to +400.0%
7E0:VALUE4=	_____	0.0%	0.0 to +400.0%
7E0:BAND4 =	_____	0.0%	0.0 to +400.0%
7E0:INPUT <-	_____	NC	analogue
7E0:OUTPUT->	_____	NC	analogue
🗁 7F0:COMPARATOR 1	User	Default	Range/Type
7F0:BAND =	_____	5.0%	0.0 to +400.0%
7F0:IN0 <-	_____	NC	analogue
7F0:IN1 <-	_____	NC	analogue
7F0:OUTPUT->	_____	NC	digital
🗁 7G0:COMPARATOR 2	User	Default	Range/Type
7G0:BAND =	_____	5.0%	0.0 to +400.0%
7G0:IN0 <-	_____	NC	analogue
7G0:IN1 <-	_____	NC	analogue
7G0:OUTPUT->	_____	NC	digital
🗁 7H0:COMPARATOR 3	User	Default	Range/Type
7H0:BAND =	_____	5.0%	0.0 to +400.0%
7H0:IN0 <-	_____	NC	analogue
7H0:IN1 <-	_____	NC	analogue
7H0:OUTPUT->	_____	NC	digital

INDEX

Symbols

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Specifications are subject to change without notice.

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