

Fitting Yaskawa Inverter

How to fit a Yaskawa Inverter as a replacement in the field

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Version History

Version	Date	By	Description	Section	Notes
1	01/01/19	GMG	Original Release		
2	23/07/20	GMG	50 / 300Hz Contactors on ZX3 / Microline	2.7	Change text to reflect removal of 50/300Hz contactors and use 50Hz signal for inverter 50Hz signal
3	09/09/20	GMG	V5 software upgrade on E100s	2.6	Add links to the process for installing the latest v5 software
4	22/09/20	GMG	Alternative for InvZro on E100	2.7	Notes on how to use an alternative slice / IO channel for invZro Added a test at the end to check InvZro is functional Add check that the decel time of front end exceeds decel of back end
5	16/10/20	GMG	Anomalies on M008 upgrade	2.7.1	M008 is a post-refurb Microline with Wago slices and unique slice wiring, not quite the same as a machine wired as E100 from scratch. Modifications noted
6	08/06/22	GMG	Add Autoflow - Delta combination	2.8	A2018 is an autoflow with Twinsafe Fitted and a delta inverter
7	12/10/22	GMG	Y316 InvDP on TwinCAT2	2.1, 2.8	TwinCAT2 uses Y316, not the Standard Y271 as the Inv_DP Output
8	04/01/23	GMG	Add Beckhoff ZX3 Instructions	2.3	Instructions were for ZX4. Now added 50/300Hz Changeover Added Mapping details

1. Introduction-Upgrade Kit

There are two versions of the upgrade kit for these parts:

Stock No	Description	Used On
R0015105	Kit: Yaskawa Inverter Upgrade	All Autoflows ZX3, Zx4, ZX5 from Z043 -in Summary, all machines where inverter is in a separate cabinet from the front end PC
R0015105B	Kit: Yaskawa Inverter Upgrade - Same Cabinet	All Flowlines (with High speed ring upgrade) ZX3, Zx4 up to Z042 All Microlines - in Summary, all machines where the Inverter is located in the same cabinet as front end PC

1.1 What is the Yaskawa inverter?

- Like the Delta inverter, it has an internal PLC. We have worked alongside Goodwin Electronics to write a PLC program specifically for the Stuga machines.
- Unlike the Delta inverters, when we receive an inverter from Goodwin Electronics, it will already be pre-programmed and ready to run on any machine.
- This inverter can replace the Jaguar and the Delta inverters. It has STO functionality which will be used on new builds and can also be retrospectively wired into machines in the field if needed.
- This inverter has shown to provide more protection in fault scenarios than the Delta inverter. One of the worries of the Delta was how it handled issues on the incoming supply. The Yaskawa inverter has shown resilience to shorts, missing phases, phases to earth and other issues on both incoming and outgoing supplies.
- The Yaskawa inverter adds extra functionality as well. We can now monitor the zero speed of the spindles. This means we can more accurately time when we switch spindle relays on and off. This will lead to less arcing in spindle boxes and premature failure of spindle cards/relays.

 ...PLEASE NOTE: BEFORE DISCONNECTING AND RECONNECTING INVERTERS, ENSURE MACHINE IS POWERED DOWN!

1.2 Mechanical Fitting Notes

In place of a Delta inverter


The Yaskawa has a very similar outer body size to the Delta inverter. This means that it will fit into the same space that the Delta did. However, the hole centres are different. New holes will need to be drilled when first fitting a Yaskawa.

In place of a Jaguar inverter

The Yaskawa is much taller than the Jaguar inverter. This may mean that the Yaskawa will not fit in the same space that the Jaguar did. We had the same problem when replacing Jaguar with Delta. There has been occasions in some of the older style ZX cabinets where the plastic trunking had to be re-routed to allow the room for the new inverter to fit.

1.3 Wiring the Yaskawa Inverter

This is a general diagram for cabling into the different machine types - more details for each machine will follow

 ...The Yaskawa is sometimes supplied with a link wire between SC and SP. This link wire should be removed

When the inverter is fitted, the screen needs to be removed via the clip on the top. If you do not do this, the connector that is behind the screen can be bent out of place and the screen will not reconnect. The main cover that is at the front of the inverter needs to be removed with the screw at the bottom right. You then have to pinch either side of the inverter and lift the cover up.

You can then start wiring in cables from the original inverter setup as per table in the electrical drawing.

There will be some wiring that needs to be added. The table shows all extra wiring that is needed for the inverter. The extra wiring will need to splice off existing cables in the electrical cabinet. The Yaskawa inverter needs more IO than the Jaguar. If there is a Delta fitted, you will find that most of the IO will already be in.

1.4 Software Upgrades

Extra Functionality


The Yaskawa inverter has also been programmed to monitor the temperature of the dump resistor. If the machine has a dump resistor with a thermal overload on it, this needs to be wired into the inverter. The alarm for this input is only in fault state when the input is high. This means if you do not have a thermal overload, leave the input terminal empty.

The Yaskawa inverter also has an output to say the spindle is at zero speed. This will need to be wired back into the main machine PLC or IO slices. This will then need a software update from Stuga.

TwinCAT3 Notes

- Timing issues on switching the double plunge configuration means that another IO channel is needed – OuB_InvDP (Y271). This output used to directly control the inverter, not the Y376, Y377, Y58, Y62
- Version 6.2514 or later needed
- Mapping required for Y271

Software Version Requirements

Control System	Front End Version	Back End Version
Nextmove Mint	5.4.4.0 (29/06/16)	3.9997 (Feb 17) 
TwinCAT2	5.4.4.0 (29/06/16)	See GG
TwinCAT3	Any	6.2514 (24/10/18)

2. Machine Applications


2.1. Autoflow TwinCAT 2 Notes

Inverter

- Increase C1-01 accel time on 50Hz to 0.4
- Increase C1-05 accel time on 300Hz to 0.4
- Wire S1 to Module B Output Slice channel 1 (Y63)
- Wire S2 to Module B Output Slice channel 2 (Y63)
- Wire S3 and S4 to Module B Output Slice Channel 3 and 4 (Y376)
- 59a to 0v
- 24v link across 3 other inputs
- Inverter fault direct output (bypass the useless link through the overload relay)
- Inverter reset wire to output slice
- Inverter at zero wire to input slice channel 7 (X308)
- Resistor fault not working correctly, leave disconnected STO??! Inverter powers off on estop, works ok, leave links in HC, H1,H2

Back end

- Double link the double plunge outputs (Y316) 0> Channel 3 and 4

 ...This is different to the standard Y271. Only applies to TwinCAT2 controlled machines

- Link inverter reset (X308) -> Channel 7
- Link inverter zero
- Latest software version

Front end

- Ensure inverter alarm is correct sense
- Parameter Invert300hz=1
- Check inverter display changes to 300hz / 50 HS when spindles are selected

2.2. Flowline Mk3 Refurb TwinCAT3

- The phase monitoring device is not needed any more, but it is inactive, so can be left in place.
- Remove the cable 127 connecting SIG to the Delta inverter
- 3 new wires required, Y63 (Inv_300), Y271(Inv_Dp) and X308 (Inv_Zero)
- Y63, Y271 and X308 will need mapping in TwinCAT3 and adding to IO Ref
- Parameter Invert300Hz needs to be true
- Latest Software needs to be added to sort timings and use of Y63, Y271 and X308

Function	Wire Number / Colour	Yaskawa Terminal
Mains In L1, L2, L3	26, 27, 28	L1, L2, L3
Motor Out U, V, W	126, 127, 128	T1, T2, T3
Input: Select 50Hz #1	Y63 Wire to MC4 Ou7	S1
Input: Select 50Hz #2	Link to S1	S2

Input: Double Plunge #1	Y271 Wire To MC4 Ou8	S3
Input: Double Plunge #2	Link to S3	S4
Input: Motor Run	Y358	S5
Input: Inverter Reset	Y374	S6
Input: Resistor Thermal Ovl	n/c	S7
Input: Motor 2 Safety	Link to M4	S8
Inverter OK 24v	24v (Yellow)	MC
Inverter OK Output	X342	MB
Output 24v Supply	24v (Yellow)	M1, M3
Output: Spindle At Zero	New Wire X308 To io slice MC5 Input channel 8	M2
Output: Motor 2 Safety	Link to S8	M4
STO Override	Link	H1, H2, HC
External 0v	0v (White)	SC
Braking Resistor	1,2	B1, B2


IODef.mul additions

```
Inv_Zero,308,1,0,0,0,0,1,12,0
Inv_DP ,271,2,0,0,0,0,1,10,0
Inv_300 ,63,2,0,0,0,0,1,11,0
```

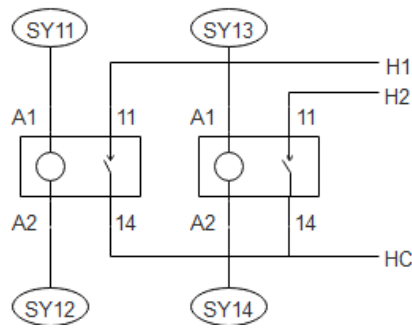
2.3. ZX3/4 Mk5/6 (Beckhoff and TwinSAFE) Retrofitting in place of Delta

Electrical Highlights:

- Ensure 24v connected to M1, M3 and MC
- There is a cable already labelled Y377.
 - This will be relabelled Y271 (OuB_InvDp) .
 - This connects to S3 and add link to S4.
- There is a cable already labelled Y376
 - This will be relabelled X308 (InA_InvZero)
 - At Yaskawa end, this connects to M2
 - At Beckhoff end, this was connected to MC3B pin 15 (OU1). This now needs to be moved to pin 4 (IN4)

 ...On some machines this cable is in MC3B pin 11

- A link wire between M4 and S8 needs to be added
- For ZX3 only, there are existing cables Y362 and Y363 (used to signal Delta to change to 50Hz)
 - Remove Y363 cable (Only one signal is needed on Yaskawa inverter)
 - Rename Y362 cable to Y63 (This is now OuB_300 output to tell Yaskawa to switch to 300Hz)
 - At Yaskawa end, Y63 cable connects to S1 with a link to S2
- Remove Wire 60B (From Aux contact on F5 to RC1 on Delta Inverter). Not needed because Inverter OK signal does not need to be in series with F5 overload
- Remove wire 61B from Phase monitor to Delta MI6. Not needed because Yaskawa does phase monitoring internally
- 2 additional 24v control relays needed for interfacing TwinSafe to the STO inputs as per diagram



Function	Wire Number / Colour	Yaskawa Terminal
Mains In L1, L2, L3	21B, 22B, 23B	L1, L2, L3
Motor Out U, V, W	70B, 71B, 72B	T1, T2, T3
Input: Select 50Hz #1	ZX4: n/c ZX3: Y63	S1
Input: Select 50Hz #2	ZX4: n/c ZX3: Link to S1	S2
Input: Double Plunge #1	Y271 -Wire To MC4 Ou8	S3
Input: Double Plunge #2	Link to S3	S4
Input: Motor Run	Y358	S5
Input: Inverter Reset	Y374	S6
Input: Resistor Thermal Ovl	n/c	S7
Input: Motor 2 Safety	Link to M4	S8
Inverter OK 24v	24v (Yellow)	MC
Inverter OK Output	X342	MB
Output 24v Supply	24v (Yellow)	M1, M3
Output: Spindle At Zero	New Wire X308 -To io slice MC3B IN4	M2
Output: Motor 2 Safety	Link to S8	M4
STO Override	Add 2 relays as per diagram. Relay control via Beckhoff safety slices	H1, H2, HC
External 0v	0v (White)	SC
Braking Resistor	1,2	B1, B2

IODEf.mul additions

```
Inv_Zero,308,1,0,0,0,0,19,5,0
Inv_DP ,271,2,0,0,0,0,19,6,0
OuB_50 ,63,2,0,0,0,0,19,7,0
```

Mapping

IO needs to be mapped for the new / remapped IO

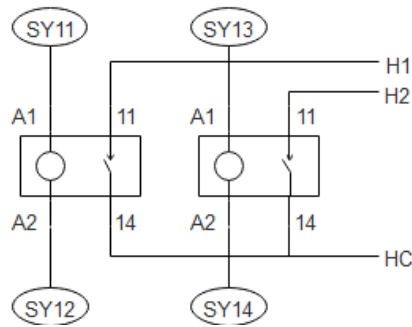
- X308 Inv_Zero New
- Y271 Inv_DP Replacing 377
- Y63 OuB_300 in place of 362

2.4. ZX5 Retrofitting in place of Delta

Electrical Highlights:

- Ensure 24v connected to M1 and M3
- Y271(OuB_InvDp) uses the existing cabling in S4, currently labelled Y377
 - A link will need to be added up to S3, where there currently is a cable labelled Y376
- Using Y376 cable, remove the labelling and label as X308 (InA_InvZero)

- The other end of this currently goes to the beckhoff slice MC2B pin 15 (OU7). This now needs to be moved to pin 4 (IN4), and relabelled.
- A link wire between M4 and S8 needs to be added
- 2 additional 24v control relays needed for interfacing TwinSafe to the STO inputs as per diagram



Function	Wire Number / Colour	Yaskawa Terminal
Mains In L1, L2, L3	21B, 22B, 23B	L1, L2, L3
Motor Out U, V, W	70B, 71B, 72B	T1, T2, T3
Input: Select 50Hz #1	n/c	S1
Input: Select 50Hz #2	n/c	S2
Input: Double Plunge #1	Y271 -Wire To MC2B Ou8	S3
Input: Double Plunge #2	Link to S3	S4
Input: Motor Run	Y358	S5
Input: Inverter Reset	Y374	S6
Input: Resistor Thermal Ovl	n/c	S7
Input: Motor 2 Safety	Link to M4	S8
Inverter OK 24v	24v (Yellow)	MC
Inverter OK Output	X342	MB
Output 24v Supply	24v (Yellow)	M1, M3
Output: Spindle At Zero	New Wire X308 -To io slice MC2B IN4	M2
Output: Motor 2 Safety	Link to S8	M4
STO Override	Add 2 relays as per diagram. Relay control via Beckhoff safety slices	H1, H2, HC
External 0v	0v (White)	SC
Braking Resistor	1,2	B1, B2

IODEf.mul additions

```
Inv_Zero,308,1,0,0,0,0,19,3,0
Inv_DP ,271,2,0,0,0,0,19,4,0
```

2.6. Flowline Mk3 Refurb Notes (Nextmove E100)

Electrical Highlights:

- To create space for the new inverter, remove the contactor and timer for delaying the drive switching (If they exist) – these are normally located under the old inverter. This switching was only necessary when a DOS PC was used, the contactor can be bypassed.
- The supply to the new inverter needs to be wired directly rather than via the estop contactor. The new drive has “STO” (Safe Torque Off) inputs that are wired through two 24v dc relays (supplied). This means when ESTOP is pressed, the drive does not power off, it goes into safe torque off mode. This is a much more reliable system than “crash” shutting off the inverter on estop.
- The phase monitoring device (if fitted) is not needed any more, but it is inactive, so can be left in place.
- The 50Hz relays for RY1 and RY4 should be removed and the wires RY1, RY4 wired directly to the inverter inputs S1 and S2. This removes the relays as a potential point of failure.

- Ensure 24v connected to MC, M1 and M3
- New cable for Y271(OuB_InvDp) from S3 and S4 (link), connect to Output channel 8 on 1st IO slice. Note: the SPDP wire (Y99) may be numbered Y58 and in the output channel 8. For consistency, make:
- Ou7 - SPDP - Y99
- Ou8 - Inv_DP - Y271
- New Cable X308 (InA_InvZero) from M2, connect to Input channel 7 on 4th IO slice.
- A link wire between M4 and S8 needs to be added
- 2 additional 24v control relays needed for interfacing Estop to the STO inputs as per diagram
- The Inverter OK signal (X27) should be wired directly from the inverter to the input slice – it is probably wired via the inverter overload relay auxiliary contact – this is now redundant and will cause confusion
- Remove the link SP to SC. This is for grounding an internal PSU that is not used
- Remove X99 wire, this was a feedback check to ensure the 50Hz relays had switched, no not required

Function	Wire Number / Colour	Yaskawa Terminal
Mains In L1, L2, L3	26, 27, 28	L1, L2, L3
Motor Out U, V, W	26B, 27B, 28B	T1, T2, T3
Input: Select 50Hz #1	RY1	S1
Input: Select 50Hz #2	RY4	S2
Input: Double Plunge #1	Y271 -Wire To Output channel 8 on 1 st IO slice	S3
Input: Double Plunge #2	Link to S3	S4
Input: Motor Run	Y9	S5
Input: Inverter Reset	Y6	S6
Input: Resistor Thermal Ovl	n/c	S7
Input: Motor 2 Safety	Link to M4	S8
Inverter OK 24v	24v (Yellow)	MC
Inverter OK Output	X27	MB
Output 24v Supply	24v (Yellow)	M1, M3
Output: Spindle At Zero	New Wire X308 - connect to Input channel 7 on 4 th IO slice.	M2
Output: Motor 2 Safety	Link to S8	M4
STO Override	Add 2 relays as per diagram.	H1, H2, HC
External 0v	0v (White)	SC
Braking Resistor	1,2	B1, B2

IODEf.mul additions

```
INVDP ,616,2,8,7,0,0,1,7,1
InZRO ,608,1,8,14,0,0,2,11,1
```

Ensure SPDP is:
 SPDP ,569,2,8,6,0,0,1,6,V

Delete any reference to IS300 input

Alarms.mul

Ensure the alarms are set for each individual spindle:

```
41,MOVL,False,SPIN1,True,0,4,Spindle 1 Alarm,True,False
42,MOVL,False,SPIN2,True,0,4,Spindle 2 Alarm,True,False
43,MOVL,False,SPIN3,True,0,4,Spindle 3 Alarm,True,False
44,MOVL,False,SPIN4,True,0,4,Spindle 4 Alarm,True,False
45,MOVL,False,SPIN5,True,0,4,Spindle 5 Alarm,True,False
46,MOVL,False,SPIN6,True,0,4,Spindle 6 Alarm,True,False
```

The MOVL should be High when the inverter is OK.
 Remove any alarms relating to IS300 input

Front end

- Update software to latest version 5 - see Upgrading to Version 5
- Ensure inverter alarm is correct sense (High when inverter OK)
- Parameter Invert300hz=1
- Parameter InverterOKHigh=1
- Parameter psInvDecel300Hz=400
- Check inverter display changes to 300hz / 50 HS when spindles are selected

Other software

Download and install Yaskawa DriveWizard

Ensure the Yaskawa USB is connected to the PC

Find the COM port it is connected to (use Device Manager Ports) – this is usually COM3. If there are other connections on the same COM port, right click and uninstall them (EDG). This will need a reboot after uninstalling

Using DriveWizard, or via the physical keypad on the device, change the following parameters

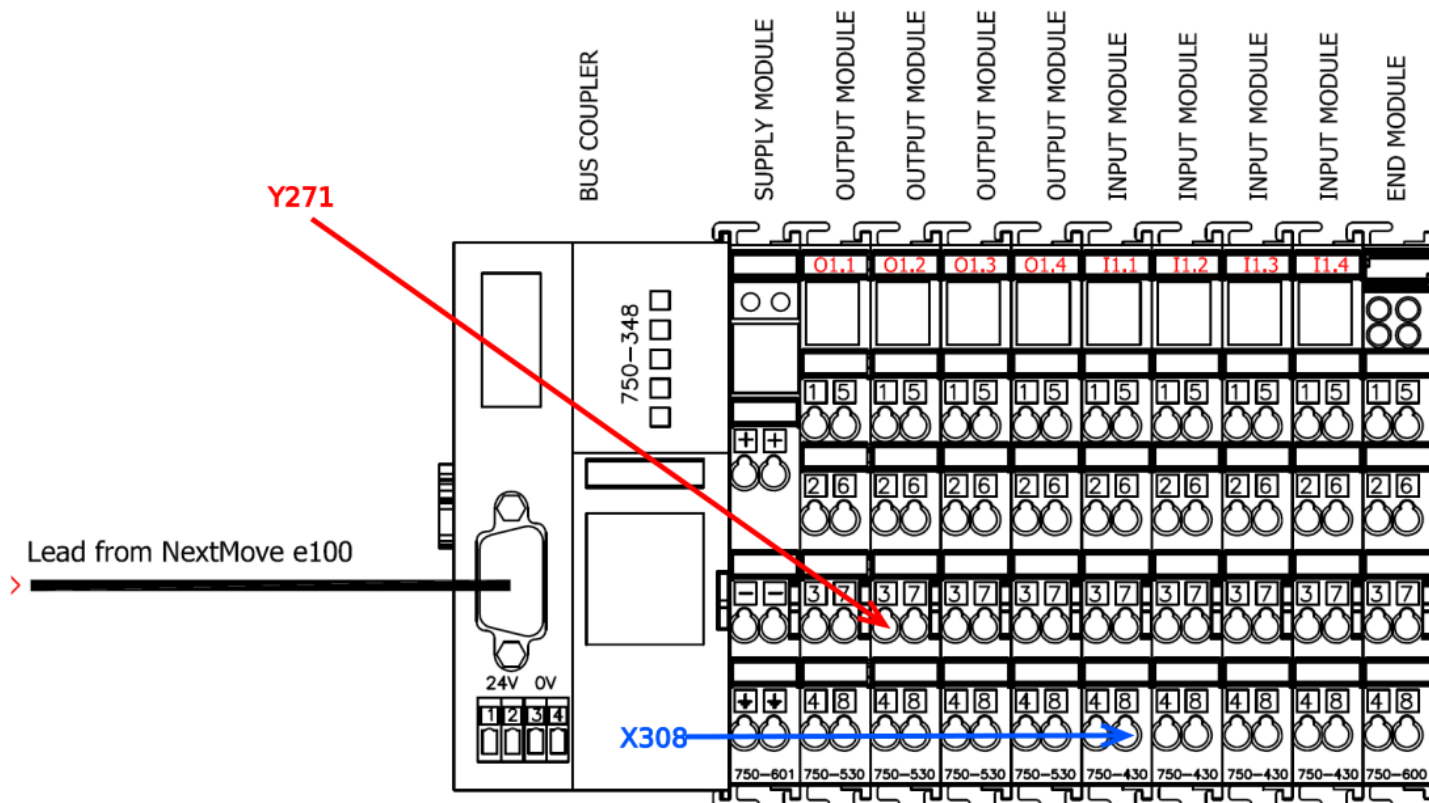
No	Description	New Value
C1-01	50Hz Accel Time	0.4
C1-02	50Hz Decel Time	0.2
C1-05	300Hz Accel Time	0.4
C1-06	300Hz Decel Time	0.2

2.7. ZX4/ZX3/Microline Replace VXR Notes (Nextmove E100)

Electrical Highlights:

- The inverter will need to be located on the side of the cabinet, as the Yaskawa is taller than the VXR
 - The supply to the new inverter needs to be wired directly rather than via the estop contactor. The new drive has “STO” (Safe Torque Off) inputs that are wired through two 24v dc relays (supplied). This means when ESTOP is pressed, the drive does not power off, it goes into safe torque off mode. This is a much more reliable system than “crash” shutting off the inverter on estop.
 - The phase monitoring device (if fitted) is not needed any more, but it is inactive, so can be left in place.
 - Ensure 24v connected to MC, M1 and M3
 - The Zx3 and Microline have a set of switchover contactors to select 50Hz (Mains) or 300Hz (Inverter). These need to be removed as the Yaskawa will do the switching. The Y5 Hz50 Output will be used to do this on S1 and S2
-
- New cable for Y271 (InvDp) from S3 and S4 (link), connect Output channel 5 on 2nd Output slice (labelled 5)

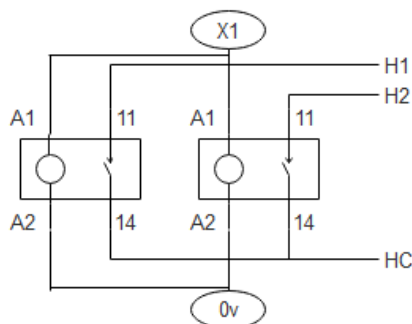




- New Cable X308 (InA_InvZero) from M2, connect to input channel 8 on 1st IO slice (labelled 8).

💡 ...If the wires cannot be added as per above diagram, You can wire to any spare channel, however you must change the ioDef file accordingly to remap the input (ASK FOR HELP!)

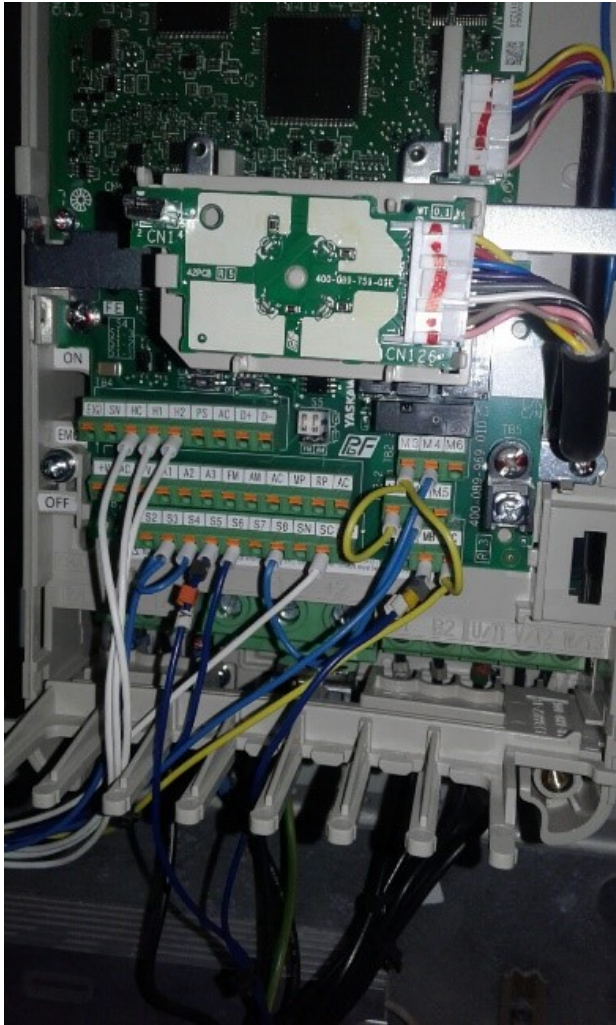
- A link wire between M4 and S8 needs to be added
- 2 additional 24v control relays needed for interfacing Estop to the STO inputs as per diagram

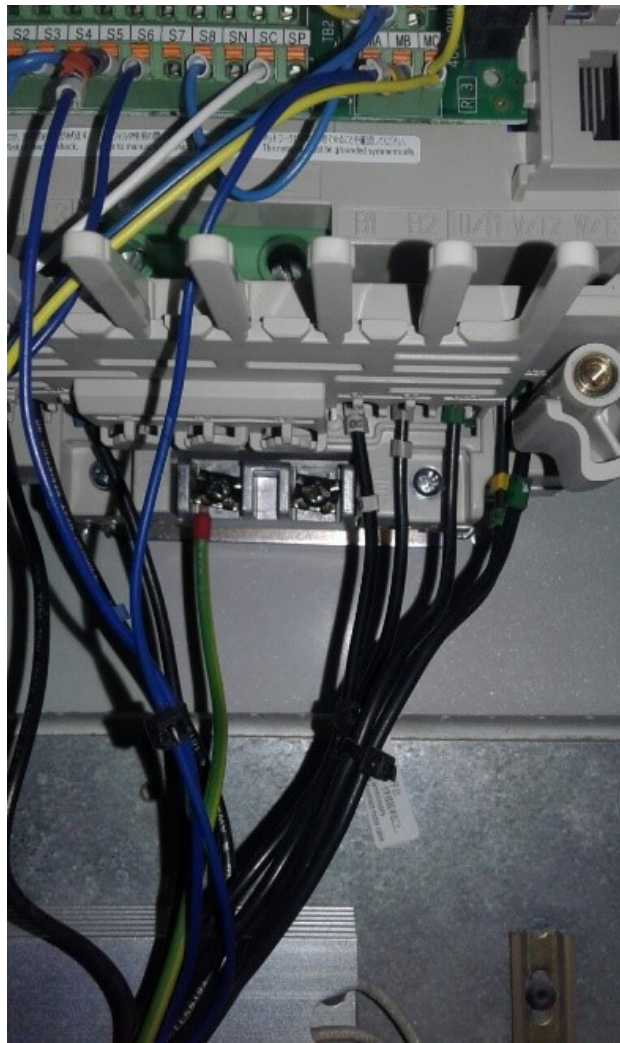


- The Inverter OK signal (X48) should be wired directly from the inverter to the input slice – it is probably wired via the inverter overload relay auxiliary contact – this is now redundant and will cause confusion
- Remove the link SP to SC. This is for grounding an internal PSU that is not used
- Inverter Reset function is done with Y34 SRST. The VXR inverter was powered off on estop, so did not need a reset function. Tag in to a Y34 cable on any servo drive (PL4 pin 2)

Function	Wire Number / Colour	Yaskawa Terminal
Mains In L1, L2, L3	60, 61, 62	L1, L2, L3
Motor Out U, V, W	53, 54, 55	T1, T2, T3
Input: Select 50Hz #1	Y5 (Hz50)	S1
Input: Select 50Hz #2	Y5 (Hz50)	S2
Input: Double Plunge #1	Y271 -Wire To Output channel 5 on 2nd Output slice (labelled 3)	S3
Input: Double Plunge #2	Link to S3	S4

Input: Motor Run	Y31 - extend to run directly Remove the relay R58 and wires 51, 52	S5
Input: Inverter Reset	Y34 - Splice into servo reset - loops across each of the servo drives	S6
Input: Resistor Thermal Ovl	n/c	S7
Input: Motor 2 Safety	Link to M4	S8
Inverter OK 24v	24v (Yellow)	MC
Inverter OK Output	X48 Remove wire 30A	MB
Output 24v Supply	24v (Yellow)	M1, M3
Output: Spindle At Zero	New Wire X308 - connect to Input channel 8 on 1st IO slice (labelled 8).	M2
Output: Motor 2 Safety	Link to S8	M4
STO Override	Add 2 relays as per diagram.	H1, H2, HC
External 0v	0v (White)	SC
Braking Resistor	Br+, Br-	B1, B2





IODEf.mul additions

```
INVDP,616,2,8,12,0,0,18,1,1
InZRO,608,1,8,7,0,0,18,2,1
```

Edit the Column and row values for the following iodefs to put the all the spindle control on the spindle IO screen – makes testing much easier (items 8 and 9 in the csv)

```
INVOK,542,1,8,23,0,0,18,6,0
HZ50,578,2,0,4,0,0,18,7,D
HZ300,579,2,0,5,0,0,18,8,E
SMOT,558,2,8,15,0,1,18,3,Z
SRST,574,2,8,18,0,0,18,4,F
```

***** GLENN NOTE ***** On a Microline, check in IODEf.mul for

```
CLSIP,607,2,9,3,0,0,2,3,X
CLSOV,608,2,9,4,0,0,2,4,Y
CLSOP,609,2,9,5,0,0,2,5,Z
```

change CLSOV from reference 608 to 618
See Microline Issue Saw Outfeed Clamp

Alarms.mul

Ensure the alarms are set for each individual spindle:

41,INVOK,False,SPIN1,True,0,4,Spindle 1 Alarm,True,False
 42,INVOK,False,SPIN2,True,0,4,Spindle 2 Alarm,True,False
 43,INVOK,False,SPIN3,True,0,4,Spindle 3 Alarm,True,False
 44,INVOK,False,SPIN4,True,0,4,Spindle 4 Alarm,True,False
 45,INVOK,False,SPIN5,True,0,4,Spindle 5 Alarm,True,False
 46,INVOK,False,SPIN6,True,0,4,Spindle 6 Alarm,True,False
 47,INVOK,False,SPIN7,True,0,4,Spindle 7 Alarm,True,False

The INVOK should be High when the inverter is OK.
 Remove any alarms relating to IS300 input

Front end

- Parameter Invert300hz=1
- Parameter InverterOKHigh=1
- Parameter psInvDecel300Hz=400
- Check inverter display is 300hz

Other software

Download and install Yaskawa DriveWizard

Ensure the Yaskawa USB is connected to the PC

Find the COM port it is connected to (use Device Manager Ports) – this is usually COM3. If there are other connections on the same COM port, right click and uninstall them (EDG). This will need a reboot after uninstalling

Using DriveWizard, or via the physical keypad on the device, change the following parameters

No	Description	New Value
C1-01	50Hz Accel Time	0.4
C1-02	50Hz Decel Time	0.2
C1-05	300Hz Accel Time	0.4
C1-06	300Hz Decel Time	0.2

2.7.1 Anomalies with M008 Upgrade

When upgrading M008, the wiring did not match the expectations above. These anomalies are noted here for guidance on a similar upgrade in future

		Details	Solution
1	Hz50 / Hz300 Outputs	The wiring diagram only shows a Hz300 output on Y6, but the backend software needs Y5 Hz50 to do the switching. Y5 is the main saw motor!	Swap the mapping channel of the Hz50 and Hz300 outputs to ensure Hz50 is connected to the inverter S1, S2 using Y6 (DOUT5) <div style="border: 1px solid black; padding: 5px; width: fit-content;"> HZ300,579,2,0,9,0,0,18,8,F HZ50,578,2,0,5,0,1,18,7,J </div>
2	Reset	Inverter reset on the drawings is not connected, yet physically connected via the servo cards to Y43, not Y34	
3	Nodes	The system uses Beckhoff IO slices, not Wago, therefore needs two sets of nodes. This is a different diagram to the one published. Pictures are below	Different IoDef mapping needed <div style="border: 1px solid black; padding: 5px; width: fit-content;"> INVDP,616,2,9,13,0,0,18,1,1 InZRO,608,1,8,15,0,0,18,2,1 </div>
4	InvOK	Labelled X14 on the drawing and physically in the machine, wired through the overload relay	Wire directly from DIN13 on nextmove - keep same mapping to channel 0,13

2.8 Autoflow with Delta Inverter

Function	Wire Number / Colour	Yaskawa Terminal	Notes
Mains In L1, L2, L3	21B, 22B, 23B	L1, L2, L3	

Motor Out U, V, W	29B, 30B, 31B	T1, T2, T3	There may be a phase detection relay between 26B-29B 27B-30B 28B-31B This can be discarded Remove wire 61B from Phase monitor to Delta MI6. Not needed because Yaskawa does phase monitoring internally
Input: Select 50Hz #1	Y63	S1	Existing Y63 OuB_Spin300 connects to S1 and add link to S2
Input: Select 50Hz #2	link to S1	S2	
Input: Double Plunge #1	Y316 -Wired To MC2B OU1 (pin9)	S3	There is a cable already labelled Y55. <ul style="list-style-type: none"> This will be relabelled Y316 (OuB_InvDp). This connects to S3 and add link to S4. <div style="border: 1px solid blue; background-color: #e0f0ff; padding: 5px; margin-top: 10px;"> i ...This is different to the standard Y271. Only applies to TwinCAT2 controlled machines </div>
Input: Double Plunge #2	Link to S3	S4	
Input: Motor Run	Y62	S5	Existing wire
Input: Inverter Reset	Y374	S6	Existing Wire
Input: Resistor Thermal Ovl	n/c	S7	
Input: Motor 2 Safety	Link to M4	S8	A link wire between M4 and S8 needs to be added
Inverter OK 24v	24v (Yellow)	MC	Ensure 24v connected to MC, not through an auxiliary contact Remove Wire 60B (From Aux contact on F5 to RC1 on Delta Inverter). Not needed because Inverter OK signal does not need to be in series with F5 overload
Inverter OK Output	X90	MB	Ensure this connected directly to MC2B Pin 3 and does not go through any auxiliary
Output 24v Supply	24v (Yellow)	M1, M3	Ensure 24v connected to M1, M3
Output: Spindle At Zero	X308 -To io slice MC2B IN6 (pin6)	M2	Reuse an existing cable for this new connection There is a cable already labelled Y59 <ul style="list-style-type: none"> This will be relabelled X308 (InA_InvZero) At Yaskawa end, this connects to M2 At Beckhoff end, this was connected to MC2B pin 15 (OU1). This now needs to be moved to pin 6 (IN4)
Output: Motor 2 Safety	Link to S8	M4	A link wire between M4 and S8 needs to be added
STO Override	Add 2 relays as per diagram. Relay control via Beckhoff safety slices	H1, H2, HC	
External Ov	0v (White)	SC	
Braking Resistor	1,2	B1, B2	Replace braking resistor if supplied. If not supplied, check the resistor is not short circuit - this has been the root cause of failure in the past

IODEf.mul additions

```
InB_InvZero,308,1,0,0,0,0,19,7,0
OuB_InvDP,271,2,0,0,0,0,19,8,0
```

Alarms.mul additions / changes

41,InB_InvSpinOk,False,OuB_Spin1On,True,0,4,Spindle 1 Alarm,True,False
 42,InB_InvSpinOk,False,OuB_Spin2On,True,0,4,Spindle 2 Alarm,True,False
 43,InB_InvSpinOk,False,OuB_Spin3On,True,0,4,Spindle 3 Alarm,False,False
 44,InB_InvSpinOk,False,OuB_Spin4On,True,0,4,Spindle 4 Alarm,True,False
 45,InB_InvSpinOk,False,OuB_Spin5On,True,0,4,Spindle 5 Alarm,True,False
 46,InB_InvSpinOk,False,OuB_Spin6On,True,0,4,Spindle 6 Alarm,True,False
 47,InB_InvSpinOk,False,OuB_Spin7On,True,0,4,Spindle 7 Alarm,False,False
 48,InB_InvSpinOk,False,OuB_Spin8On,True,0,4,Spindle 8 Alarm,True,False
 50,InF_GtOpen,0,OuF_Gate,True,30,3,Safety Gate Not Open,False,False,0
 51,InF_GtClosed,0,OuF_Gate,False,30,3,Safety Gate Not Closed,False,False,0


Change IO Links in Beckhoff Software

Module	Slice	IO Channel	Was	Change To	Notes
Module B	MC2B	Output 0	Y55	Y271	Were duplicates of the Double plunge output for spindles 2+5. Now change to Ou_InvDP
Module B	MC2B	Output 1	Y59	Blank	This needs to be a separate output from the spindle DP because the timing is different and crucial
Module B	MC2B	Input 6	Blank	X308	New input for Inverter at Zero

3. Completion

3.1. Checklist

General Item Checklist before power on

Item	Tick
Inverter Replaced	
If the old braking resistor is reused, test the resistance matches the stated value. If an ohmmeter is not available, ensure it is not a dead short to ground or open circuit	
Phase Detect Relay Removed	
M4 to S8 Link	
Inverter OK signal bypasses overload relay and configured so InvOK signal is High when OK	
Inverter FWD signal wired in	
Inverter 50Hz select wired in and link	
Inverter Double Plunge Input and link wired in	
Inverter Reset Input Wired In	
Inverter At Zero Output wired back to controller	
STO Relays Fitted and wired	
Mains Connections and Earth Safely wired	
Front End updated if required	
Back End updated if required	
 ...If this is a Nexmove, set the YASKAWAINVERTER parameter to _TRUE <pre>Define YASKAWAINVERTER = _true ' 3.9997</pre>	
IO Def reconfigured	
Alarms Reconfigured	
Yaskawa Drive Wizard installed Download here	

<p>Check Inverter accel and decel parameters - Double check that psInvDecel300Hz=400 Inverter Deceleration Parameters C1-02, C1-06 are set to 0.2 Inverter Acceleration Parameters C1-01, C1-05 are set to 0.4</p> <p>i ...the ps is set in milliseconds, the inverter parameter in seconds The inverter deceleration time must be LESS than the front end parameter, otherwise the relay contacts will open before the inverter has finished decelerating the spindles, leading to burning and arcing</p>	
<p>Check Inverter DC Injection parameters set to zero Parameters B2 -02 and B2-04</p>	
<p>Test InverterOK signal (high when OK) Ensure alarm triggers on InvOK low</p>	
<p>Ov connected to SC</p>	
<p>24v Connected to M1, M3, MC</p>	
<p>Update Control Systems Log for the software version and Inverter type</p>	

3.2. Testing

For this machine type, testing a spindle should follow this process

50Hz V notch motor

1. Select a spindle 1 or 2
2. Set HZ50 to run
3. Set Hz50 off

Single 300Hz Elte Motor

1. Select a spindle 3 to 7
2. Set HZ300
3. Set SMOT to accelerate
4. Ensure InZRO goes off and InvOK stays on
5. Reset SMOT to decelerate
6. Reset HZ300
7. Reset Spindle

Double 300Hz Elte Motor

Same as single, but select double plunge spindles and set InvDP to tell inverter to double the output power

Test InvZro input to system is low when inverter running, high when spindle stops