

DELTA Newsletter

Industrial Automation Products

Edition 2017-04

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1 News


1.1 Hannover Messe from 24~28 April, 2017




Experience Delta's High-Calibre Solutions for Smart Manufacturing & Energy Efficiency at Hannover Messe 2017

Delta's expanded and strengthened portfolio of state-of-the-art solutions, capable of realizing smart manufacturing and higher energy efficiency in a broad range of applications, will be featured at Hannover Messe 2017 from **April 24 to 28**. Visitors will witness live demos of our innovative and customer-centric **Integrated IIoT, Automation and Robot Workstation** and receive customized business card holder gifts with it. Key highlights from our showcase will also include newly-launched solutions from our industrial automation division, smart building automation platforms, fast and

Deltronics (Netherlands) B.V., De Witbogt 20, 5652 AG Eindhoven, The Netherlands

 +31 (0)40 8003800

 +31 (0)40 8003898 and 99

convenient EV chargers, high-efficiency renewable energy solutions and energy storage technology, UPS systems, complete power infrastructure for telecommunications, our newest wireless charging for industrial vehicles, display & monitoring technology, and a wide spectrum of power and thermal management components.

We look forward to meeting you in Hannover!

Free e-Ticket

[Click here to register for your personalized free entrance e-ticket!](#)

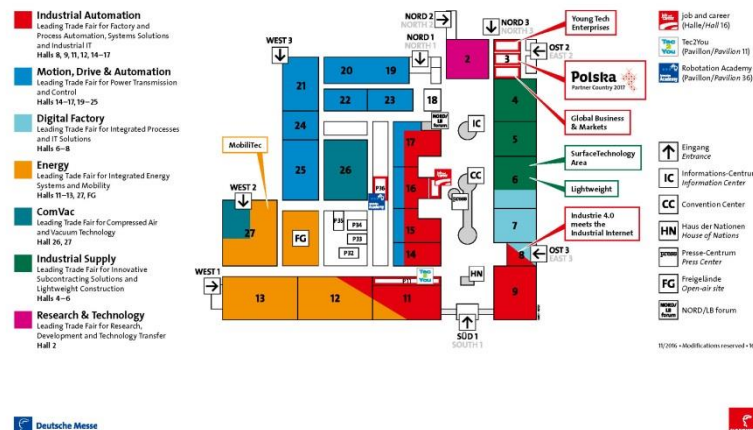
The e-Ticket is valid for the entire duration of Hannover Messe 2017. Please do register online before attending. Also fill in the day of your visit to make sure we are there at your most convenient time.

About Delta

Delta, founded in 1971, is a global leader in power and thermal management solutions. Our mission is "To provide innovative, clean and energy-efficient solutions for a better tomorrow," and our businesses encompass Power Electronics, Energy Management, and Smart Green Life. Delta has sales offices, manufacturing facilities and R&D centres worldwide. In 2014, was ranked at the highest A-level of the Climate Performance Leadership Index of the Carbon Disclosure Project (CDP). Since 2011, Delta is part of the Dow Jones Sustainability Indices (DJSI) World Index. For detailed information about Delta, please visit: www.deltawww.com

HANNOVER MESSE • 24 – 28 April 2017

Visit us:
Hall 11, Stand A57



1.2 ftp-site link

Just to let you know (again), you can find the latest info about our products (manuals, pictures, catalogues, application notes, presentations, software, etc.) on our ftp-site.

<ftp://den-eindhoven:BuPd2175@ftp2.delta-europe.com/deltronics-eindhoven/customer-service>

Name and password are included in the link.

Name: den-eindhoven

Password: BuPd2175

2 Product update

2.1 UPDATE – REG2000 firmware 1.04

Correcting functions

	V1.03 Function descriptions	Corrections in V1.04
1	When REG2000 used EMC-BP01 Power supply card, during device power-on initialization, there's CF2 error happened.	Fixed CF2 problem when install EMC-BP01 Power supply card
2	When the VDC and AC voltage differential is too large, it will lead to OCS error during AC voltage power off. It may make REG has to reset manually.	Modify the protection mechanism of AC off interval, to avoid customer mis-trigger OCS protection when turn off mains.
3	By using the external power supply card with 24Vdc power supply, the relay timing differences may be come out RYF (Relay feedback fault) error.	Add [24V power supply card mode], when users sets Pr03-05(power supply card mode) =1(On),and Relay on , there is a delay time interval which can be set by Pr06-37 before issuing Relay closing command in MCU.

Functional changes

- REG2000 v1.04 add new operation status: "PREPARE" In the meantime, the new version also modifies Modbus communication definition (2101h / 2119h) and new communication address of(22XXh)

a. C2101 with the C2119 change items :

c2101h & c2119h	VFD Define	REG Define	REG Define status description
b1~b0	00: RUN LED light off, STOP LED light up(Drive Stop)	Standby (Ready to complete)	Power feedback unit after power up without any errors and warnings, and a complete phase-locked, users in the Run command.
	01: RUN LED blink, STOP LED light up(Drive Decelerate during the drive stopping)	RUN (In operation)	User release RUN command, power feedback unit is in a normal operating state, waiting for the regenerative of the conditions are met.
	10: RUN LED light up, STOP LED blink(Drive standby)	Prepare (In preparing)	Power feedback unit after power up, power ampoules in a unit test.
	11: RUN LED light up, STOP LED light off(Drive Run)	Regenerate (A pick-up in)	Power feedback unit regenerative AC current to the mains (AC).

b. Added / Fixed parameters communication address(22XXh) :

Address	R/W	物理量內容	單位
2102h	R	Frequency Command	0.01Hz
2200h	R	Output current (A)	0.01A
2203h	R	DC-Bus Voltage (U)	0.1V
2204h	R	Output Voltage(E)	0.1V
2206h	R	Output Power(P)	0.1kW
220Eh	R	Heat Sink temperature (t.)	0.1°C
220Fh	R	IBGT temperature (T)	0.1°C
2210h	R	DI ON/OFF status (i)	N/A
2211h	R	DO ON/OFF status (o)	N/A
2219h	R	oL counter	N/A
2222h	R	Fan speed (%)	%
2229h	R	KWH Low number	0.1kWh
222Ah	R	KWH High number	0.1kWh
2237h	R	Display the current limit (p)	%

2. REG Operate State/ Alarm are organized as follows, and change the LED display basing on the according changes.

Control no	Alarm (ALARM)	Power supply (POWER)	Defined	Description	Note
1	Blinking Red +blinking green	Blinking Red + blinking green	Prepare	Initial preparation	REG2000 is self-testing after power on.
Control no	Alarm (ALARM)	Power supply (POWER)	Defined	Description	Note
2	off	red	READY	Ready for RUN command (Short MI1 to DCN, or hit RUN on Keypad)	REG2000 pass self-test without any error, the user can execute "RUN" command to REG.
3	off	green	RUN	REG running	After hitting "RUN" , REG2000 function normally and waiting for motor braking.
4	off	Blinking Green	REGENERATE	Energy Regeneration	REG2000 regenerates AC current to the mains (AC).

Control no	Alarm (ALARM)	Power supply (POWER)	Defined	Description	Corresponding error / warning message on Keypad
5	red	Blinking Red	OV	Overvoltage	ovn, ovs
6	red	Blinking green	EF	External error	EF
7	red	red	OL	Over load	oL
8	Blinking red	red	OH	Temperature anomaly	oH1, oH2, tH1o, tH2o
9	red	off	OC	Over current	ocn, ocs
10	Blinking Red	Blinking Red	Comm. Err.	Communication anomaly	Pco, CE1, CE2, CE3, CE4, CE10, SE1, SE2, SE3
11	Blinking Red	off	Mains Err.	Power supply anomaly	OrP, PLE, LvS Input phase less abnormal, PLL and DC low voltage warning
12	Blinking Green	Blinking Green	HW Err.	Hardware exceptions / memory abnormalities	cd1, cd2, cd3, Hd1, Hd2, 5VF, RYF, cF1, cF2

New Functions

1. REG2000 can speed up the boot sequence in 3 sec from power on to "RUN" status.
Application example: Elevator.
If REG2000 co-operates with the elevator with "sleeping mode"(cutting off from mains). REG2000 can boot up and ready for energy regeneration in 3 seconds, after the passengers call the elevator cart.

Release

Firmware version	Switching period	
V1.04	Taoyuan	T1519

2.2 NEW – EMC filters for C2000 (≥37kW) and CP2000 (≥45kW)

Delta has released new EMC filters for C2000 (37kW and above) and CP2000 (45kW and above). Compared to the previous solution, the new EMC filters are more compact and cost-effective. They have been split into filters for industrial environments (C3) and filters for domestic environments (C2) so that it's possible to select the filter based on the required emission level. All of the C3 filters are available directly from stock. C2 filters for Frame D drives are also available on stock. The new EMC filters have been tested together with our drives in cooperation with TDK-Epcos.

EMC filters for C3 emission levels:

Acc. To EN/IEC61800-3:2004

Frame size	C2000		Ext option filter	Shielded cable
	Model name	Rated input current ND (Arms)		Class Max motor cable length Carrier frequency
D	VFD370C43A/S/U	74	B84143A0110R410	C3 150m ≤6kHz
	VFD450C43A/S/U	101	B84143A0120R105	C3 150m ≤6kHz
	VFD550C43A	114	B84143B0180S080	C3 150m ≤6kHz*
	VFD750C43A	157		C3 150m ≤6kHz*
E	VFD900C43A	167	B84143B0250S080	C3 150m ≤4kHz
	VFD1100C43A	207		C3 150m ≤4kHz
F	VFD1320C43A	240	B84134B0400S080	C3 150m ≤4kHz
	VFD1600C43A	300		C3 150m ≤4kHz
G	VFD1850C43A	380	B84134B0600S080	C3 150m ≤4kHz
	VFD2200C43A	400		C3 150m ≤4kHz
H	VFD2800C43A	494	B84134B1000S080	C3 100m ≤4kHz
	VFD3150C43A	555		C3 100m ≤4kHz
	VFD3550C43A	625		C3 100m ≤4kHz

* For C3 Radiated Emission the 55kW and 75kW drives need to be placed inside a cabinet

Acc. To EN/IEC61800-3:2004

Frame size	CP2000		Ext option filter	Shielded cable
	Model name	Rated input current ND (Arms)		Class Max motor cable length Carrier frequency
D	VFD450CP43S-xx	91	B84143A0110R410	C3 150m ≤6kHz
	VFD550CP43S-xx	110	B84143A0120R105	C3 150m ≤6kHz
	VFD750CP43B-xx	150	B84143B0180S080	C3 150m ≤6kHz*
	VFD900CP43A-xx	180		C3 150m ≤6kHz*
E	VFD1100CP43A-xx	220	B84143B0250S080	C3 150m ≤4kHz
	VFD1320CP43B-xx	260	B84143B0320S080	C3 150m ≤4kHz
F	VFD1600CP43A-xx	310	B84143B0400S080	C3 150m ≤4kHz
	VFD1850CP43B-xx	370		C3 150m ≤4kHz
G	VFD2200CP43A-xx	460	B84143B0600S080	C3 150m ≤4kHz
	VFD2800CP43A-xx	530		C3 150m ≤4kHz
H	VFD3150CP43A/C-xx	616	B84143B1000S080	C3 100m ≤4kHz
	VFD3550CP43A/C-xx	683		C3 100m ≤4kHz
	VFD4000CP43A/C-xx	770		C3 100m ≤4kHz

* For C3 Radiated Emission the 75kW and 90kW drives need to be placed inside a cabinet

EMC filters for C2 emission levels:

Acc. To EN/IEC61800-3:2004

Frame size	C2000		Ext option filter	Zero Phase Reactor	Shielded cable
	Model name	Rated input current ND (Arms)		Output	Class Max motor cable length Carrier frequency
D	VFD370C43A/S/U	74	B84143B0120R110	N/A	C2 25m ≤6kHz*
	VFD450C43A/S/U	101	B84143B0120R110	N/A	C2 25m ≤6kHz*
	VFD550C43A	114	B84143B0180S020	T60006L2160V066	C2 13m ≤4kHz**
	VFD750C43A	157	B84143B0180S020	T60006L2160V066	C2 13m ≤4kHz**
E	VFD900C43A	167	B84143B0250S020	T60006L2160V066	C2 13m ≤4kHz
	VFD1100C43A	207		T60006L2160V066	C2 13m ≤4kHz
F	VFD1320C43A	240	B84143B0400S020	T60006L2160V066	C2 13m ≤4kHz
	VFD1600C43A	300		T60006L2160V066	C2 13m ≤4kHz
G	VFD1850C43A	380	B84143B0600S020	T60006L2160V066	C2 13m ≤2kHz
	VFD2200C43A	400		T60006L2160V066	C2 13m ≤2kHz

* For C2 Radiated Emission the 37kW and 45kW drives need to be placed inside a cabinet

** The Radiated Emission level for the 55kW and 75kW drives is C3 and only when placed inside a cabinet

Acc. To EN/IEC61800-3:2004

Frame size	CP2000		Zero Phase Reactor			Shielded cable Class Max motor cable length Carrier frequency
	Model name	Rated input current ND (Arms)	Ext option filter	Input	Output	
D	VFD450CP43S-xx	91	B84143B0120R110	N/A	N/A	C2 25m ≤6kHz*
	VFD550CP43S-xx	110	B84143B0120R110	N/A	N/A	C2 25m ≤6kHz*
	VFD750CP43B-xx	150	B84143B0180S020	N/A	T60006L2160V066	C2 13m ≤4kHz**
	VFD900CP43A-xx	180	B84143B0180S020	N/A	T60006L2160V066	C2 13m ≤4kHz**
E	VFD1100CP43A-xx	220	B84143B0250S020	N/A	T60006L2160V066	C2 13m ≤4kHz
	VFD1320CP43B-xx	260	B84143B0320S020	B64290L0084X830	T60006L2160V066	C2 13m ≤4kHz
F	VFD1600CP43A-xx	310	B84143B0400S020	N/A	T60006L2160V066	C2 13m ≤4kHz
	VFD1850CP43B-xx	370		N/A	T60006L2160V066	C2 13m ≤4kHz
G	VFD2200CP43A-xx	460	B84143B0600S020	N/A	T60006L2160V066	C2 13m ≤2kHz
	VFD2800CP43A-xx	530		N/A	T60006L2160V066	C2 13m ≤2kHz

* For C2 Radiated Emission the 45kW and 55kW drives need to be placed inside a cabinet

** The Radiated Emission level for the 75kW and 90kW drives is C3 and only when placed inside a cabinet

For more details please check our ftp-site for the latest datasheet:

2.3 NEW – Delta IP54 cabinet drive series

We are happy to announce the release of the Delta IP 54 cabinet drive series.

Delta IP 54 cabinet series was projected to fulfill the requirements of the high power range market which requires IP 54 protection level. It is intended to be used in areas which require IP 54, such as: Water, HVAC, compressors and any other that requires the same protection level. The properties, functionalities and optionals are the same as the C/CP2000 family. The cabinet series is divided into 3 categories:

- **Basic Units (from 90~400kW)**

Contain a basic IP54 cabinet solution including the cabinet, cooling, wiring, transformers, relays, fuses, safety relays, terminals, motor connectors, drive and keypad on the front of the cabinet with serial communication cable included.

Available accessories for Basic Units:

- MCCB (Molded Cases Circuit Breaker)
- Main Switch fuse disconnecter
- Handle (for MCCB and Main switch)

- **Standard Units (from 90~280kW)**

Basic units with EMC filters to comply with EN61800-3 Class C2 13m max. motor cable length and Class C3 150m max. motor cable length.

Available accessories for Standard Units:

- Main switch fuse disconnecter
- Main switch with handle

- **Customized units**

Any unit that does not fit into Standard and Basic is a customized unit, with AC reactors or filters which are not in the power range of Standard units. Before sending a request, please contact your regional Sales people for assistance on the configuration of the cabinets and its pricing. The chart below shows the power range for standard and basic units.

Available accessories for Customised units:

- AC chokes
- EMC filters (for units > 280 kW)



kW	90	110	132	160	185	220	280	315	355	400
C2000	Basic with Fuses									
	Basic with MCCB									
	Standard*									
CP2000	Basic with Fuses									
	Basic with MCCB									
	Standard*									

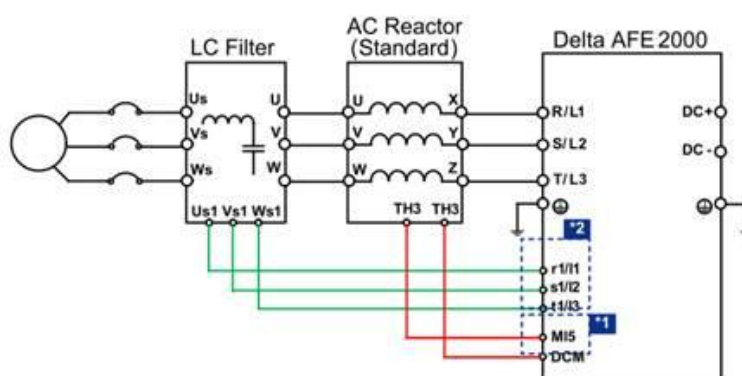
You can find the info on our ftp-site.

2.4 NEW – LC filters for AFE

AFE LC filter ensures issue-free operation in highly sophisticated industry, such as elevators.

LC Filter Wiring Diagram

The AFE LC filter enhances system power efficiency and suppresses frequency interference when matched with standard reactors and active front end units.



*1 Delta's AC reactor (standard installation accessory) is equipped with a thermal protection function. The TH3 terminal will have the AFE2000 send out a warning message when the reactor temperature exceeds 120°C.

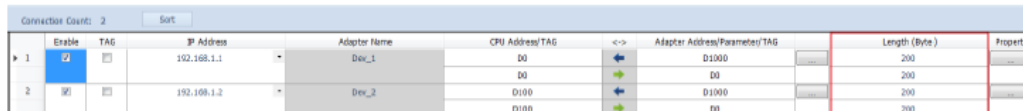
*2 For installing an LC filter, please connect the AFE's power input terminals (r1/i1, s1/i2, t1/i3) to the LC filter's AC detection terminals (Us1, Vs1, Ws1).

230V					
KW	Frame	Model	AC reactor	LC filter	EMI filter Deltron PN.
7.5	B	AFE075A23A	AF-RC075A2	AF-LC075A2	KMF336A
15	C	AFE150A23A	AF-RC150A2	AF-LC150A2	KMF3100A
22		AFE220A23A	AF-RC220A2	AF-LC220A2	
37	D	AFE370A23A	AF-RC370A2	AF-LC370A2	KMF3180A
460V					
KW	Frame	Model	AC reactor	LC filter	EMI filter Deltron PN.
7.5	B	AFE075A43A	AF-RC075A4	AF-LC075A4	KMF336A
15	C	AFE150A43A	AF-RC150A4	AF-LC150A4	KMF350A
22		AFE220A43A	AF-RC220A4	AF-LC220A4	
37	D	AFE370A43A	AF-RC370A4	AF-LC370A4	KMF3150A
45		AFE450A43A	AF-RC450A4	AF-LC450A4	
75		AFE750A43A	AF-RC750A4	AF-LC750A4	

2.5 NEW – EIP Builder software version 1.03

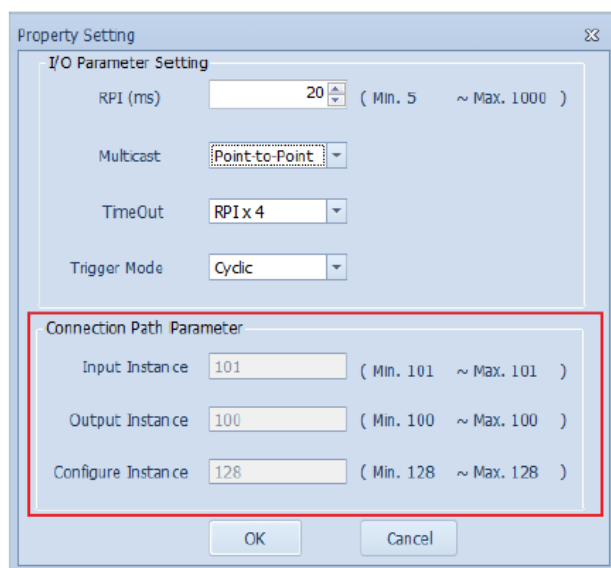
EIP Builder V1.03 is released along with the Delta EtherNet/IP related products, AHCPU5X1-EN and EtherNet/IP remote I/O modules. The functions which are modified and the functions which are added are described as below.

1. **EIP Builder V1.03 now supports AHCPU5X1-EN and remote I/O module AHRTU-ETHN-5A.**
 * AHRTU-ETHN-5A is supported for AHCPU511/521/531-EN with firmware version 2.0 or later versions. Refer to AH EtherNet/IP user manual for more information on operation.
2. Add a new column "Length (Byte)" in the editing area for data mapping. Users can modify the data length in this newly added column according to the application used.



Enable	TAG	IP Address	Adapter Name	CPU Address/TAG	Adapter Address/Parameter/TAG	Length (Byte)	Property
1	2	192.168.1.1	Dev_1	D0	D1000	200	
2	3	192.168.1.2	Dev_2	D0	D0	200	
				D100	D1000	200	
					D0	200	

3. Path parameters can be edited in this new version. Users can read and edit the path parameters in the Property Setting window. For this function to work, it is required the EDS file of the device should support the editing of the path parameters.



Property Setting

I/O Parameter Setting

RPI (ms): 20 (Min. 5 ~ Max. 1000)

Multicast: Point-to-Point

TimeOut: RPI x 4

Trigger Mode: Cyclic

Connection Path Parameter

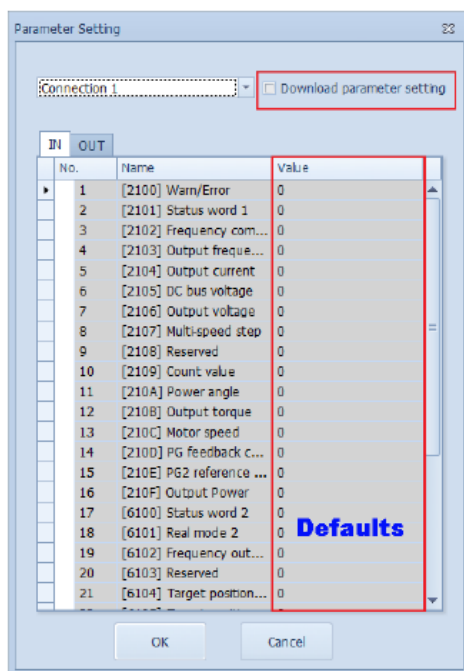
Input Instance: 101 (Min. 101 ~ Max. 101)

Output Instance: 100 (Min. 100 ~ Max. 100)

Configure Instance: 128 (Min. 128 ~ Max. 128)

OK Cancel

- Download parameter settings (defaults) can be selected or deselected. When the option is not selected, the defaults will not be imported when the connection is being established or reestablished.



- Fix the issue that errors may occur in COMMGR (V1.06 and V1.07) while connecting to devices via EIP Builder.

2.6 PHASE OUT – DVS-G008I00A

Be informed about IES product discontinuation.

Reason: chipset of DVS-G008I00A is going to phase out end of this year.

Phase-out Product List						
Type	Phase-out Product		Replacing Product		Last Buy Date (YYYY.MM.DD)	Phase-out Date (YYYY.MM.DD)
	Product Name	Description	Product Name	Description		
IES	DVS-G008I00A	Unmanaged 8-Port GbE Ethernet switch	N/A	N/A	2017. 6.30	2017. 12.31

There is no plan of replacement for this model. If customers want to order, last buy of DVS-G008I00A will be in **end of June 2017**.

Note:

- Minimum order quantity is 12 pieces from now on.
- The recommended replacing products on this announcement are only for reference. Please check with Delta's authorized distributors and sales representatives before replacing any product.

3 Application

3.1 NEW – Application Notes

New application notes have been published recently on our ftp-site:

- Metallurgical Industry Notification-Rotary Kiln Equipment.pdf
- Packaging Industry Notification-High-speed bag making machine.pdf

- [Printing Industry Notification- Die Cutting & Hot Stamping Machine.pdf](#)
- [Robot Industry Notification-Delta SCARA inserting robot station.pdf](#)
- [Electronic Industry Notification_DIAMMP Manufacturing Management Platform.pdf](#)
- [Electronics Industry Notification-Wafer Robot Application.pdf](#)
- [CNC Industry Notification-CNC Monitoring System.pdf](#)

3.2 Simplify Power Disruption Management for Higher Efficiency and Lower Cost with Delta DC-UPS

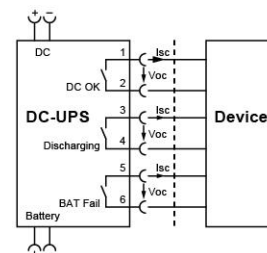
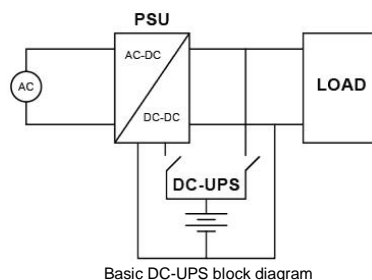


DRU-24V40ABN Delta DC-UPS

Power disruption and shutdown can be very annoying and may even be costly at times. There are various methods to maintain zero down time for a system like adding backup powers by using generators or adding Uninterruptible Power Supply (UPS). The choice of UPS depends largely on the power requirement of the system. One should look for an economical solution instead of simply using an AC-UPS which could be too bulky and expensive for a small to medium DC applicable loading. In such case, a DC-UPS would be a simpler, more efficient and cheaper option for the user.

[Read Full Article](#)

(click)



4 FAQ

4.1 VFD-series AC Motor drives

VFD-E

Q

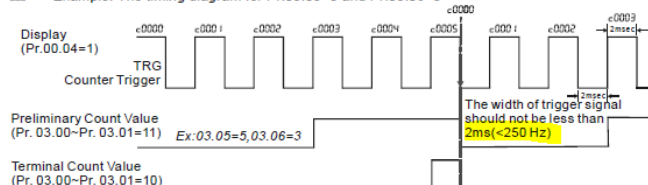
What is the max counting speed on Mlx?

A

In the manual it says 250Hz.

Chapter 4 Parameters |

Example: The timing diagram for Pr.03.05=5 and Pr.03.06=3



03.07 EF Active when Terminal Count Value Attained

This is an error, the max counting frequency is ca. 80Hz. It is limited by the Mlx response time (longer due to 2-CPU structure) plus Pr04-10 setting.

Q

What is the meaning of [PLor] on the display?

A

PLor happens when the PLC memory is really empty.

In PLC0 Mode the message should disappear.

In PLC1 or 2 mode, you can solve it by uploadin a a simple program with only the END instruction.



Q What is DEV fault?

A DEV means the PID feedback **deviates** too much from the setpoint.
This is not in the manual but it works.
The function is the same as in VFD-EL.

The level and time can be set in Pr10-12/10-13 and when it is exceeded the display shows the warning [Dev]. Pr03-00=16 activates in this case the relay.

dEv	Unusual PID feedback	Check if wiring of PID feedback is correct and parameter of PID feedback is properly setup.
-----	----------------------	---

Pr06-08

36 dEv: unusual PID feedback deviation

10.12	PID Feedback Level	Unit: 0.1
Settings	0.0 to 100.0%	Factory Setting: 10.0
☐ When Pr10.12=0, PID feedback error detection is disable.		
10.13	Detection Time of PID Feedback	Unit: 0.1
Settings	0.1 to 300.0 sec	Factory Setting: 5.0
☐ This parameter is used to set detection of the offset between set point and feedback.		
☐ When the offset is higher than (the setting of Pr.10.12 X Pr.01.00) for a time exceeding the setting of Pr.10.13, the AC motor drive will output a signal when Pr.03.00 is set to 16 and will act according to Pr.10.20.		

VFD-EL

Q What is DEV fault?

A DEV means the PID feedback **deviates** too much from the setpoint.

The level and time can be set in Pr10-12/10-13 and when it is exceeded the display shows the warning [Dev]. Pr03-00=16 activates in this case the relay.

dEv	Unusual PID feedback	Check if wiring of PID feedback is correct and parameter of PID feedback is properly setup.
-----	----------------------	---

Pr06-08

35 FBE_ERR : PID feedback error (the signal of the feedback is wrong)

36 dEv: unusual PID feedback deviation

37 10. Feedback

10.12	PID Feedback Level	Unit: 0.1
Settings	0.0 to 100.0%	Factory Setting: 10.0
☐ When Pr10.12=0, PID feedback error detection is disable.		
10.13	Detection Time of PID Feedback	Unit: 0.1
Settings	0.1 to 300.0 sec	Factory Setting: 5.0
☐ This parameter is used to set detection of the offset between set point and feedback.		
☐ When the offset is higher than (the setting of Pr.10.12 X Pr.01.00) for a time exceeding the setting of Pr.10.13, the AC motor drive will output a signal when Pr.03.00 is set to 16 and will act according to Pr.10.20.		

CP2000

Q

What is the function of Pr06-49?

A

In the CP2000 manual Pr06-49 is not described.

06 - 49 Reserved

It has the same function as in C2000

06 - 49 Lvx Auto Reset

Factory Setting: 0

Settings 0: Disable
1: Enable

C2000

Q

What is the function of Pr03-14?

A

Pr03-14 sets the gain for the negative input on AUI.

If you put a negative value to the negative input then you will get a positive gain.

If you put a positive value to the negative input then you will get a negative gain.

03 - 14 Analog Negative Input Gain (AUI)

Factory Setting: 100.0

Settings -500.0~500.0%

Parameters 03-03 to 03-14 are used when the source of frequency command is the analog voltage/current signal.

Q

Drive doesn't run when Enable and FWD are activated simultaneously. Why?

A

MI5=49 is Drive Enable. Level triggered.

Only when MI5 is active, Drive Enable, RUN, FWD, REV can be activated (edge triggered).

The driver scans Multi-IO status at 500µs timer interrupts with scan sequence FWD, REV, MI1, MI2 ...MI8.

Due to this scan sequence, the drive can't run when Enable and FWD are activated simultaneously.

Therefore a delay of minimum 500 µs between activating Enable and RUN (or FWD, REV) is required.