

## Troubleshooting Spindle Inverters

### Introduction

The INV-0093, INV-0096, and INV-0097 are all replacements for the current inverter in your machine, and are all virtually plug and play.



### Installation

To install, you either have two or three cables to plug into it for the spindle encoder, a plug for the control signals, and a plug for the Delta/Wye system. Delta/Wye systems have 2 contactors with wires going in and all over around it, but you only need to be concerned with the small white wires that come from the small switch on top of one of the contactors. This tells the inverter if it is in high or low gear.



Inverters

Inverters come from machines with a 5HP, 7.5HP, 10HP, 15HP, 20HP and on up to 30HP on the 6535 and 8535. Regardless of which one you have, they are all “dumb devices”, meaning they only do what they are told.

Below are what you have to have contained in your CNC for all feedback machines. Some are for simple speed information and others are used for rigid tapping, which is an option you can buy pre-installed on your machine.

1. Spindle Encoder
2. Spindle Encoder Feedback Cabling
3. Inverter
4. Spindle Motor
5. Control cabling fed back to the spindle control card

6. Rigid tapping machines have an extra 10 Pin connector used for syncing with the spindle and feedrate of the Z traveling down into your threaded part.
7. Non-Rigid tapping machines do not use any of the 10 Pin connectors on the bottom of the control card. This is in slot #14 of your card rack, and is called the “Spindle Control Card”.

### How It Works

The controller card takes its commands from the processor in slot #5 through your 1030 communication controller card, then to your 1010-X card (X being the version of processor you have in your card rack). Then, the 1010 card sends speed signals to the inverter via cable “A”. “A” is usually put on the plug with the most wires going through it on the inverter.

The signal to turn on your inverter travels from the processor, through the 1030 card, and then the spindle controller card in slot #14 to the spindle inverter. The inverter does exactly what it’s told to do, which is why an Inverter Battery Box (SVT-0288) is key in troubleshooting inverter problems.

With a battery box (seen here), you can bypass the control and run the drive directly from the battery box. If it doesn’t work with the battery box, then the inverter will need to be replaced.



SVT-0288

## C Axis Alarms

C Axis alarms come from the inverter or the Hall Effect switch above the spindle pulley magnet. If this Hall Effect switch is not working, you will get this alarm.

A second common problem with the C axis happens when your spindle coasts to a stop, and is caused by the regen resistors being open and not providing the necessary amount of power dissipation needed to stop the spindle rotation. These are usually found on terminals R1 and R2 on your inverter. The procedure to test this is:

1. Power down your machine
2. Remove one of the wires from the drive
3. Ohm the output of the regen circuit. It should be between 19 ohms and 7 ohms depending on what HP your inverter is. (See Table 1, attached at the end of this document, to see what regen resistors are associated with the drive you have.)

If you have good regen resistors, but your spindle is still coasting to a stop then the circuit in your inverter has failed.

A third problem you may find is if your spindle RPM fluxuates at higher speeds. If this is the case, your spindle encoder is likely the problem. You may have either a US Digital or Accu-coder brand of encoder on top of your spindle motor under the fan.

If you use a Battery Box again, you can isolate the problem and troubleshooting time can be minimized. Battery Boxes (P/N: SVT-0288) are available in our Speed Shop under, "Service Tools".

## Still need help?

If you become stuck or confused, don't panic. Simply contact us at 208.855.9426 and one of our friendly service technicians will be happy to assist you.

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*Instructions written by CNCPros.com. We put in hundreds of hours of hands-on experience in the field each year.*

Locate existing drive part number from left column, select NEW or ALTERNATE replacement.

Existing Part Number on old drive	Description	NEW Replacement Part Number	Alternate Drive Replacement	Spindle RPM	Original Regens #	1000 Line Encoder?*	Horse Power	Motor Plate RPM	Control
204558-320	INVERTER,MITS;20HP W/BRAKE	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	Brake @	No	20	1760	CNC88
4550	INVERTER,TOSHIBA;7.5HP 10K NCL	INV-0076	MTR-0111,INV-0097,WIR-0166	10000	25 ohm	No	5	1760	CNC88
4551	INVERTER,TOSHIBA;10HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	(1) 13 ohm	No	10	1760	CNC88
4552	INVERTER,TOSHIBA;15HT 10K NCL	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	(2) 13 ohm	No	20	1760	CNC88
4553-175	INVERTER,BALDOR;5HP 6.5K CL	INV-0055	MTR-0111,INV-0097,WIR-0166	6500	(1) 13 ohm	Yes	5	1160	CNC88
4553-175Y	INVERTER,BALDOR;5HP 6.5K CL	INV-0055	MTR-0111,INV-0097,WIR-0166	6500	(1) 13 ohm	Yes	5	1160	CNC88
4554	INVERTER,BALDOR;10HP 10K CL	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
4554-175	INVERTER,BALDOR;10HP 10K CL	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
4554-175-15	INVERTER,BALDOR;10HP 15K CL	INV-0097	INV-0096	15000	(1) 13 ohm	Yes	10	1760	CNC88
4554-175-V15	INVERTER,BALDOR;10HP VMC15 CL	INV-0097	INV-0096	7500	(1) 13 ohm	Yes	10	1760	CNC88
4554-175SP	INVERTER,BALDOR;10HP SINGLE PHASE	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	(1) 13 ohm	Yes	10	1760	CNC88
4554-180	VECTOR,BALDOR;10HP 10K CL	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
4554-180-V15	VECTOR,BALDOR;10HP VMC15 CL	INV-0097	INV-0096	7500	(1) 13 ohm	Yes	10	1760	CNC88
4554-182	VECTOR,BALDOR;10HP 10K CE	INV-0096	MTR-0111,INV-0097,WIR-0166	10000	(1) 13 ohm	Yes	10	1760	CNC88
4554-182-V15	VECTOR,BALDOR;10HP VMC15 CE	INV-0096		7500	(1) 13 ohm	Yes	10	1760	CNC88
4554-183-V15	VECTOR,BALDOR;10HP VMC15 CL	INV-0097	INV-0096	7500	(1) 13 ohm	Yes	10	1760	CNC88
4554-183	VECTOR,BALDOR;10HP 10K CL	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
4554Y-175	INVERTER,BALDOR;10HP 10K CL	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
4555	INVERTER,BALDOR;15HT 10K CL	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
4555-175	INVERTER,BALDOR;15HT 10K CL	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
4555-180	VECTOR,BALDOR;15HT 10K CL	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
4555-182	VECTOR,BALDOR;15HT 10K CE	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
4555Y-175	INVERTER,BALDOR;15HT 10K CL	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
4556	INVERTER,SWEO;10HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	(1) 13 ohm	No	10	1760	CNC88
4557	INVERTER,SWEO;15HT 10K NCL	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	(2) 13 ohm	No	15	1760	CNC88
4558	INVERTER,MITS;10HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	Internal	No	10	1760	CNC88
4558-15	INVERTER,MITS;10HP 15K NCL	INV-0097		15000	Internal	No	10	1760	CNC88
4558-15CL	INVERTER,MITS;10HP 15K CL	INV-0097	INV-0096	15000	Internal	Yes	10	1760	CNC88
4558-205	INVERTER,MITS;5HP 10K NCL	INV-0076	MTR-0111,INV-0097,WIR-0166	10000	Internal	No	5	1760	CNC88
4558-305	INVERTER,MITS;5HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	Internal	No	5	1760	CNC88
4558-305-V15	INVERTER,MITS;5HP 7.5K NCL	INV-0076	MTR-0111,INV-0097,WIR-0166	7500	Internal	No	5	1760	CNC88
4558-315	INVERTER,MITS;15HT 10K CL	INV-0093		10000	Brake @	1000/1024	15	1760	CNC88
4558-320	INVERTER,MITS;20HP NCL W/O BRAKE	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	Brake @	No	20	1760	CNC88
4558Y	INVERTER,MITS;10HP 10K CL	INV-0097	INV-0096	10000	Internal	Yes	10	1760	CNC88
4558Y-305	INVERTER,MITS;10HP 10K CL	INV-0097	INV-0096	10000	Internal	Yes	10	1760	CNC88
4558Y-315	INVERTER,MITS;15HT 10K CL	INV-0093	INV-0096	10000	Brake @	Yes	15	1760	CNC88

\* Some VMC's, (1990-1991), have 1024 Line BEI Encoder. May need to replace motor with MTR-0147 and WIR-0166.

@ Mitsubishi Brake unit has (2) 24 Ohm resistors, and Glentek Brake unit has (2) 13 Ohm resistors in parallel.

# (1) 13 ohm regen is currently replaced with (1) 19 ohm regen. (2) 13 ohm regens are currently replaced with (2) 19 ohm regens.

Mitsubishi Brake is replaced with Glentek and (2) 13/19 ohm regens. Some units may need an extra 19 ohm regen.

Locate existing drive part number from left column, select NEW or ALTERNATE replacement.

Existing Part Number on old drive	Description	NEW Replacement Part Number	Alternate Drive Replacement	Spindle RPM	Original Regens #	1000 Line Encoder?*	Horse Power	Motor Plate RPM	Control
INV-0006	INVERTER,MITS;20HP 10K W/BRAKE	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	Brake @	No	20	1760	CNC88
INV-0015	VECTOR,BALDOR;10HP 10K CL	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
INV-0016	VECTOR,BALDOR;10HP VMC15 CL	INV-0097	INV-0096	7500	(1) 13 ohm	Yes	10	1760	CNC88
INV-0020	VECTOR,BALDOR;15HT 10K CL	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
INV-0025	INVERTER,MITS;10HP 15K NCL	INV-0097		10000	Internal	No	10	1760	CNC88
INV-0026	INVERTER,MITS;10HP 15K CL	INV-0097	INV-0096	10000	Internal	Yes	10	1760	CNC88
INV-0027	INVERTER,MITS;5HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	Internal	No	5	1760	CNC88
INV-0031	INVERTER,MITS;5HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	Internal	No	5	1760	CNC88
INV-0032	INVERTER,BALDOR;5HP 7.5K NCL YD	INV-0076		7500	Internal	No	5	1760	CNC88
INV-0033	INVERTER,MITS;5HP 6500RPM NCL	INV-0057		6500	Internal	No	5	1160	CNC88
INV-0034	INVERTER,MITS;15HT 10K CL	INV-0093	INV-0096	10000	Brake @	Yes	15	1760	CNC88
INV-0035	INVERTER,MITS;20HP NCL NO BRAKE	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	Brake @	No	20	1760	CNC88
INV-0036	INVERTER,MITS;10HP 10K CL YD	INV-0097	INV-0096	10000	Internal	Yes	10	1760	CNC88
INV-0037	INVERTER,MITS;10HP 10K CL	INV-0097	INV-0096	10000	Internal	Yes	10	1760	CNC88
INV-0038	INVERTER,MITS;15HT 10K CL YD	INV-0093	INV-0096	10000	Brake @	Yes	15	1760	CNC88
INV-0039	VECTOR,BALDOR;15HT 10K CE	INV-0093	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
INV-0040	VECTOR,BALDOR;15HT 10K	INV-0093	INV-0096	10k/7.5k	(2) 13 ohm	Yes	15	1760	CNC88
INV-0041	VECTOR,BALDOR;10HP 10K CL	INV-0097	INV-0096	10k/7.5k	(1) 13 ohm	Yes	10	1760	CNC88
INV-0042	VECTOR,BALDOR;10HP 10K CE	INV-0097	INV-0096	10000	(1) 13 ohm	Yes	10	1760	CNC88
INV-0043	VECTOR,BALDOR;15HT 7.5K YD	INV-0093	INV-0096	7500	(2) 13 ohm	Yes	15	1760	CNC88
INV-0044	VECTOR,BALDOR;10HP 7.5K YD CE	INV-0097	INV-0096	7500	(1) 13 ohm	Yes	10	1760	CNC88
INV-0045	VECTOR,BALDOR;10HP 7.5K YD	INV-0097	INV-0096	10k/7.5k	(1) 13 ohm	Yes	10	1760	CNC88
INV-0046	VECTOR,BALDOR;15HT 7.5K YD CE	INV-0097	INV-0096	7500	(2) 13 ohm	Yes	15	1760	CNC88
INV-0049	VECTOR,BALDOR;10HP 7.5K/10K	INV-0097	INV-0096	10k/7.5k	(1) 19 ohm	Yes	10	1760	CNC88
INV-0052	INVERTER,BALDOR;10HP 10K NCL	INV-0097	MTR-0111,INV-0097,WIR-0166	10000	(1) 13 ohm	No	10	1760	CNC88
INV-0054	INVERTER,BALDOR;15HT 10K NCL	INV-0086	MTR-0147,INV-0093,WIR-0166	10000	(2) 13 ohm	No	20	1760	CNC88
INV-0055	VECTOR,BALDOR;10HP 6.5K CL	INV-0055		6500	(1) 13 ohm	Yes	5-10	1160	CNC88
INV-0056	VECTOR,AMC;15/10HP 10K/7.5K	INV-0096	INV-0093/INV-0097	10k/7.5k	(2) 13 ohm	Yes	10-15	1760	CNC88
INV-0057	INVERTER,BALDOR;5HP 6500RPM 6POLE	INV-0057		6500	(1) 13 ohm	No	5	1160	CNC88
INV-0058	VECTOR,BALDOR;20HPVHT 10K CL	INV-0086		10000	(2) 19 ohm	Yes	20	1760	CNC88
INV-0059	VECTOR,BALDOR;20HPVHT 10K CE	INV-0086	INV-0070	10000	(2) 19 ohm	Yes	20	1760	CNC88
INV-0070	VECTOR,BALDOR;20HPVHT 10K CE	INV-0086	INV-0070	10000	(2) 19 ohm	Yes	20	1760	CNC88
INV-0071	INVERTER,YASKAWA;7.5HP 7.5K YD NCL	INV-0076		7500	(2) 13 ohm	No	7.5	1760	CNC88
INV-0072	INVERTER,YASKAWA;7.5HP 7.5K YD RIGID TAP	INV-0085		7500	(2) 13 ohm	Yes	7.5	1760	CNC88
INV-0073	VECTOR DR,480V;45HT 7500 CL 6535-50T	INV-0073		7500	(2) 19 Ohm	1000/1024	50	1760	CNC88
INV-0075	INVERTER,/CBL,YASKAWA;7.5HP 7500RPM RT	INV-0085		7500	(1) 19 Ohm	No	7.5	1760	CNC88

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@ Mitsubishi Brake unit has (2) 24 Ohm resistors, and Glentek Brake unit has (2) 13 Ohm resistors in parallel.

# (1) 13 ohm regen is currently replaced with (1) 19 ohm regen. (2) 13 ohm regens are currently replaced with (2) 19 ohm regens. Mitsubishi Brake is replaced with Glentek and (2) 13/19 ohm regens. Some units may need an extra 19 ohm regen.

## FADAL Inverter/Vector Drive Cross-Reference List

Locate existing drive part number from left column, select NEW or ALTERNATE replacement.

Existing Part Number on old drive	Description	NEW Replacement Part Number	Alternate Drive Replacement	Spindle RPM	Original Regens #	1000 Line Encoder?*	Horse Power	Motor Plate RPM	Control
INV-0076	INVERTER,/CBL,YASKAWA;7.5HP 7500RPM NON-RT	INV-0076		7500	(1) 19 Ohm	Yes	7.5	1760	CNC88
INV-0077	VECTOR DRIVE,YASKAWA;15HT 10K CE 104D	INV-0093	INV-0096	10000	(2) 19 Ohm	Yes	15	1760	CNC88
INV-0083	VECTOR DR,YASKAWA;10HP CE 7.5/10K	INV-0097	INV-0096	10k/7.5k	(1) 19 Ohm	Yes	10	1760	CNC88
INV-0085	INVERT/CBL,YASKAWA G7 7.5HP CL CE 104D	INV-0085		7500	(1) 19 Ohm	Yes	10	1760	CNC88
INV-0086	VECTOR DRIVE,YASKAWA;20VHT 10K CE CNC88	INV-0086	INV-0070	10000	(2) 19 Ohm	Yes	15	1760	CNC88
INV-0087	SPINDLE DRIVE,50T; A SPM-26i;FNC	INV-0087		7500		Yes			Fanuc
INV-0088	SPINDLE DRIVE,HT; A SPM-15i;FNC	INV-0088		10000		Yes			Fanuc
INV-0089	SPINDLE DRIVE,STD; A SPM-11i;FNC	INV-0089		7500		Yes			Fanuc
INV-0090	SPINDLE DRIVE,VHT; A SPM-22i;FNC	INV-0090		10000		Yes			Fanuc
INV-0093	VECTOR DRIVE,YASKAWA;15HT 10K CE CNC88	INV-0093	INV-0096	10k/7.5k	(2) 19 Ohm	Yes	15	1760	CNC88
INV-0095	VECTOR,AMC;15/10HP 10K/7.5K CE PWR SUPPLY	INV-0095		10k/7.5k	(2) 19 ohm	Yes	10-15	1760	CNC88
INV-0096	VECTOR,AMC;15/10HP 10K/7.5K	INV-0096	INV-0093/INV-0097	10k/7.5k	(2) 19 ohm	Yes	10-15	1760	CNC88
INV-0097	VECTOR DR,GLENTEK;15HP CE 104D	INV-0097	INV-0096	10000	(2) 13 ohm	Yes	15	1760	CNC88
INV-0098	VECTOR DR,GLENTEK;15HP CE 104D	INV-0097	INV-0096	10000	(2) 13 Ohm	Yes	15	1760	CNC88

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