Knowledge Base Document

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Title: Digitax ST to Digitax HD retro fitting guide

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SUMMARY OF CONTENTS

This document provides guidance when retro fitting existing Digitax ST inverters with equivalent product from the Digitax HD range.

Contents

1 Product information

1.1 Introduction

The Digitax HD series is a range of high performance servo drives used as a standalone single axis or easily configured for multi-axis systems. Functionality also allows for this range of drives to be reconfigured for high performance universal AC motor control. Inverters from the Digitax HD series can be used as replacements for Digitax ST (DST), Unidrive SP size 0 and Epsilon EP products.

This document describes the technical differences between Digitax ST and the replacement Digitax HD drive.

The table 1-1 lists the Digitax HD frame sizes covered by this document and the equivalent Digitax ST frame size.

Table 1-1   Frame size comparison

Digitax ST frame size	Digitax HD frame size
1	1
	2
	3

There are four derivatives of Digitax HD. These derivatives and the equivalent Digitax ST are listed in table 1-2.

Table 1-2   Digitax HD derivatives and the equivalent Digitax ST

Digitax ST model	Digitax HD model
Digitax ST Indexer with SM-Ethernet	M750 Ethernet
Digitax ST Base	M751 Base
Digitax ST EtherCAT	M753 EtherCAT
Digitax ST Plus	M754 MCi*
Digitax ST EZ Motion	

*   Future addition

NOTE   This retrofit guide is intended for swapping Digitax ST drives for Digitax HD. It is assumed that the motor and load conditions will remain the same. Refer to the product user guides for more detailed information. This guide does not cover the Digitax HD frame size 3.

1.2 Drive features

Figure 1-1 Digitax ST features
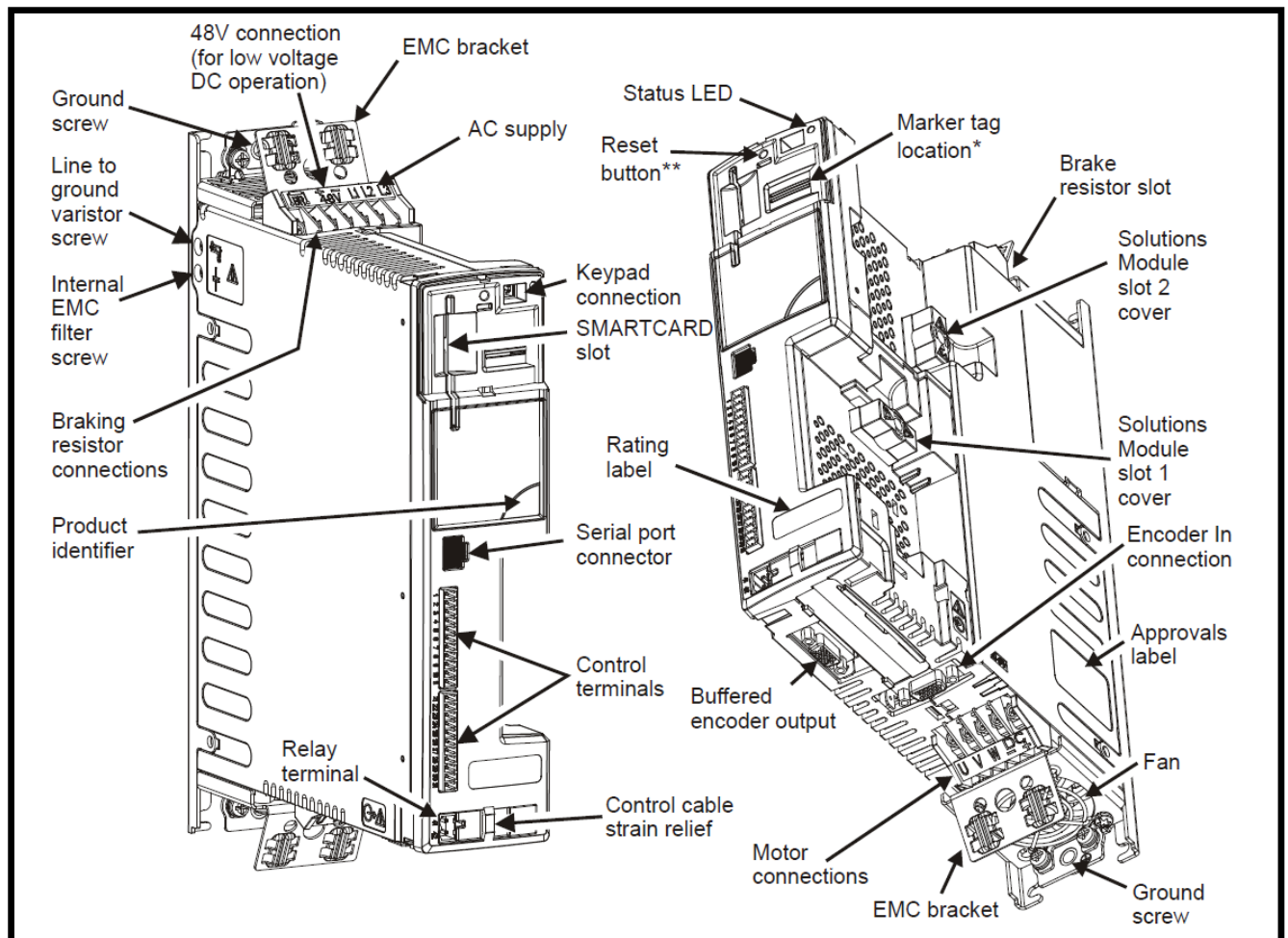
* The Marker tag (as shown in Figure 1-1 above), is where markers can be placed to identify a particular drive which can prove beneficial where several Digitax ST drives are located in the same panel.

Figure 1-2 Digitax HD features
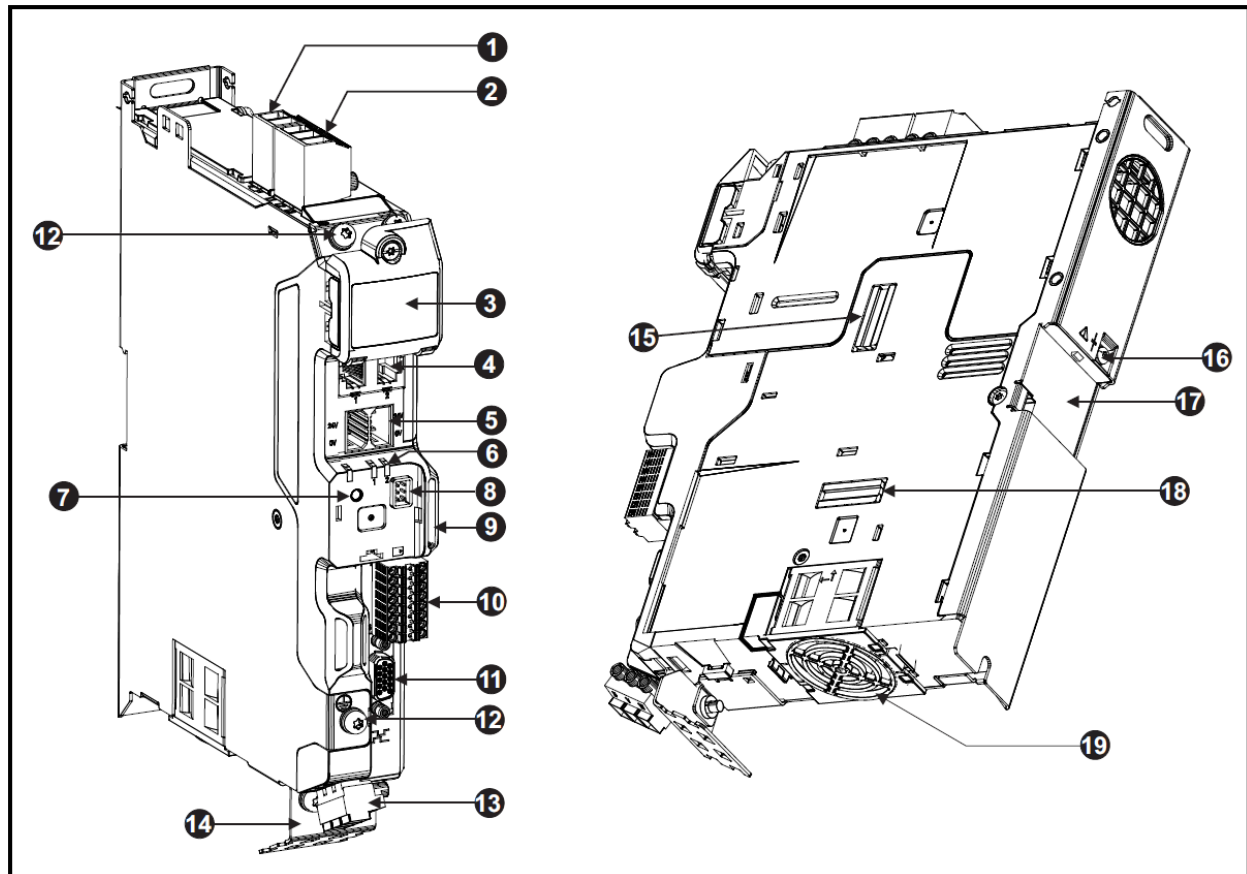
Table 1-3   Key to Digitax HD features (linked to figure 1-2)

Number	Description
1	Braking terminals
2	AC supply terminals
3	DC bus terminal cover
4	Communication port connections
5	External 24 V supply terminals
6	Status and communication LED's
7	Reset
8	Display connection
9	SD card slot
10	Control and holding brake terminals
11	Position feedback connection
12	Ground screw
13	Motor terminals
14	Cable screen bracket
15	Option module slot 1 cover*
16	Internal EMC filter screw (frame 1 and 2)
17	DIN rail alignment
18	Option module slot 2 cover*
19	Cooling fan

*Additional mounting frame required when connecting option modules where not already installed.

1.3   Maximum ratings

The drive ratings given below are for 40 °C (104 °F) at 1000m altitude. The tables show the ratings for the Digitax ST drives and the equivalent Digitax HD.

Table 1-4   Digitax ST / Digitax ST maximum ratings

Model Digitax ST / Digitax HD	Number of input phases	Nominal current A	Peak current A
DST1201	1	1.1*	2.2
M75X01200022	1	1.1	6.6
DST1202	1	2.4*	4.8
M75X01200040	1	2.2	12
DST1203	1	2.9*	5.8
M75X01200065	1	3.5	19.5
DST1204	1	4.7*	9.4
M75x02200090	1	5.6	27
DST1201	3	1.7	5.1
M75X01200022	3	2.2	6.6
DST1202	3	3.8	11.4
M75X01200040	3	4	12
DST1203	3	5.4	16.2
M75X01200065	3	6.5	19.5
DST1204	3	7.6	22.8
M75X02200090	3	9	27
DST1401	3	1.5	4.5
M75X01400015	3	1.5	4.5
DST1402	3	2.7	8.1
M75X01400030	3	3	9
DST1403	3	4	12
M75X01400042	3	4.2	12.6
DST1404	3	5.9	17.7
M75X02400060	3	6	18
DST1405	3	8	24
M75X02400080	3	8	24

*The maximum rating information, in Table 1-4 above, for the 200 V single phase supply, illustrates a 200% overload capability. When the Digitax ST 120x is used with a single phase supply it is possible to achieve three phase nominal current as long as the single phase peak current is observed. This is due to the higher levels of DC bus ripple on single phase drives.

1.4   Option modules

The table below shows a comparison between Digitax HD and Digitax ST option module availability.

Table 1-5   Comparison between Digitax HD and Digitax ST option modules.

Digitax ST	Digitax HD
SM-PROFIBUS-DP-V1	SI-PROFIBUS
	SI-PROFINET V2
SM-DeviceNet	SI-DeviceNet
SM-CANopen	SI-CANopen
SM-Ethernet	Onboard Ethernet (M750 / M754) SI-Ethernet (M751 / M753)
SM-Resolver	Onboard resolver all variants
SM-EtherCAT	Onboard EtherCAT (M753) SI-EtherCAT (M750 / M751 / M754)
SM-I/O Plus	SI-I/O
SM-I/O 24 V Protected	
SM-Encoder Plus	SI-Encoder
SM-Universal Encoder Plus	SI-Universal Encoder
SM-Encoder Output Plus	
SM-LON	
SM-I/O Lite	
SM-I/O Timer	
SM-CAN	
SM-INTERBUS	
SM-Applications Lite	MCi200 SI-Apps Compact
SM-SLM	
SM-Applications	SI-Apps Compact
SM-Apps plus	MCi210 SI-Apps Compact
SM-I/O PELV	
SM-I/O 120 V	
SM-I/O 32	
SM-SERCOS	

Conclusion

Two Digitax HD frames sizes cover the range of ratings that were previously covered by one Digitax ST frame size. Each equivalent Digitax HD offers a higher peak current level. The five model variants of Digitax ST are covered by four variants of Digitax HD. Both Digitax ST and Digitax HD can be fitted with two user-fit options modules at a time. Digitax ST is provided with a display to view and edit parameters. Digitax HD variants M750 and M753 are supplied with a KI-Compact display with single character code drive status representation, node address setting and a push button reset. Digitax HD M751 is not supplied with a KI-Compact display. A remote-Keypad RTC used with a KI-Compact 485 adaptor can be used to view and edit parameters.

2 Mechanical

2.1 Drive dimensions

Figure 2-1 **Digitax ST dimensions**
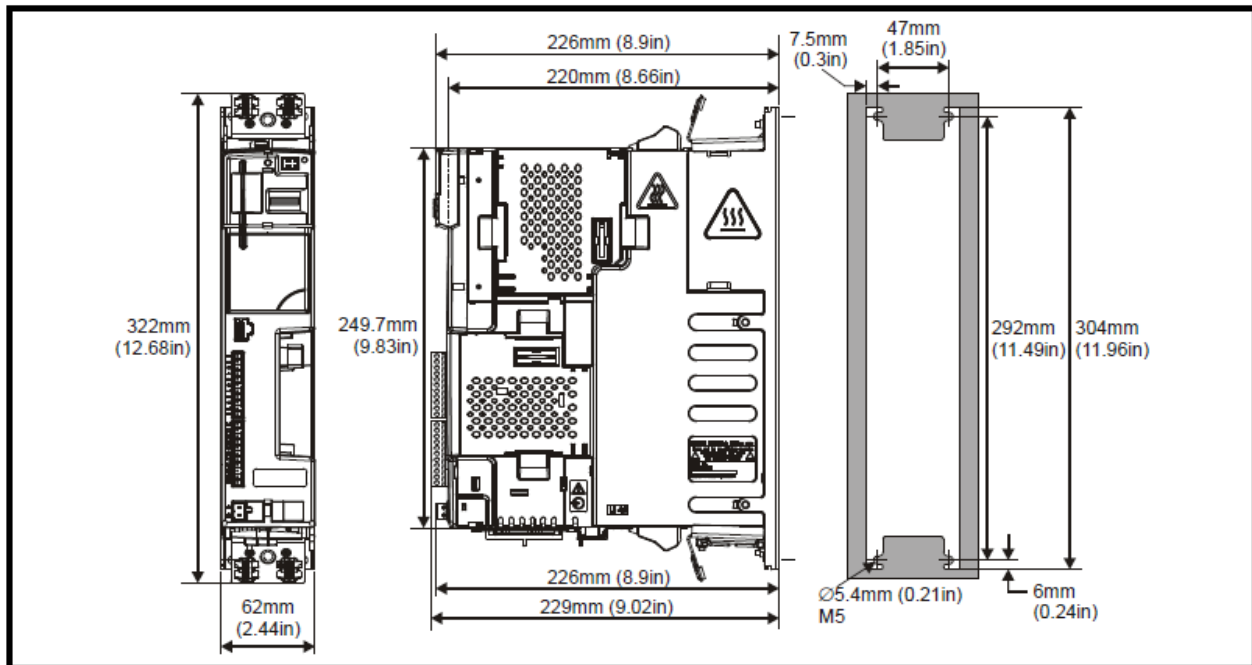
Figure 2-2 Digitax ST minimum mounting clearances

*2mm clearance between drives to allow for mechanical tolerance. If solutions modules are installed larger clearance between drives will be required if access to the modules is needed without removing the drive.
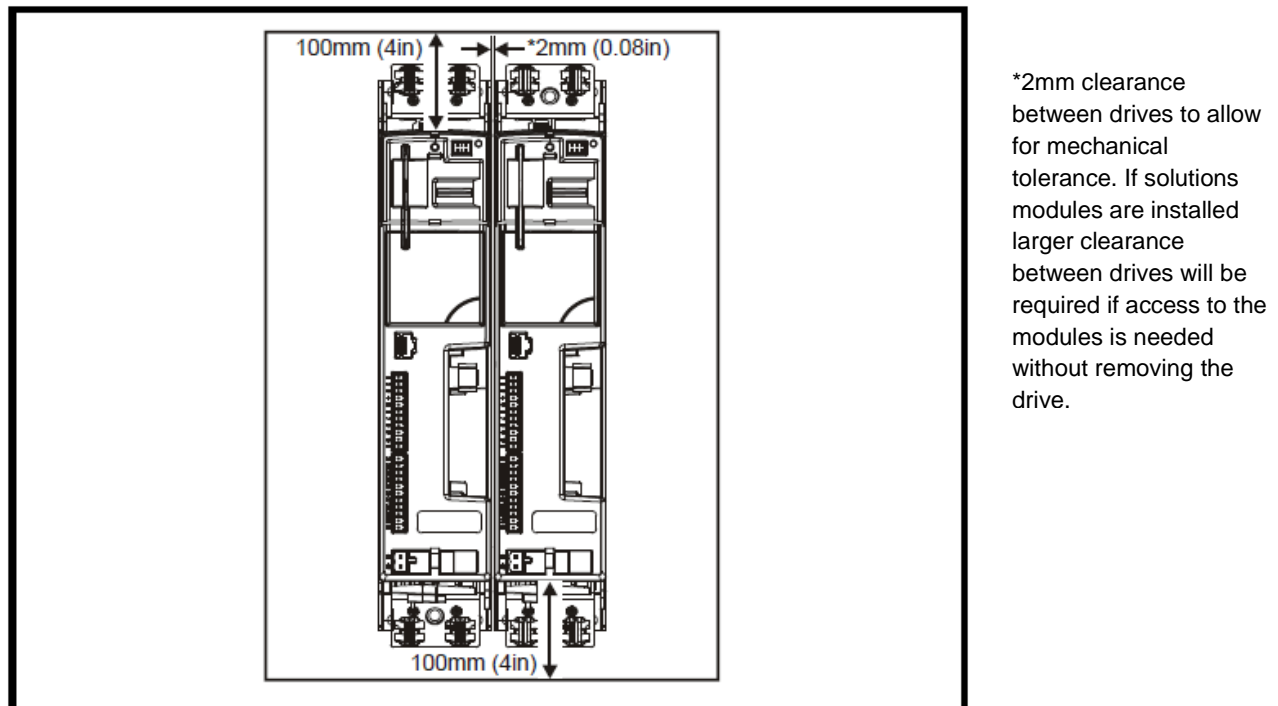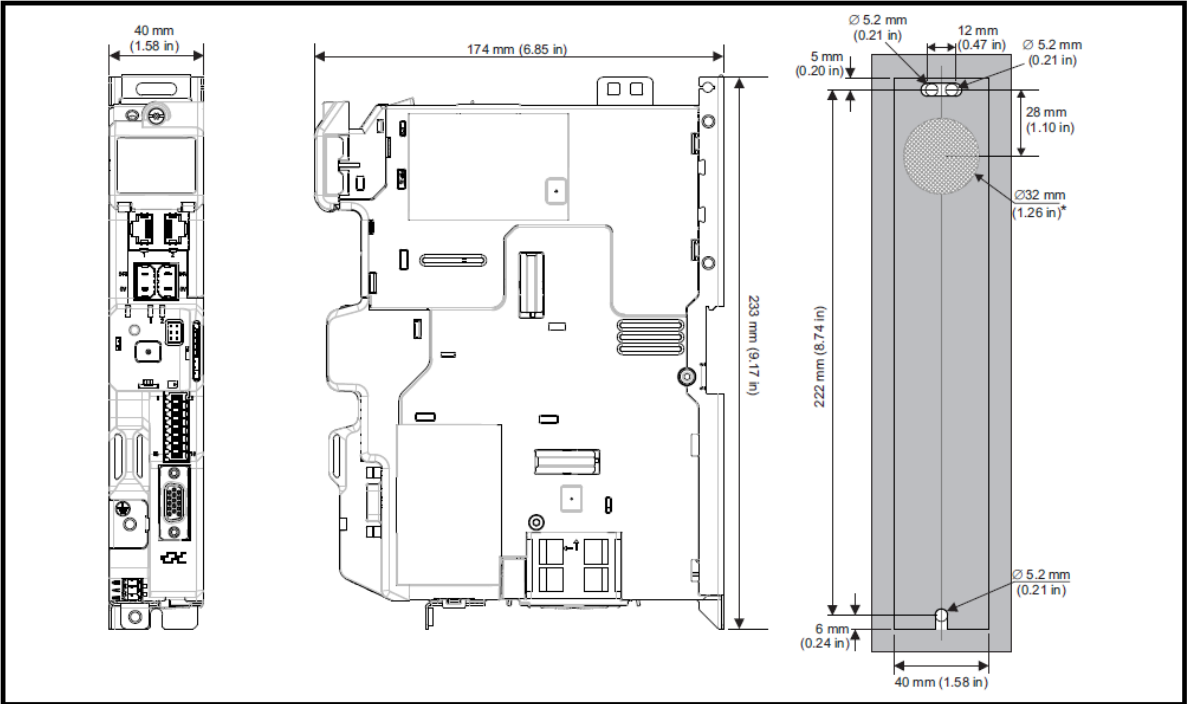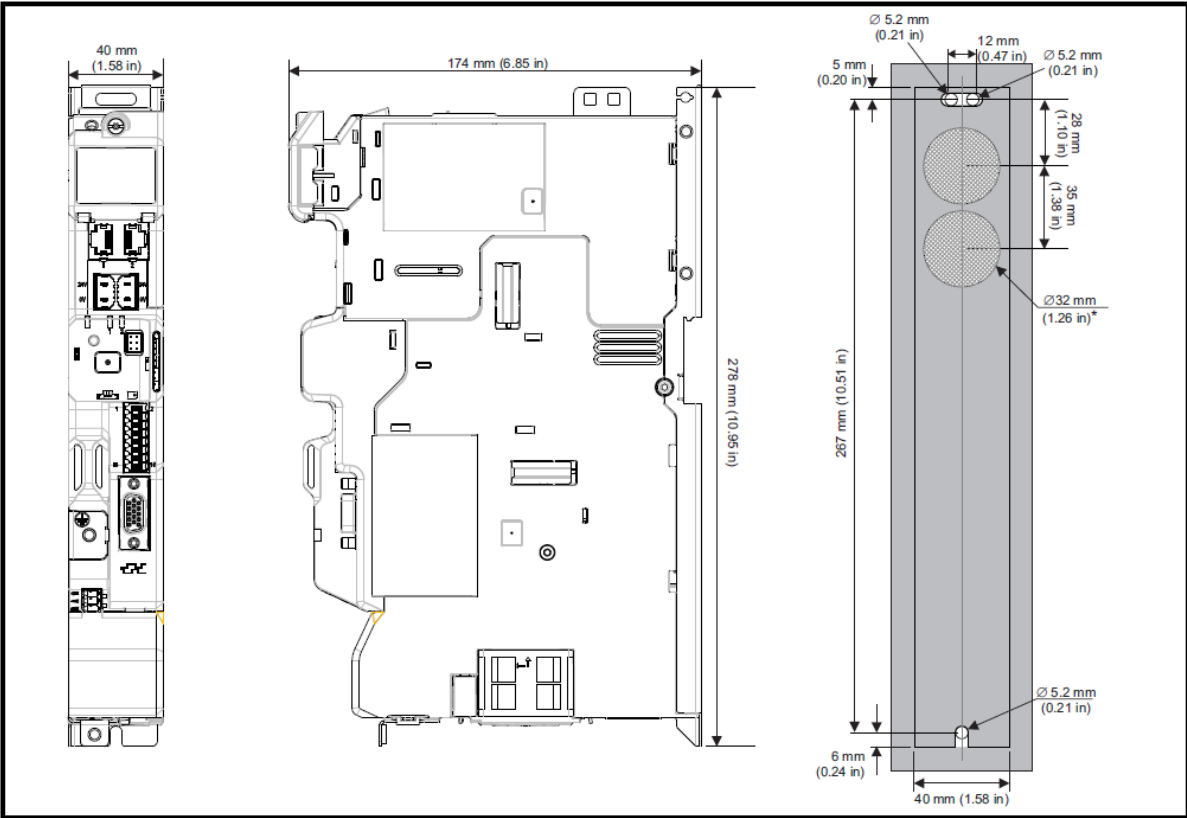
Figure 2-3   Digitax HD frame 1 dimensions

* Cut out only required for rear venting

Figure 2-4   Digitax HD frame 2 dimensions

* Cut outs only required for rear venting

2.1.1 Digitax HD with SI-Option Mounting kit installed

An SI-Option mounting kit (9500-1055) is required when connecting SI-Option Modules to Digitax HD. The SI-Option mounting kit will add 22mm to the width of the drive (see Figure 2-5).

NOTE

Digitax HD M751 is supplied with the SI-Option mounting kit already fitted, for Digitax HD M750 and M753, the SI-Option mounting kit is not supplied with the drive.

Figure 2-5 Digitax HD width with SI-Option Mounting kit installed.
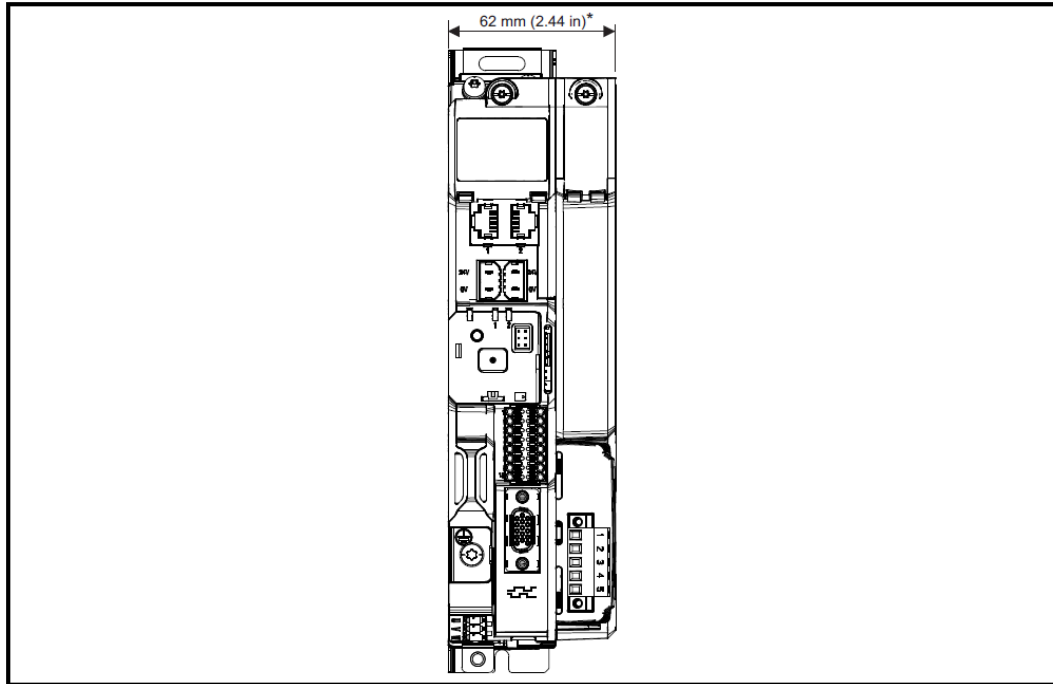
*Allow up to +0.5mm tolerance for each drive

Table 2-1 Comparison of dimensions

Dimensions				
Model	**Height**	**Width (no SI-option mounting kit fitted**	**Width (SI-option mounting kit fitted**	**Depth**
Digitax ST	322 mm (12.68 in)	62 mm (2.44 in)		226 mm (8.89 in)
Digitax HD Frame 1	233 mm (9.71 in)	40 mm (1.85 in)	62 mm (2.44 in)	174 mm (6.85 in)
Digitax HD Frame 2	278 mm (10.95 in)	40 mm (1.85 in)	62 mm (2.44 in)	174 mm (6.85 in)

2.2   Retro-fit plates

For applications that have previously used Digitax ST, there is a retro-fit plate available. This plate allows existing mounting holes to be used for mounting Digitax HD. The retro-fit plate is for Digitax HD frame sizes 1 and 2. There are no Digitax ST ratings equivalent to the Digitax HD therefore this retrofit plate is not required on Digitax HD frame size 3. The CT part number is 6521-0208-00.

See Figure 2-6 for more details.

Figure 2-6   Digitax HD retro-fit bracket
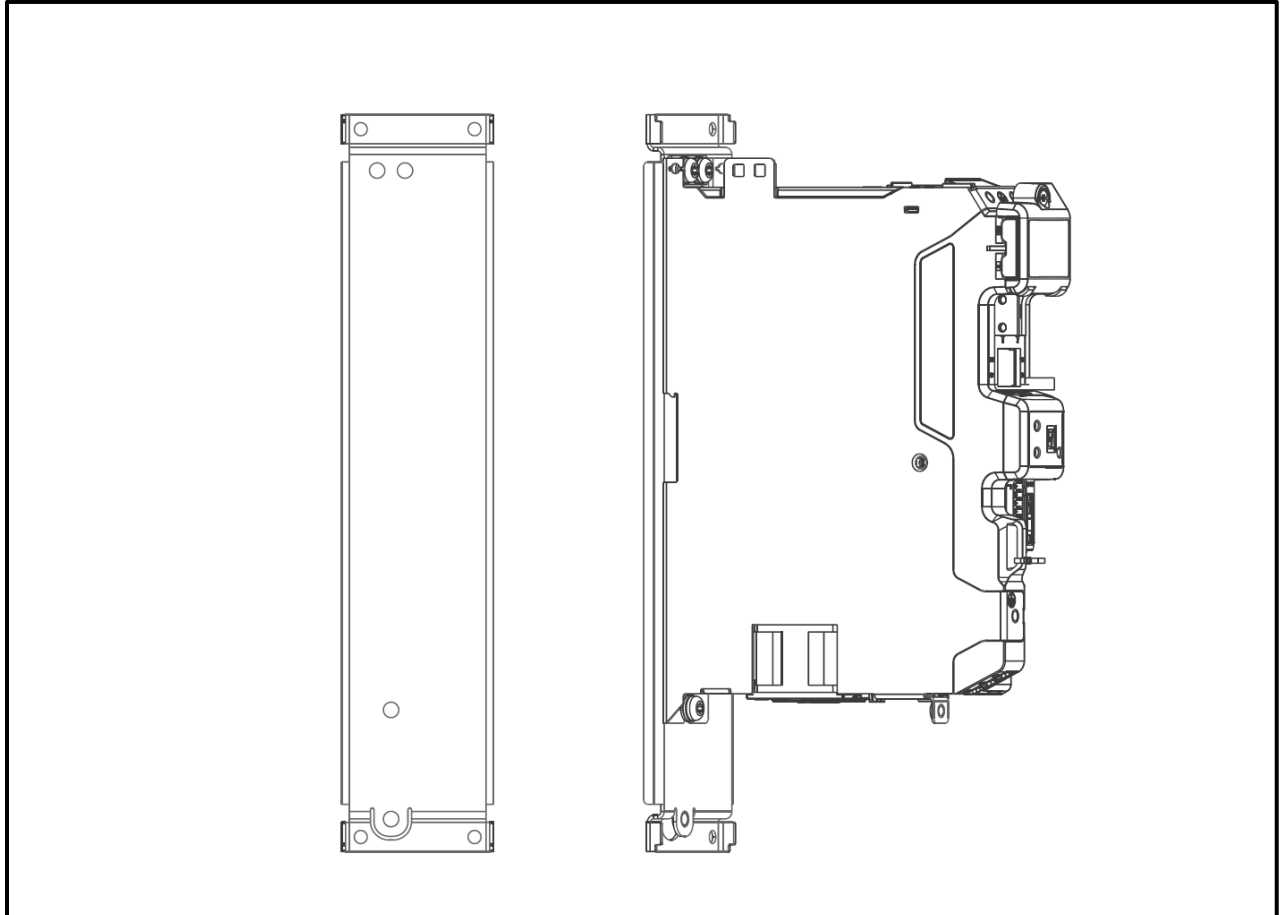
2.3 EMC filter mounting

Digitax ST has the option of footprint mounting the external EMC filter or mounting it to the side of the drive.

Figure 2-7 Side mounting (not attached to drive)
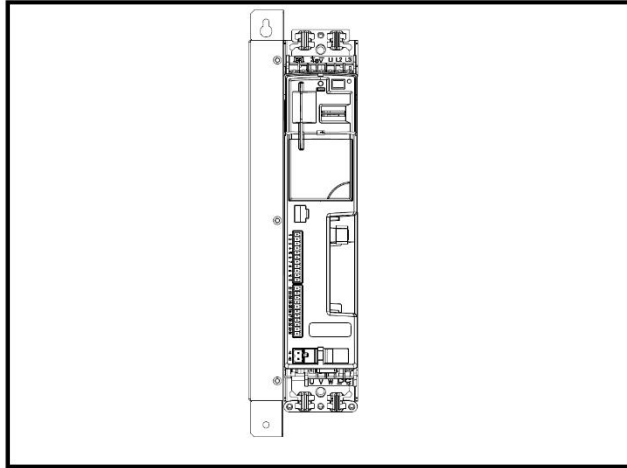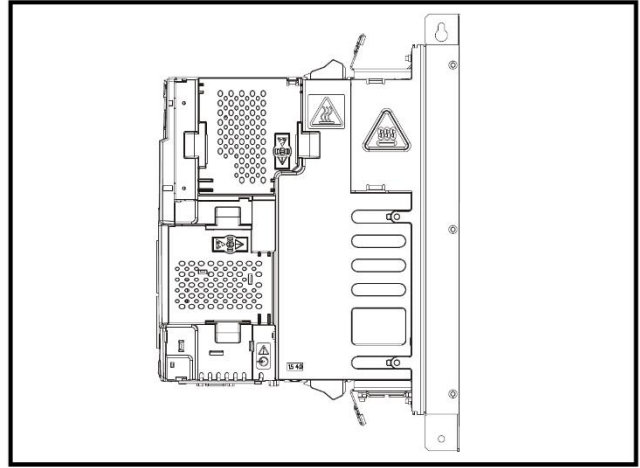

Figure 2-8 Footprint mounting (attached to drive)

Digitax HD does not have the option to mount the EMC filters directly to the drive. For a list of EMC filters for both Digitax ST and Digitax HD refer to Table 2-2.

**Table 2-2 EMC filters by part number for Digitax ST/Digitax HD**

Model Digitax ST / Digitax HD	Voltage rating V	Number of input phases	Filter part number	Dimensions		
				H	W	D
DST1201	200	1	4200-6000	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01200022			4200-3503	149.5 mm (5.89 in)	105 mm (4.13 in)	57.6 mm (2.27 in)
DST1202	200	1	4200-6000	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01200040			4200-3503	149.5 mm (5.89 in)	105 mm (4.13 in)	57.6 mm (2.27 in)
DST1203	200	1	4200-6000	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01200065			4200-3503	149.5 mm (5.89 in)	105 mm (4.13 in)	57.6 mm (2.27 in)
DST1204	200	1	4200-6000	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X02200090			4200-5033	230 mm (9.06 in)	115 mm (4.53 in)	60 mm (2.36 in)
DST1201	200	3	4200-6001	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01200022			4200-8744	204 mm (8.03 in)	40 mm (1.57 in)	70 mm (2.76 in)
DST1202	200	3	4200-6001	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01200040			4200-6002	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
DST1203	200	3	4200-6001	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01200065				359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
DST1204	200	3	4200-6001	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X02200090			4200-5833	290 mm (11.42 in)	50 mm (1.97 in)	85 mm (3.35 in)
DST1401	400	3	4200-6002	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01400015			4200-8744	204 mm (8.03 in)	40 mm (1.57 in)	70 mm (2.76 in)
DST1402	400	3	4200-6002	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01400030			4200-8744	204 mm (8.03 in)	40 mm (1.57 in)	70 mm (2.76 in)
DST1403	400	3	4200-6002	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X01400042			4200-8744	204 mm (8.03 in)	40 mm (1.57 in)	70 mm (2.76 in)
DST1404	400	3	4200-6002	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X02400060			4200-1644	264 mm (10.39 in)	45 mm (1.77 in)	70 mm (2.76 in)
DST1405	400	3	4200-6002	359 mm (14.13 in)	61 mm (2.40 in)	29 mm (1.14 in)
M75X02400080			4200-1644	264 mm (10.39 in)	45 mm (1.77 in)	70 mm (2.76 in)

In retro-fit applications (where replacement is based on matched drive ratings), existing Digitax ST filters will continue to attenuate conducted emissions but compliance with category C1 and C2 of IEC61800-3 cannot be guaranteed.

2.5 Braking resistor positioning

Figure 2-9 Digitax ST braking resistor position
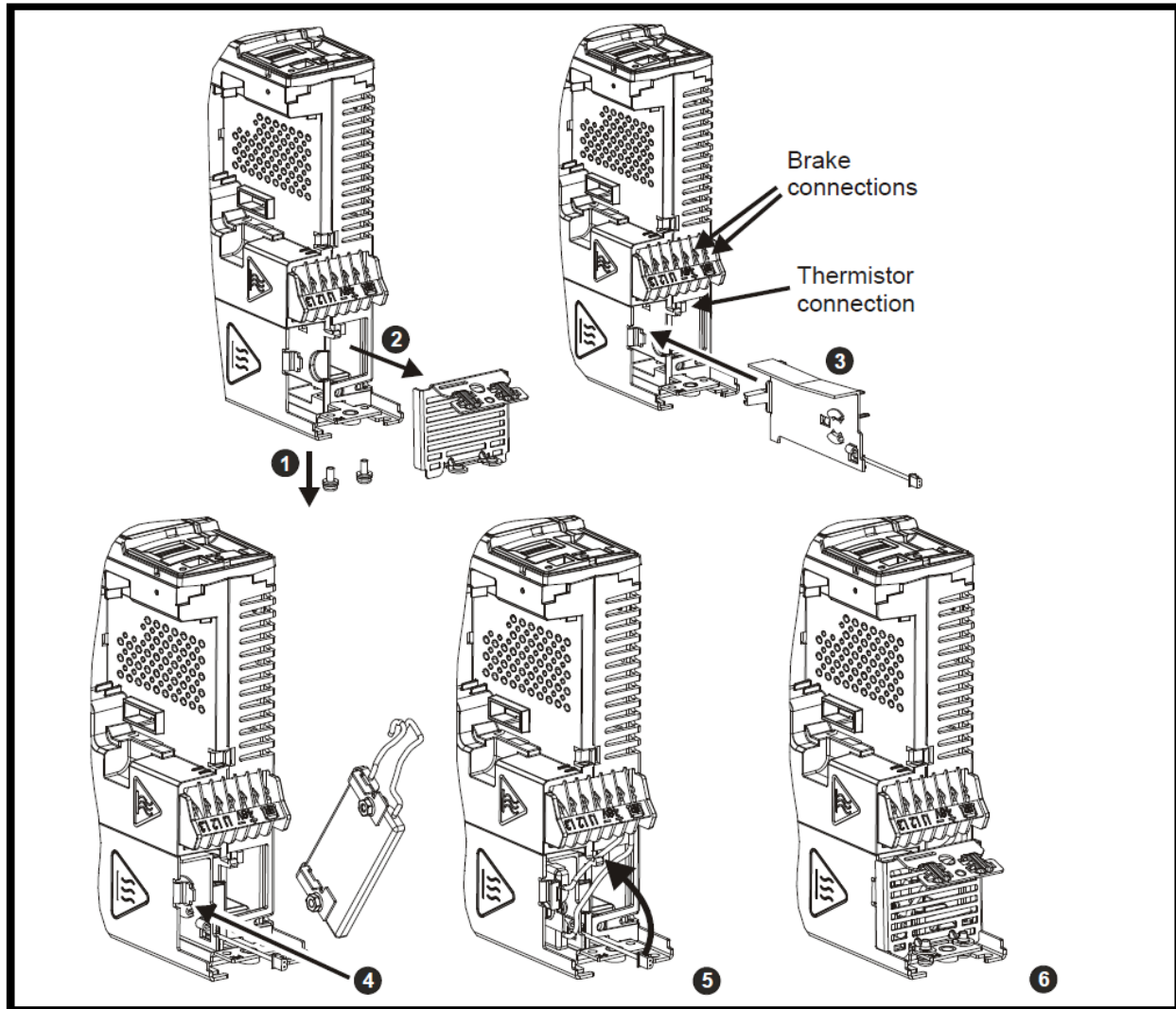
Whilst the electrical characteristics of the internal braking resistors for both Digitax ST and Digitax HD are the same, they are dimensionally different and therefore cannot be interchanged.

Figure 2-10   Digitax HD braking resistor position
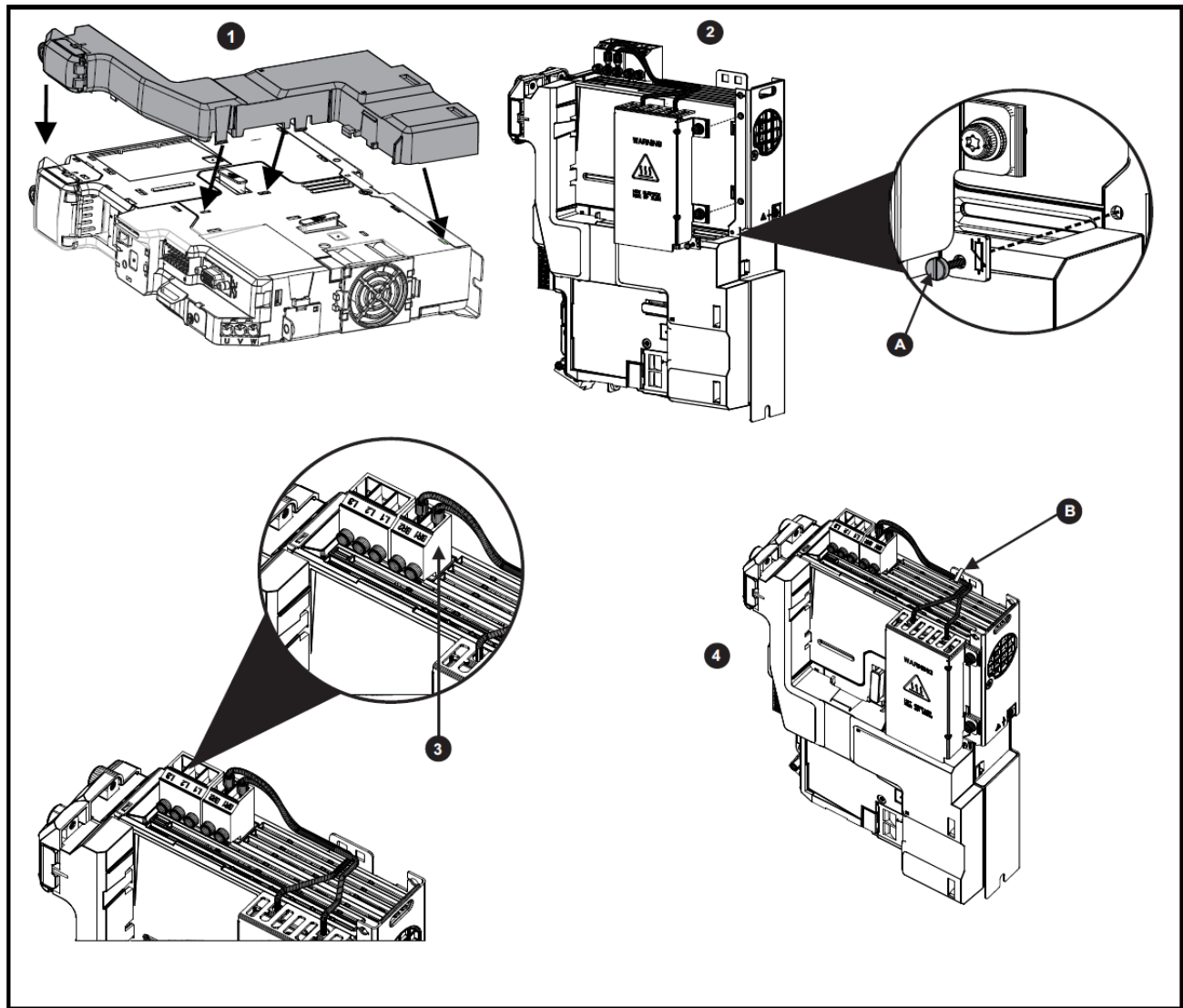
Installation procedure:

1. Install the SI Option module mounting kit.

2. Secure the contact brake assembly to the metal side panel using two M3 mounting screws. Attach and secure the M2 screw (A).

3. Connect the brake resistor cables to terminals BR1 and BR2 on the brake terminal connector.

4. Secure cables to bracket (B).

Table 2-3   Internal/compact braking resistor data

Parameter	Digitax ST		Digitax HD	
Part number	1299-0001		9500-1049	
DC resistance at 25°C	70 Ω		70 Ω	
Peak instantaneous power over	200 V	400 V	200 V	400 V
1ms at nominal resistance	2.2 kW	8.7 kW	2.2 kW	8.7 kW
Average power over 60 s	50 W		50 W	
Height	42.5 mm (1.68 in)		68 mm (2.68 in)	
Width	90 mm (3.57 in)		130 mm (5.12 in)	
Depth	6 mm (0.24 in)		15 mm (0.59 in)	

2.6   DIN rail assembly

DIN rail attachment positions differ between Digitax ST and Digitax HD.

The DIN rail attachment for Digitax ST is at the bottom of the drive as shown in Figure 2-11. Digitax HD DIN rail assembly is in a central position, as shown in Figure 2-12. Therefore, depending on the drive/enclosure layout there may be a requirement to reposition some of the enclosure components when migrating from Digitax ST to Digitax HD. Digitax HD DIN rail mounting positions are given in figure 2-13

Figure 2-11   Digitax ST DIN rail alignment
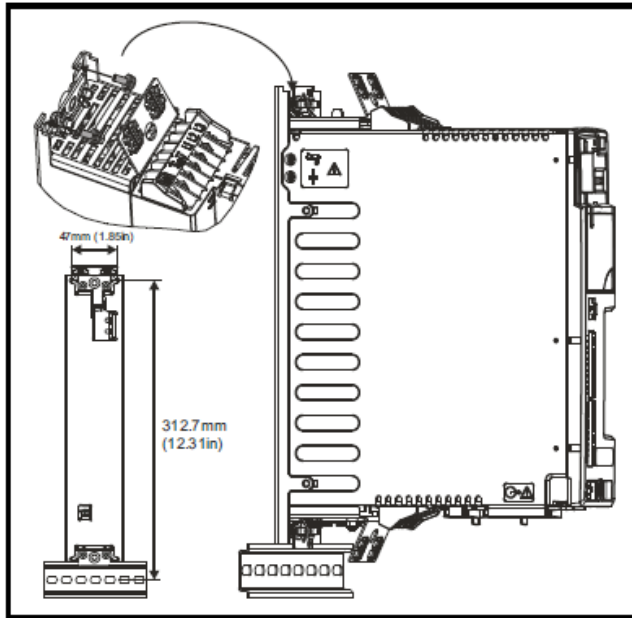
Figure 2-12 Digitax HD DIN rail alignment
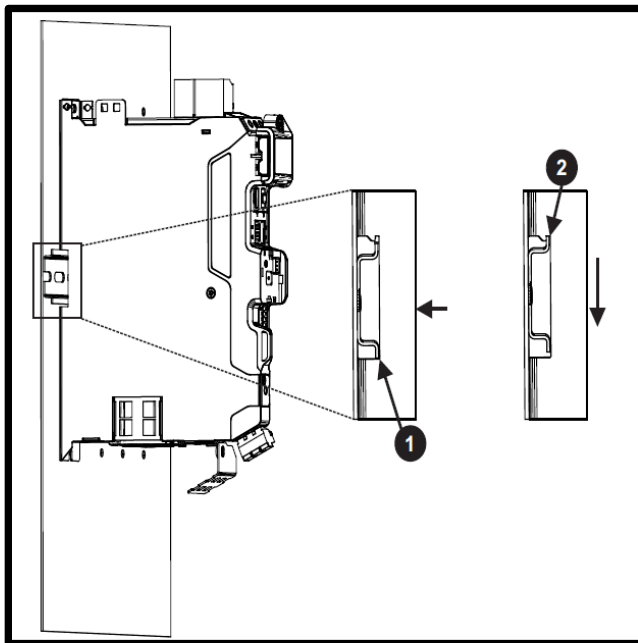
- Fit the drive over the DIN rail with the bottom rail flush against the lower edge of the recess at the rear of the drive (1)
- Slide the drive down so that the top rail sits into the channel at the upper edge of the recess at the rear of the drive (2)

Figure 2-13 Digitax HD mounting dimensions with DIN rail alignment (no option module support)

The DIN rail attachment is for alignment only and must not be used alone for drive mounting.

CAUTION

2.7   Hand tools required for setting up and installing the drive

The following hand tools are required for the setting up and installation of the Digitax ST and Digitax HD series.

Table 2-4   Hand tools required for setting up and installing the drive

Tool	Digitax ST	Digitax HD
Pozi PZ2 screwdriver	●	
T10 torx screwdriver	●	●
T20 torx screwdriver		●
2.5mm flatblade screwdriver	●	●

2.8   Terminal torque settings and cable sizes

Table 2-5   Digitax ST / Digitax HD terminal data

Model	Terminal description	Max cable size	Min cable size	Recommended torque	Tool
Digtiax ST	AC power terminal connector	2.5 mm^2 (14 AWG)	0.75mm^2 (16 AWG)	1 Nm (12.1 lb in)	
Digtiax HD		4 mm^2 (10 AWG)	0.5 mm^2 (20 AWG)	0.7 Nm (6.2 lb in)	
Digtiax ST	Motor power terminal connector	0.75 mm^2 (18 AWG)	0.75 mm^2 (18 AWG)	1 Nm (12.1 lb in)	
Digtiax HD		1 mm^2 (14 AWG)	0.5 mm^2 (20 AWG)	0.5 Nm (4.4 lb in)	
Digtiax ST	Brake terminal connector	2.5 mm^2 (14 AWG)	0.75mm^2 (16 AWG)	1 Nm (12.1 lb in)	2.5mm flat blade screwdriver
Digtiax HD		4 mm^2 (10 AWG)	0.5 mm^2 (20 AWG)	0.7 Nm (6.2 lb in)	
Digtiax ST	Control terminal	1.5 mm2 (16 AWG)	1.5 mm2 (16 AWG)	0.2 Nm (1.7 lb in)	
Digtiax HD		1.5 mm^2 (16 AWG)	0.2 mm^2 (24 AWG)		
Digtiax HD	+24 V supply connector	6 mm^2 (8 AWG)	0.5 mm^2 (20 AWG)	0.5 Nm (4.4 lb in)	
Digtiax HD	DC busbar			2 Nm (17.7 lb in)	T20 Torx screwdriver
Digtiax HD	Ground busbar			2 Nm (17.7 lb in)	

Conclusion

Digitax HD is smaller in height, width and depth than Digitax ST. However, when the SI-Option mounting kit is fitted to Digitax HD both drives measure a width of 62mm. A retrofit plate is available to aid re-installation with Digitax HD.

The DIN rail assembly position is more central to the Digitax HD than the Digitax ST so when using the DIN rail for alignment it is possible that adjustments to the position of some components may be necessary.

The internal braking resistors are equally matched electrically although the Digitax HD compact brake assembly is larger in size. This will not pose any problems from a mechanical installation viewpoint as the braking resistor is fitted within the confines of the drive.

3 Electrical

3.1 Power and ground connections

Figure 3-1 Digitax ST power and ground connections

Connectors specification:
Maximum size of power cable
= 4.0mm²(10AWG)
Torque setting = 1 N m

DST12XX = 200 to 240V±10%
DST14XX = 380 to 480V±10%

WARNING It is essential that the braking resistor be protected against overload caused by a failure of the brake control. Unless the resistor has in-built protection, a circuit like those shown in Figure 4-1 should be used, where the thermal protection device disconnects the AC supply to the drive. Do not use AC relay contacts directly in series with the braking resistor circuit, because it carries DC.

Terminals	Torque setting
Power terminals	1.0 N m (12.1 lb in)
Control terminals	0.2 N m (1.7 lb in)
Status relay terminals	0.5 N m (4.5 lb in)
Ground terminal screws	4 N m (35 lb in)
Small ground terminal screws	2 Nm (17.7 lb in)
**Torque tolerance = 10%	

NOTE

* When using a 200 V drive on a single phase supply, the live and neutral conductors can be connected to any of the AC connectors on the drive.

** This is not required if the optional internal braking resistor is used

Figure 3-2   Digitax HD power and ground connections

Model size	Terminal block description	Recommended torque*
All	AC power terminal connector	0.7 N m (6.2 lb in)
	Motor power terminal connector	0.5 N m (4.4 lb in)
	Brake terminal connector	0.7 N m (6.2 lb in)
	DC busbar	2.0 N m (17.7 lb in)
	Ground busbar	2.0 N m (17.7 lb in)
	Internal EMC filter screw	0.8 N m (7.1 lb in)
	Compact brake resistor mounting screw	0.8 N m (7.1 lb in)
	Compact brake resistor thermistor screw	0.3 N m (2.7 lb in)

* Torque tolerance = 10 %

NOTE

The Digitax HD motor cable connection is closer to the center of the drive and the DC terminals are at the opposite end of the drive compared with the Digitax ST, therefore if the motor cable installation or DC supply cable position/length on the Digitax ST is fixed and allows no additional movement there is a possibility that the existing cable will not reach the Digitax HD connectors.

3.2   AC supply requirements

Digitax HD allows for a wider range of supply frequency as shown in table 3-2

Table 3-1 Digitax ST / Digitax HD AC supply requirements

Model	Voltage	Frequency range
DST120X	200 V to 240V $\pm$ 10 % single phase	48 Hz to 65 Hz
Digitax HD 200 V	200 V to 240V $\pm$ 10 % single phase	45 Hz to 66 Hz
DST120X	200 V to 240V $\pm$ 10 % three phase*	48 Hz to 65 Hz
Digitax HD 200 V	200 V to 240V $\pm$ 10 % three phase*	45 Hz to 66 Hz
DST140X	380 V to 480 V $\pm$ 10 % three phase*	48 Hz to 65 Hz
Digitax HD 400 V	380 V to 480 V $\pm$ 10 % three phase*	45 Hz to 66 Hz

* Maximum supply in-balance: 2 % negative phase sequence (equivalent to 3 % voltage in-balance between phases).

3.3   AC Fusing and cable sizes

Table 3-2 Fuse ratings and cable size for Digitax ST/Digitax HD

Model Digitax ST / Digitax HD	Voltage rating V	Number of input phases	Nominal current A	Peak current A	Fuse rating A		Cable size			
					IEC class gG	UL class CC, J or T	Input mm²	Input AWG	Output mm²	Output AWG
DST1201	200	1	1.1	2.2	6	10	0.75	16	0.75	24
M75X01200022				6.6	8	15		14		
DST1202	200	1	2.4	4.8	10	10	1	16	0.75	22
M75X01200040			2.2	12	12	15	1.5	14		
DST1203	200	1	2.9	5.8	16	15	2.5	14	0.75	20
M75X01200065			3.5	19.5				12		
DST1204	200	1	4.7*	9.4	16	20	2.5	12	0.75	18
M75X02200090			5.6	27	25	25	4	10		16
DST1201	200	3	1.7	5.1	6	10	0.75	16	0.75	24
M75X01200022			2.2	6.6	8	15		14		20
DST1202	200	3	3.8	11.4	10	10	1	16	0.75	22
M75X01200040			4	12	12	15	1.5	14		18
DST1203	200	3	5.4	16.2	16	15	2.5	14	0.75	20
M75X01200065			6.5	19.5				14		16
DST1204	200	3	7.6	22.8	16	20	2.5	12	0.75	18
M75X02200090			9	27	25	25	4	10	1	14
DST1401	400	3	1.5	4.5	4	10	0.75	16	0.75	24
M75X01400015					6	15		14		20
DST1402	400	3	2.7	8.1	6	10	0.75	16	0.75	24
M75X01400030			3	9	8	15		14		20
DST1403	400	3	4	12	8	10	0.75	16	0.75	22
M75X01400042			4.2	12.6		15		14		18
DST1404	400	3	5.9	17.7	10	10	1	16	0.75	20
M75X02400060			6	18	16	25	2.5	14		16
DST1405	400	3	8	24	12	15	1.5	14	0.75	18
M75X02400080					16	25	2.5	12		14

NOTE

If the motor and load conditions remain the same, there is no requirement to change fuses or cables when retrofitting a Digitax HD in place of a Digitax ST.

Maximum AC branch circuit fuse ratings for multiple drive installations are listed in table 3-3 below.

Table 3-3   Maximum AC input fuse ratings

Model	Fuse rating IEC class gG	Fuse rating IEC class CC	Fuse rating IEC class J
	A	A	A
Digitax ST - All Variants	20	20	
Digitax HD - All Variants	40		40

3.4   DC supply requirements

Table 3-4 Digitax ST / Digitax HD DC supply requirements

| Model	Under voltage threshold	Standard under voltage threshold	Over voltage (Peak)	Over Voltage (Max continuous voltage for >15 s)
	(Vdc)	(Vdc)	(Vdc)	(Vdc)
DST120X	175		415	400
Digitax HD 200 V		230	415	410
DST140X	330		830	800
Digitax HD 400 V		330	830	815

3.5   DC supply connections

Digitax ST DC bus paralleling must be done by using cables as no pre-made DC busbar kits are available. Digitax HD can be paralleled by using cables or by using the custom DC busbar links.

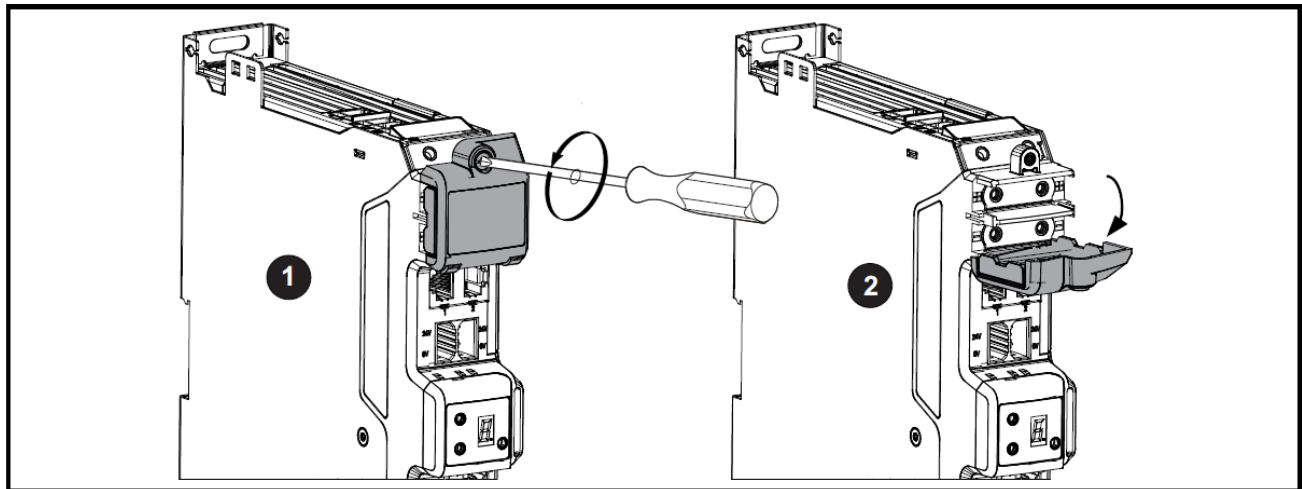### 3.5.1   Digitax HD DC terminal access

The DC supply connections are located under the DC terminal cover.

Figure 3-3 Location of DC terminal cover (Digitax HD)
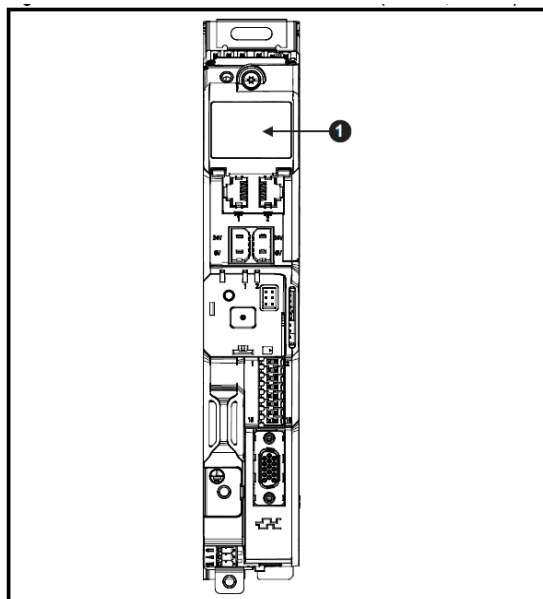
1 – DC terminal cover

**Figure 3-4 Accessing the DC supply terminals (Digitax HD)**

1. Undo the Torx slotted screw (T10 torx screwdriver).
2. The DC cover can then be hinged downwards or removed.
When replacing the terminal covers, the M3 screw should be tightened to a torque of 1 N m (8.9 lb in).

3.5.2   Digitax HD DC paralleling using cables

DC supply cables up to 6mm^2 (AWG 10) can be connected directly to the DC terminals using a suitably insulated M4 ring crimp and cable grommet (CT part 3470-0145). DC terminal cover break out tab (1) will need to be removed when connecting DC cables and cable grommet, refer to figure 3-5 below.

Figure 3-5   DC supply connections and cable routing
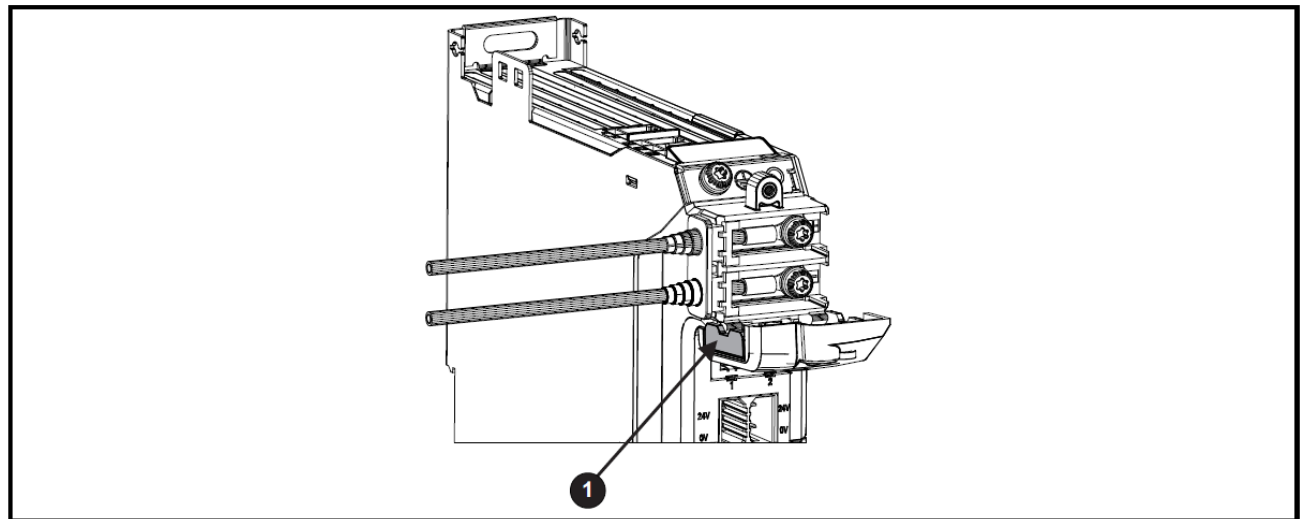
Larger external DC supply cables for multi axis installations (between 6mm^2 and 16mm^2) can be accommodated using an external DC bus cable connection kit (9500-1050). External DC bus cable connection kits can be installed using the steps outlined below:

Figure 3-6   External DC bus cable connection kit – installation step 1.
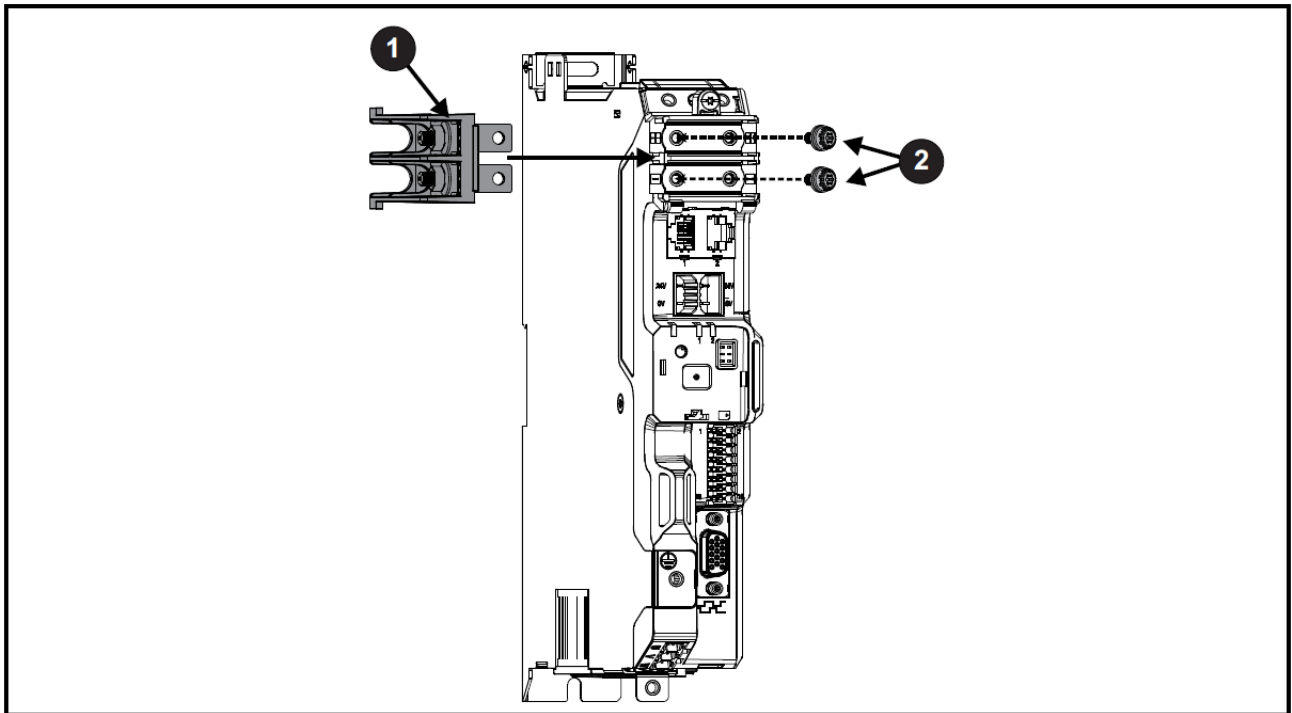
Installation step 1
• Attach the base assembly of the External DC bus cable connection kit to the drive (**1**).
• Secure the DC busbar terminals with the M4 screws (**2**) supplied with the kit.

Figure 3-7   External DC bus cable connection kit – installation step 2.
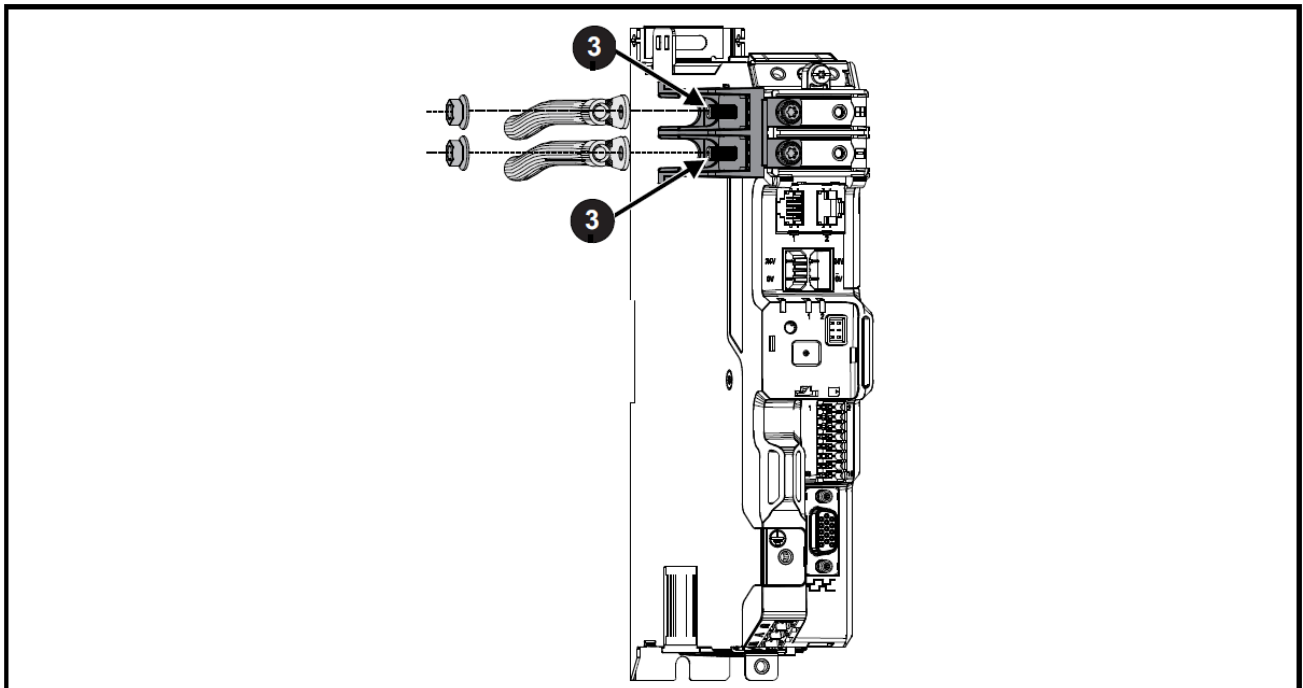
Installation step 2
• Connect the DC cables to the terminal studs of the External DC bus cable connection kit (**3**) and secure using the M5 nuts provided. Tools required - M8 socket and torque wrench, torque 4 N m (35.4 lb in).

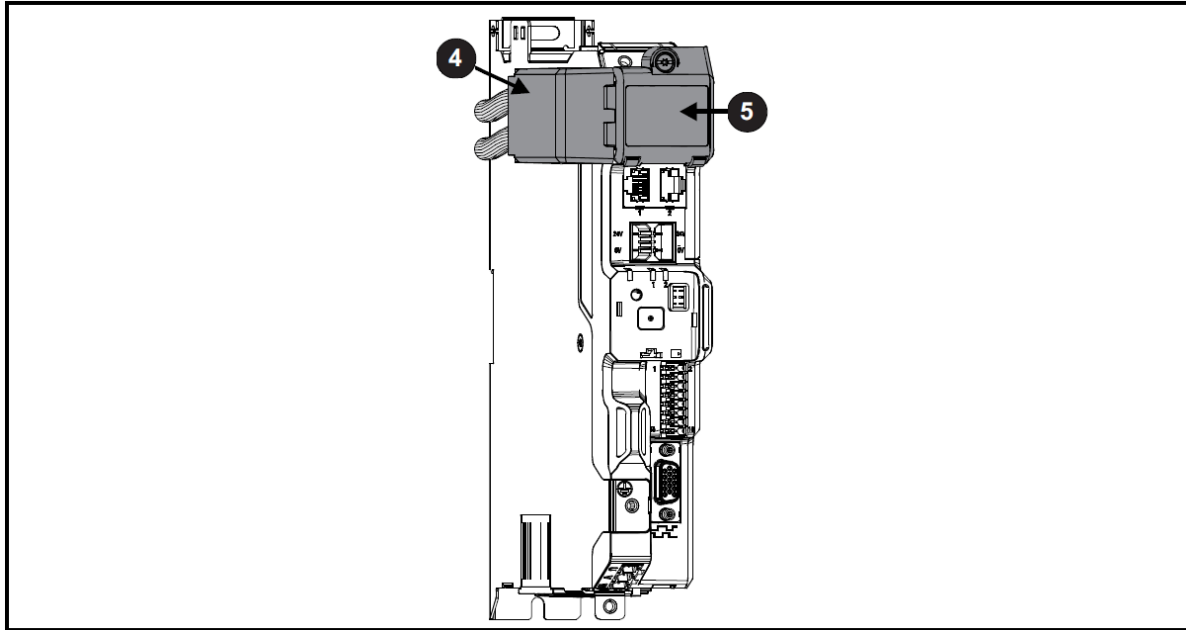**Figure 3-8   External DC bus cable connection kit – installation step 3.**

Installation step 3

• Slide the DC bus cable connection cover into position (**4**) and secure the DC terminal cover (**5**).

3.6   DC Fusing

NOTE

If the motor and load conditions remain the same, there is no requirement to change fuses or cables when retrofitting a Digitax HD in place of a Digitax ST.

Table 3-5   DC fuses

Model	Nominal AC input voltage V	Heavy duty current rating A	Fuse current rating A	
			Ferraz 6.900 CP URC 14 x 51 mm	Siba URZ 14 x 51 mm GR690 V
DST1201	230	1.7	20	25
M75X01200022		1.1		
DST1202		3.8	25	40
M75X01200040		2.2		
DST1203		5.4	32	40
M75X01200065		3.5		
DST1204		7.6	40	50
M75X02200090		5.6		
DST1401	400	1.5	25	25
M75X01400015		1.5		
DST1402		2.7	25	25
M75X01400030		3.0		
DST1403		4.0	25	25
M75X01400042		5.9		
DST1404		5.9	25	25
M75X02400060		6.0		
DST1405		8.0	32	25
M75X02400080		8.0		

3.7 Low voltage DC operation

Both the Digitax ST and Digitax HD drives can be operated from a low voltage DC supply. For Digitax ST it is nominally 24 Vdc (control) and 48 Vdc (power). The under voltage trip level is not programmable.

Digitax HD can operate from 24 Vdc up to the maximum DC volts. To fully exploit the new low voltage mode of operation, the under voltage trip level is now user programmable down to 24 Vdc. Refer to the relevant Digitax HD M75X parameter reference guide for more information.

3.7.1 Digitax ST and Digitax HD low voltage DC levels

Table 3-6 Low voltage DC levels

Condition	Digital ST value	Digitax HD value
Minimum continuous operating voltage	36 V	26 V
Minimum start up voltage	40 V	32 V
Maximum over voltage trip threshold	69 V to 104 V	230 V drives: 415 V
		400 V drives: 830 V

3.8 External 24 Vdc supply

Digitax ST

An optional auxiliary 24 Vdc power supply can be connected to act as a backup supply to maintain the drive control circuits when the line power supply is removed (to supplement the drive's own internal 24 V supply) however it is not necessary to connect this to run the drive.

Digitax HD

An external 24 Vdc supply must be connected to power all the low voltage circuits within the drive. The drive will power down and reset if the external 24 V is removed. The cable length between the 24 Vdc power supply and the drive should not exceed 10 m. The 0 V connection of the 24 Vdc power supply should be connected to the same ground connection as the drive. Where this is not possible the 0 V connection of the 24 Vdc power supply should be floating.

The external 24 V power and current requirements for Digitax HD and associated accessories is detailed in table 3-7 below.

NOTE

During start-up of the external 24 Vdc supply, allow for an additional 1 A for 300 ms per drive for all Digitax HD models.

Table 3-7 24 Vdc typical input current and power requirements

Model / Option / Feature	Frame size	Typical input current (mA) @ 24 V	Typical input power (W)
Digitax HD M75X drive module	1, 2	894	21.5
	3	1039	25
SI-option module	Per module	450	11
High current brake output	All	1200	28.8
KI-Compact display	All	10	0.24
KI-Remote LCD keypad	All	73	1.75

Digitax HD external 24 Vdc supply terminals

With reference to figure 3-9, the 24 Vdc supply connector has been designed to allow wiring from either the left or right hand side of the drive. The same plug should be used but attention is required to the polarity of the wiring. If it is reversed, the drive will not power up but will not be damaged.

For standalone drives connection to either terminal is permissible.

Figure 3-9 Location of external 24 Vdc supply terminals on Digitax HD
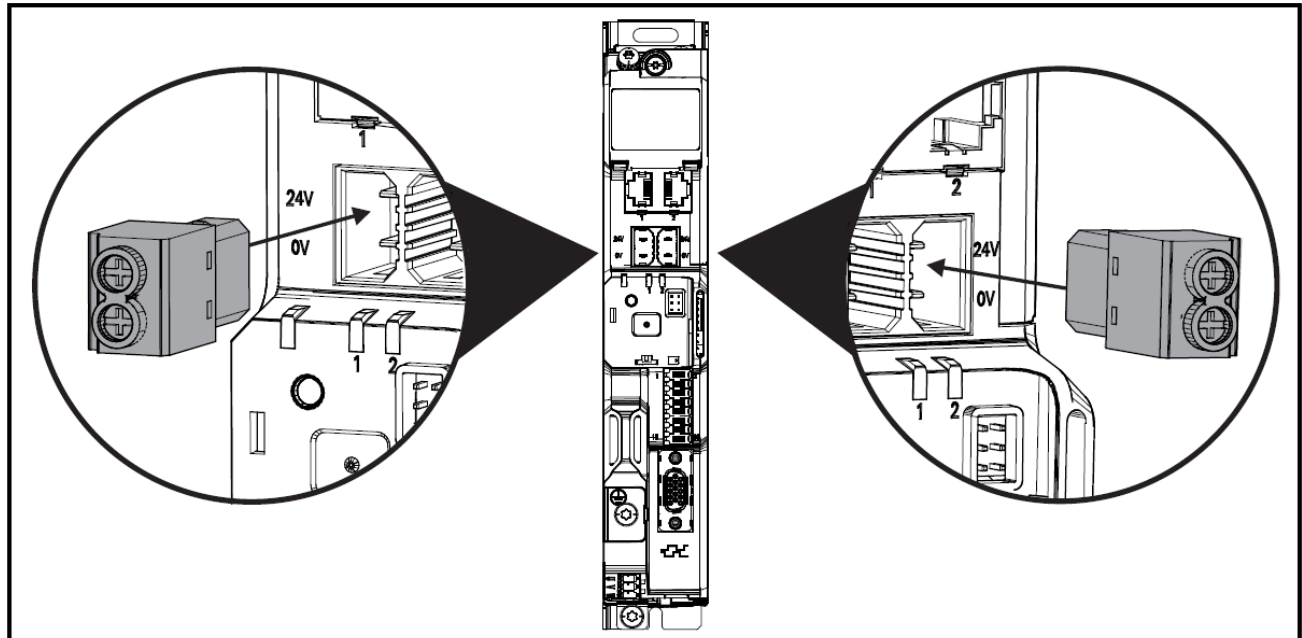
The working voltage range of the 24 V power supply for both versions of Digitax is listed below:

Table 3-8   Working voltage range of the 24 Vdc supply

All frame sizes	Digitax ST	Digitax HD
Nominal operating voltage	24.0 Vdc	24.0 Vdc
Minimum continuous operating voltage	19.2 V	20.4 V
Maximum continuous operating voltage	30. 0 V	28.8 V
Minimum start up voltage	21.6 V	20.4 V

3.9 Multi axis systems

NOTE

In a multi axis DC paralleled system where a Digitax ST is used to provide the DC supply is replaced by a Digitax HD, the replacement Digitax HD should be sufficiently sized to prevent its rectifier from being overloaded. The worst case system output power demand from all axes must not exceed the maximum rectifier power given in table 3-7 at any time.

NOTE

Some variants of Digitax HD have a higher internal DC capacitance than the equivalent Digitax ST. Where a replacement Digitax HD is fitted in a DC paralleled system, ensure that the rectifier maximum frame block capacitance continues to be greater than the sum of all the individual internal drive DC bus capacitance values with the replacement Digitax HD installed. Individual and maximum frame block capacitance is detailed in table 3-7.

NOTE

Digitax HD is not approved for AC and DC parallel systems, for retrofitting, the higher input power capability of the Digitax HD rectifier should be used to create separate DC frame blocks each with an individual AC branch circuit and the existing DC inductors removed.

Table 3-9 Multi axis ratings

Model	Voltage range	Internal drive DC capacitance	Maximum frame block capacitance when AC source	Maximum rectifier power
	V	μF	μF	kW
DST1201	200	440	2200	0.609
M75X01200022	200	580	5800	4
DST1202	200	880	2200	1.35
M75X01200040	200	580	5800	4
DST1203	200	880	2200	1.92
M75X01200065	200	580	5800	4
DST1204	200	1320	2200	2.38
M75X01200090	200	580	5800	4
DST1401	400	220	880	0.924
M75X01400015	400	110	1900	6.5
DST1402	400	220	880	1.63
M75X01400030	400	110	1900	6.5
DST1403	400	220	880	2.44
M75X01400042	400	110	1900	6.5
DST1404	400	220	880	3.58
M75X02400060	400	290	2030	8.7
DST1405	400	220	880	3.65
M57X02400080	400	290	2030	8.7

Conclusion

The Digitax HD motor cable connection is closer to the center of the drive and the DC terminals are at the opposite end of the drive compared with the Digitax ST, therefore if the motor cable installation or DC supply cable position/length on the Digitax ST is fixed and allows no additional movement there is a possibility that the existing cable will not reach the Digitax HD connectors.

If the motor and load conditions remain the same, there is no requirement to change fuses or cables when retrofitting a Digitax HD in place of a Digitax ST.

Digitax HD can operate from 24 Vdc up to the maximum DC volts. To fully exploit the new low voltage mode of operation, the under voltage trip level is now user programmable down to 24 Vdc

An external 24 Vdc supply must be connected to power all the low voltage circuits within the Digitax HD. The drive will power down and reset if the external 24 V is removed.

3.10 Analog and Digital I/O

Table 3-10 Summary of Digital and Analog I/O

Control connection	Inverter		
	Digitax ST	**Digitax HD**	**Digitax HD & SI-I/O**
Analogue input	3	1	4
Analogue output	2	0	1
10 V user output	1	0	0
Digital input	3	2	Additional 4 inputs or outputs
Digital output	3	2	
24 V control only input	1	0	0
24 V user output	1	1	1
Relay output	1	0	2
Safe torque off	1	2	2

Figure 3-10 Control terminal for Digitax ST

Figure 3-11 Control terminal for Digitax HD
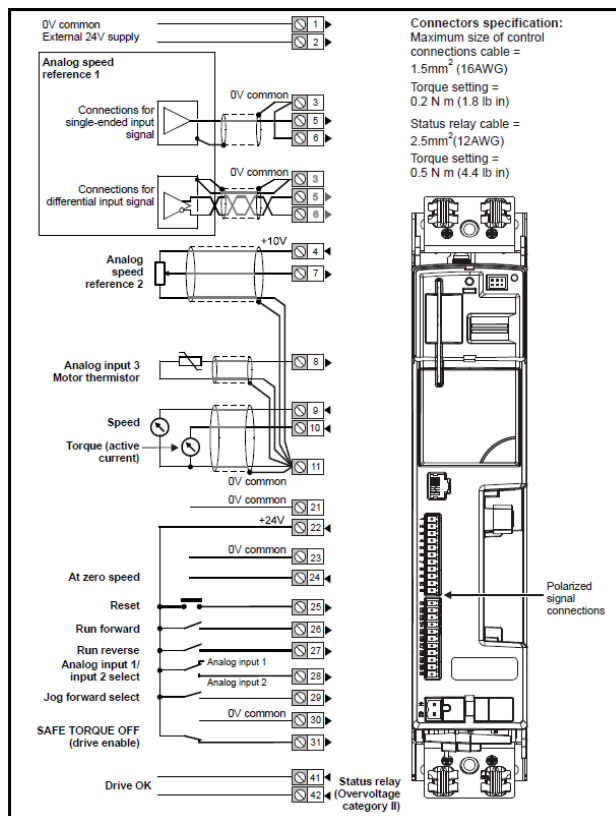
NOTE

Digitax HD is not fitted with a status relay. Pr **10.001** (Drive OK) can be set as a digital output source to give a 24 Vdc output, or monitored by a network.

The Digitax HD offers a more compact set of I/O to the Digitax ST. However, the functionality can be expanded by using a SI-I/O option module. This option module will provide the drive with, by default, 4 programmable digital inputs/outputs and three single ended analog inputs and one analog output, one high resolution differential analog input, one single ended analog input and one analog output. The equivalent option module for the Digitax ST is the SM-I/O module.
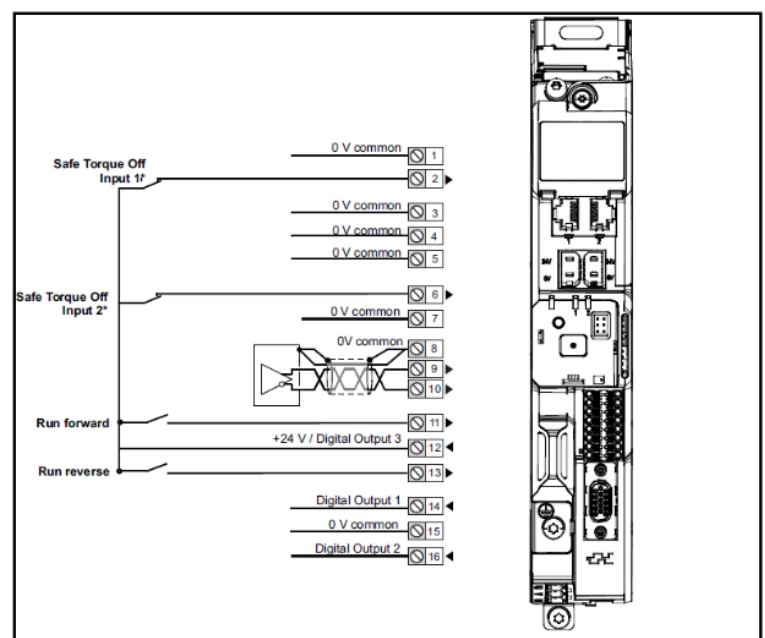
Table 3-11 Analog inputs

	Analog Input 1		Analog Input 2		Analog Input 3	
	Digitax ST	**Digitax HD**	**Digitax ST**	**Digitax HD**	**Digitax ST**	**Digitax HD**
Default function	Speed reference	Speed reference	Speed reference		Motor thermistor input (PTC)	
Type of input	Bipolar differential analog voltage	Bipolar differential analog voltage	Bipolar single-ended analog voltage or unipolar current		Bipolar single-ended analogue voltage, unipolar current or motor thermistor input	
Full scale voltage range	9.8 V	10 V	9.8 V		9.8 V	
Sampling period	250 µs with destinations as Pr **1.36**, Pr **1.37** or Pr **3.22**	250 µs with destinations Pr **01.036**, Pr **01.037**, Pr **03.022** or Pr **04.008** in RFC-A and RFC-S modes. 4 ms for open loop and all other destinations in RFC-A and RFC-S modes	250 µs when configured as voltage input with destinations as Pr **1.36**, Pr **1.37**, Pr **3.22** or Pr **4.08**		250 µs when configured as voltage input with destinations as Pr **1.36**, Pr **1.37**, Pr **3.22** or Pr **4.08**	
Resolution	16-bit plus sign	11-bit plus sign	10-bit plus sign		10-bit plus sign	

Table 3-12 Analog outputs

	Analog Output 1		Analog Output 2	
	Digitax ST	**Digitax HD**	**Digitax ST**	**Digitax HD**
Default function	Speed output signal		Motor active current	
Type of output	Bipolar single-ended analog voltage or unipolar single ended current		Bipolar single-ended analog voltage or unipolar single ended current	
Full scale voltage range	9.6 V		9.6 V	
Sampling period	250 µs when configured as a high speed output with sources as Pr **4.02**, Pr **4.17**, Pr **3.02** or Pr **5.03**. 4 ms when configured as any other type of output or with all other sources.		250 µs when configured as a high speed output with sources as Pr **4.02**, Pr **4.17**, Pr **3.02** or Pr **5.03**. 4 ms when configured as any other type of output or with all other sources.	
Resolution	10-bit plus sign		10-bit plus sign	

Table 3-13 Digital inputs

	Digital Input 4		Digital Input 5		Digital Input 6	
	Digitax ST	**Digitax HD**	**Digitax ST**	**Digitax HD**	**Digitax ST**	**Digitax HD**
Default function	RUN REVERSE input	RUN FORWARD input	Analog INPUT 1 / INPUT 2 select	RUN REVERSE input	JOG SELECT input	
Type of input	Positive or negative logic digital inputs	Positive or negative logic digital inputs	Positive or negative logic digital inputs	Positive or negative logic digital inputs	Positive or negative logic digital inputs	
Voltage range	0 V to +24 V	0 V to +24 V	0 V to +24 V	0 V to +24 V	0 V to +24 V	
Sampling period	1 µs when T27 (Digital Input 4) destination is Pr **8.40**. 250 µs with destinations as Pr **6.35** or Pr **6.36**. 600 µs with destination as Pr **6.29**. 4 ms in all other cases	250 µs when configured as an input with destinations Pr **06.035** or Pr **06.036**. 600 µs when configured as an input with destination Pr **06.029**. 2 ms in all other cases	1 µs when T27 (Digital Input 4) destination is Pr **8.40**. 250 µs with destinations as Pr **6.35** or Pr **6.36**. 600 µs with destination as Pr **6.29**. 4 ms in all other cases	250 µs when configured as an input with destinations Pr **06.035** or Pr **06.036**. 600 µs when configured as an input with destination Pr **06.029**. 2 ms in all other cases	1 µs when T27 (Digital Input 4) destination is Pr **8.40**. 250 µs with destinations as Pr **6.35** or Pr **6.36**. 600 µs with destination as Pr **6.29**. 4 ms in all other cases	
Impedance	6 kΩ	6 kΩ	6 kΩ	6 kΩ	6 kΩ	

Table 3-14 Digital outputs

	Digital I/O 1	Digital Output 1	Digital I/O 2	Digital Output 2	Digital I/O 3	Digital Output 3 (selectable)
	Digitax ST	**Digitax HD**	**Digitax ST**	**Digitax HD**	**Digitax ST**	**Digitax HD**
Default function	AT ZERO SPEED output	AT ZERO SPEED output	DRIVE RESET input	High current motor brake output	RUN FORWARD input	+24 V user output
Type of output	Positive or negative logic digital inputs, positve or negative logic push-pull outputs or open collector outputs	Positive logic source outputs	Positive or negative logic digital inputs, positve or negative logic push-pull outputs or open collector outputs	Positive logic source outputs	Positive or negative logic digital inputs, positve or negative logic push-pull outputs or open collector outputs	Can be switched on or off to act as a third digital output (positive logic only) by setting the source Pr **08.028** and source invert Pr **08.018**
Nominal working voltage range	0V to +24 V	0V to +24 V	0V to +24 V	0V to +24 V	0V to +24 V	24 V
Nominal maximum output current	200 mA	100 mA	200 mA	1 A (1.3 A max)	200 mA	100 mA
Sampling period	250 µs when configured as an input with destinations as Pr **6.35** or Pr **6.36**. 600 µs when configured as an input with destination as Pr **6.29**. 4 ms in all other cases.	2 ms (output will only change at the update rate of the source parameter)	250 µs when configured as an input with destinations as Pr **6.35** or Pr **6.36**. 600 µs when configured as an input with destination as Pr **6.29**. 4 ms in all other cases.	2 ms (output will only change at the update rate of the source parameter)	250 µs when configured as an input with destinations as Pr **6.35** or Pr **6.36**. 600 µs when configured as an input with destination as Pr **6.29**. 4 ms in all other cases.	2 ms when configured as an output (output will only change at the update rate of the source paramter if slower)

3.11   Control Terminal connectors

The control terminals for both Digitax ST and Digitax HD are pluggable.

3.12   Power terminal connectors

For Digitax ST, the AC supply, 48 Vdc supply and braking terminals are combined into a fixed terminal at the top of the drive. The motor output and DC bus terminals are combined into a fixed terminal at the bottom of the drive.

For Digitax HD, all power terminals are pluggable.

3.13   Internal EMC filter removal

Both Digitax ST and Digitax HD are fitted with internal EMC filters which should not be removed unless there is a reason for doing so. The filters are disconnected by removing a single screw on both drives.
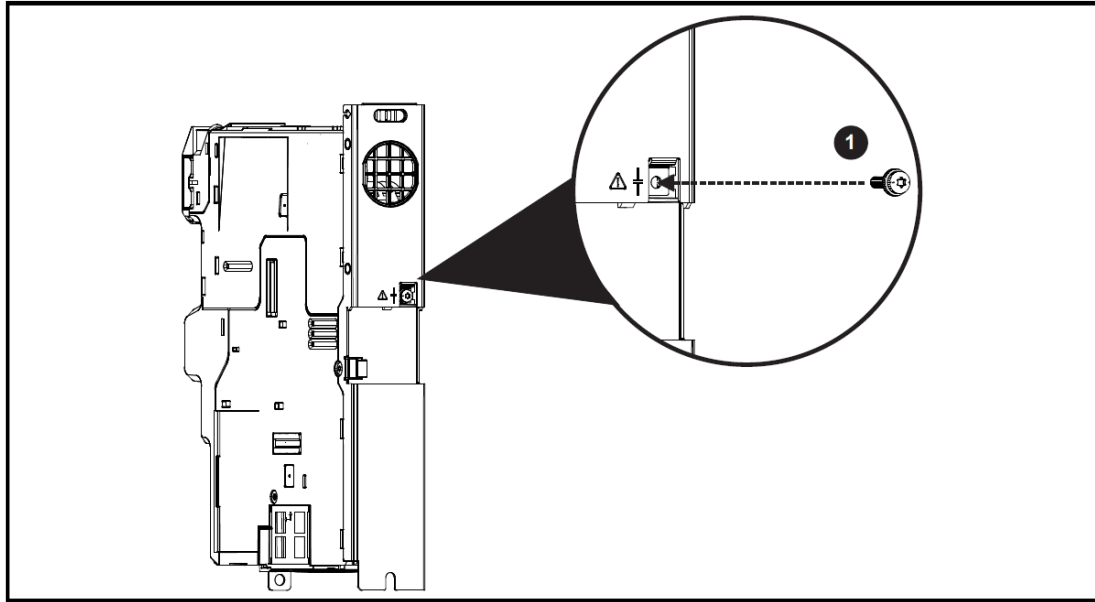
NOTE

Digitax ST also has line to ground varistors that can be disconnected. These are disconnected by removing the screw marked '2' in figure 3-12.

Figure 3-12   Disconnection of the internal EMC filter and line to ground varistors on Digitax ST
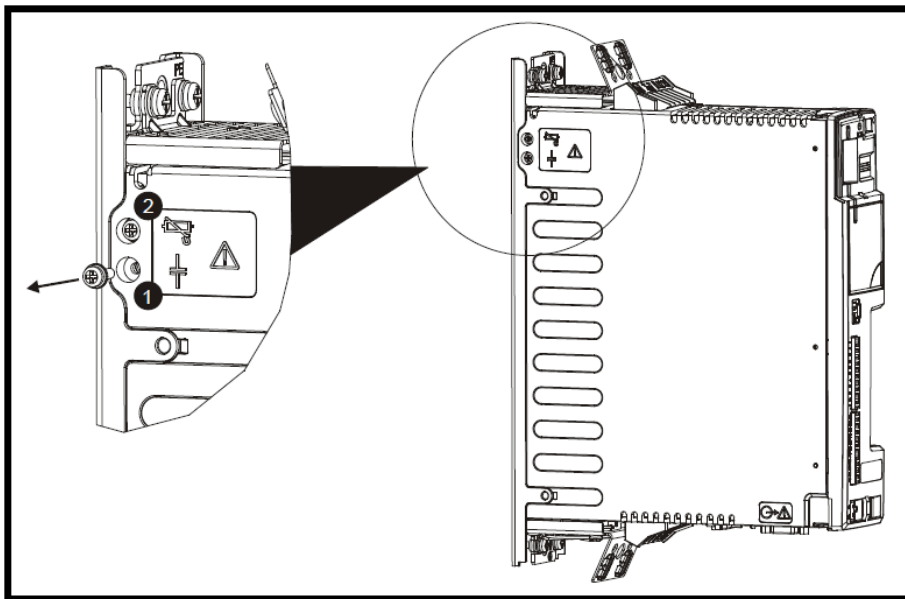
1. Internal EMC filter. Remove the bottom screw as shown.
2. Line to ground varistors. Remove the top screw as shown.

Figure 3-13   Disconnection of the internal EMC filter on Digitax HD

To electrically disconnect the EMC filter, remove the screw (1) as shown above

NOTE

Digitax HD does not have a screw to disconnect the line to ground varistors.

3.14   Communications

Digitax ST has a serial communications port (serial port) supporting 2 wire EIA485 communications via a RJ45 connector. Digitax HD M751 provides an internal RS485 comms interface, Digitax HD M750 an Ethernet internal interface and Digitax HD M753 an EtherCAT internal interface.

Digitax ST EtherCAT utilises an internal SM EtherCAT module.

Descriptions of the Unidrive M751 and M753 communications formats are detailed below.

3.14.1   RS485 (Digitax HD M751)

The 485 option provides two parallel RJ45 connectors allowing easy daisy chaining.

2–wire 485 communications on RJ45 connectors with same pin out as Digitax ST.

Digitax ST supports two protocols, Modbus RTU and CT ANSI. Digitax HD M751 only supports Modbus RTU. ANSIx3.28 is not supported as standard.

Digitax HD M751 includes parameters to change the data format (i.e. stop bits and parity) and to define the silent period.

3.14.2 EtherCAT

Table 3-15 EtherCAT interface features

Feature	Digitax ST	Digitax HD
Standard RJ45 with support for shielded twisted pair, half-duplex / full-duplex and 10 Mbs / 100 Mbs connectivity	●	●
Dual 100 Mbs EtherCAT interfaces for use in line topologies i.e. daisy chaining	●	●
Control loop synchronisation	●	●
Control cycle times down to 250 µs	●	●
Configured Station Alias	●	●
CANopen over EtherCAT (CoE)	●	●
Support of CAN open CiA402	●	●
Cyclic sync position mode	●	●
Cyclic sync velocity mode		●
Cyclic sync torque mode		●
Interpolated position mode	●	●
Velocity mode	●	●
Profile torque mode	●	
Homing mode	●	●
Two transmit and two receive PDO's	●	
One transmit and one receive PDO's via cyclic synchronous communication		●
Additional one transmit and one receive PDO's via non-synchronous cyclic communication		●
SDO access to all profile objects and drive parameters	●	●
Two digital inputs available for use in homing mode	●	
EoE (Ethernet over EtherCAT)	●	●

3.15   Braking resistors

Table 3-16   Minimum resistance and power ratings for Digitax ST / Digitax HD

Model	Voltage rating V	Minimum resistance Ω	Peak power rating kW	Continuous power rating kW
DST1201	200 V	23	6.6	0.5
M75X01200022		25	6	2
DST1202	200 V	23	6.6	1.2
M75X01200040		25	6	2
DST1203	200 V	23	6.6	1.6
M75X01200065		25	6	2
DST1204	200 V	16	9.3	2.3
M75X02200090		13	11.1	3.7
DST1401	400 V	111	5.5	0.8
M75X01400015		106	5.7	1.9
DST1402	400 V	111	5.5	1.4
M75X01400030		106	5.7	1.9
DST1403	400 V	75	8.1	2
M75X01400042		106	5.7	1.9
DST1404	400 V	28	21.7	3
M75X02400060		36	16.8	5.6
DST1405	400 V	28	21.7	4.1
M75X02400080		36	16.8	5.6

3.15.1 Braking resistor parameters

There are changes in the braking resistor parameter functions.

For Digitax ST, Pr **10.30** is the full power braking time and Pr 1**0.31** is the full power braking period.

Digitax HD has replaced the function of these parameters. Pr **10.031** is now the braking resistor rated power and Pr **10.031** is the braking resistor thermal time constant. In addition to this, Pr **10.061** has been included to capture the braking resistor resistance. This set up offers an improved and easier to set up method of braking resistor control.

Conclusion

Both drive types are provided in 200 V single phase and 400 V 3 phase versions. The Digitax HD can support a wider range of input frequency. In terms of low voltage DC levels, Digitax HD's maximum continuous operating voltage and minimum start up voltage are lower than Digitax ST.

When switching from a Digitax ST to a Digitax HD, a 24 V DC supply is needed to power the low voltage requirements. A power supply protected to 30 A is required for this purpose.

DC paralleling is easier by using the DC busbars on Digitax HD. This removes the need for cabling that was previously required with Digitax ST.

Where Digitax HD is used as a direct replacement for Digitax ST, if the motor and load conditions remain the same then there is no requirement to change the AC fusing or cables.

There is reduced control terminal functionality with the availability of one analogue input for Digitax HD. Resolution is also slightly reduced. There are no analogue outputs on Digitax HD. Digital input/output functionality is maintained on Digitax HD with a faster sampling period for digital outputs.

4 Motor control

4.1 Performance

4.1.1 Current and speed loop sample times

The table below compares the current loop and speed loop update times for Digitax ST and Digitax HD.

Table 4-1 Comparison of current loop and speed loop update times

Switching frequency	Digitax ST		Digitax HD	
	Current loop	Speed loop	Current loop	Speed loop
2kHz			250µs	500µs
3kHz	167µs	250µs	167µs	250µs
4kHz	125µs	250µs	125µs	250µs
6kHz	83µs	250µs	83µs	250µs
8kHz	125µs	250µs	62.5µs	250µs
12kHz	83µs	250µs	83µs	250µs
16kHz			62.5µs	250µs

4.2 Position feedback

4.2.1 Supported position feedback types

The Digitax HD position feedback interface uses the same 15 way D-type terminal as used on Digitax ST. The main enhancements is the inbuilt second interface as standard. The table below compares the position feedback types supported on Digitax HD and Digitax ST.

Table 4-2 Feedback types supported

Position Feedback Type		Digitax ST	Digitax HD
AB	Digital incremental	Yes	Yes
FD		Yes	Yes
FR		Yes	Yes
AB Servo	Digital incremental with commutation signals	Yes	Yes
FD Servo		Yes	Yes
FR Servo		Yes	Yes
SC	Sincos incremental *[1]	Yes	Yes
SC Hiperface	Sincos with Hiperface communications	Yes	Yes
SC EnDat	Heidenhain encoders with EnDat comms	Yes	Yes
EnDat 2.1	EnDat communications only	Yes	Yes
SSI	SSI communications only	Yes	Yes
SC SSI	Sincos with SSI communications	Yes	Yes

[1] Digitax HD supports sincos encoders with small marker pulses, without the need for a UT03 (reference marker interface board).

4.3.2 Second position feedback input and encoder simulation output

For Digitax ST, an option module was required to provide a second position interface. The Digitax ST has a buffered encoder output, which derives its position from the drive encoder input. The buffered encoder output is sourced from the drive encoder input and can be any incremental type or any SIN/COS type.

For Digitax HD, the two position feedback interfaces and the encoder simulation output all share the same 15-way D-type connector on the drive, therefore, there are limitations on which functions can be provided simultaneously depending of what feedback devices are selected.

4.3.3 Encoder cable length compensation

Digitax HD provides encoder cable length compensation. This will allow the drive to compensate for the length of the encoder cable when used with communications only encoders such as EnDat (2.1 and 2.2) and BiSS. This will allow high baud rates to be used with longer encoder cable length (at least 100m). The maximum encoder communications baud rate on Digitax ST is 2 MBaud compared with 4 Mbaud on Digitax HD.

4.3.4 Freeze inputs

Digital inputs 4 or 5 (24V logic level) or the marker pulse inputs (485 logic level) on the position interfaces can be used as high speed freeze triggers. If a position feedback device doesn't use a marker input (such as an EnDat only or BiSS encoder) then the marker pulse input is available as a freeze input. Digitax ST has one high speed freeze input which has an update period of 1 µs when digital input 4 destination is Pr 8.40. With destinations set to Pr 6.35 or Pr 6.36 the update period is 250 µs. Digitax HD has a fastest update period of 250 µs when destinations Pr 06.035 and Pr 06.036 are used.

4.3.5 Thermistor input

The Digitax ST thermistor input on the encoder port is connected in parallel to the analogue input 3 (Terminal 8) on the drive. The encoder port on Digitax HD has its own dedicated thermistor input (pin 15) which is independent of the analogue inputs. Thermistor types supported are DIN44082 and KTY84.

Conclusion

Digitax HD offers AC induction motor control utilizing the open loop and RFC-A control methods as well as the RFC-S servo mode with or without a feedback sensor. Digitax ST is less flexible offering only closed loop servo control mode only. Digitax HD includes a 2 kHz switching frequency setting which was not included on Digitax ST. Current and speed loop update times on Digitax HD are at an equivalent or improved level.

Supported feedback devices are the same across both products. An in-built second interface is standard on the Digitax HD range.

5   Drive cloning and back up

Digitax ST supported a SMARTCARD for parameter cloning and back up. The SMARTCARD could also be used to clone or backup the onboard PLC program in the drive.

Digitax HD supports an SD card for parameter cloning and back up. It is not possible to use an SD card adaptor to transfer parameter sets between the Digitax ST and Digitax HD. The most effective method of transferring parameter sets from Digitax ST to Digitax HD is to:

- Open CT Soft and extract parameter set from the SMARTCARD via a SMARTCARD reader.

- Save parameter file, open Connect and load parameter file into Digitax HD.