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## Bridgeport CNC machine number (2)

Bridgeport Series 1 INTERACT Mark 2 with Heidenhain TNC-155B  
Serial 664201089 C

Full documentation included with machine, including original Machine Parameters Sheet with original configuration and calibration

### Issue 1) Thyristor Spindle drive Fire

Within 30 minutes of turning on, 3 of the 6 RIFA branded snuffer capacitors on the THY-1R board inside the KTK thyristor drive burst and caught fire. This is common for this brand capacitors made in late '80, especially when reactivated equipment after storage.

These were 500Vac/1000Vdc rated capacitors, as needed for the high-voltage DC motor back-EMF spikes. Replaced all 6 capacitors with same rating capacitors, but plastic film rather than paper film

Also replaced 2 more RIFA capacitors on related MTI-1 board and 3 more RIFA X2 safety capacitors on auxiliary board. The X2 safety capacitors had built-in inrush resistors, so they were replaced with an ad-hoc heat-shrunked resistor-capacitor pair

THY-1 board	0.1uF RIFA 500Vac/1000Vdc	6x		
MDI-1 board	0.1uF RIFA 500Vac/1000Vdc	1x	0.022uF RIFA 250Vac/500Vdc	1x
Aux board	0.220uF+220R RIFA RC network X2 250Vac/450Vdc	3x		

Spindle worked correctly after this.

## Issue 2) Modify Machine Parameters

To enter individual Machine Parameters.

- Press MOD (the bottom-right one)
- Walk down to Code, and enter code 95148
- You can walk up/down, or use GOTO
- When done, press ENT and then END
- Depending on the parameter changed, the machine may reset

### Changed Calibration Parameters

Software limits were tuned to avoid running into hardware limit switch

	Old	New	
MP44	+8.500		X+ limit
MP45	-448.600	-443.000	X- limit
MP46	+6.500		Y+ limit
MP47	-298.600		Y- limit
MP48	+8.000	+7.550	Z+ limit
MP49	-119.100	-119.550	Z- limit

### Changed Configuration Parameters

	Old	New	
MP92	0	3	3=English/Decimal point ; 0=Dutch/Comma
MP217	0 P	0 P	0 = Klartext Dialog; 1=ISO G-codes
MP222	168	168	V24 RS232 definitions (see manual)
MP223	0		0=Normal, 1=Blockwise transfer (seems to work with 0 too though??)

## Issue 3) Safety Guard

This machine seems to have a factory build in Safety Guard system, that is *\*not\** shown in any of the schematics. The manual is incorrect/incomplete (and also is the *only* thing I encountered where the manuals and schematics are incorrect/incomplete).

***So this was not an issue, no modifications were made, but this does deviate from the manual.***

- There is an extra relay 17CR next to relay 16CR
- The relay seems controlled by wire 39, which has to be connected to wire 65 (+24V) for the relay to activate. So the "Guard" is basically interrupting wires 39 from 65 on the terminal block.
- The relay in turn puts 24V via wire/terminal block 77 onto Jumper J5/5 of the TNC-155  
While the schematics show J5/5 unconnected, but it is connected to wire 77
- Likely the relay also enables some of the other relays (15CR spindle start, wire 89/89A), so there is a hardware guard as well as a software guard

When wires 65 & 39 from terminal block 65 & 39 are shorted, the machine operates, when they are open, the machine refuses to operate and give a "Guard" message on the screen. Several guard switches can be put in a chain if multiple guard switches are needed.

#### Issue 4) Z-Axis position encoder fixed

The Z-Axis motor had suffered a mechanical impact and the encoder PCB got out of position due to bent mounting studs. Carefully repositioning made it operational again.

#### Issue 5) TNC-155 cabinet Fan was replaced

It worked, but was very noisy, the new one is more silent.

#### Issue 6) Spindle Motor Cooling Fan bearings

The bearings were very noisy. New bearings were fitted. Fan is better but still not completely silent.

## Bridgeport CNC machine number (1)

Bridgeport Series 1 INTERACT Mark 2 with Heidenhain TNC-155B  
Serial 663080589 C

Most documentation included, however the original Machine Parameters Sheet with original configuration and calibration were missing. We rebuild those based on Machine (2)

### Issue 1) Thyristor Spindle drive Capacitors

Based on Machine (2), we preventatively replaced the RIFA capacitors.

It appeared the 1000V rated RIFA branded snubber capacitor on the MTI-1 board had burst in the past and was replaced by a new but incorrectly rated capacitor. This burst capacitor (and maybe also replacing with an incorrect one) may have caused further damage to thyristor and transformer (see issues below)

In any case, we replaced all RIFA capacitors.

THY-1 board	0.1uF RIFA 500Vac/1000Vdc	6x		
MDI-1 board	0.1uF RIFA 500Vac/1000Vdc	1x	0.047uF RIFA 250Vac/500Vdc	1x
Aux board	0.220uF+220R RIFA RC network X2 250Vac/500Vdc	3x		

### Issue 2) Shorted power supply on TNC155

The TNC155 refused to turn on.

It turned out the internal PSU had a shorted Frako branded electrolytic capacitor. Replacing the capacitor made the unit work again.

It is possible someone attempted this repair before. Or at least, the TNC-155 appears to have been dismantled and remounted, and the two analog spindle drive wires 247/250 were incorrectly wired to connector J4/7 and J4/8 (Analog 4<sup>th</sup> axis) while the schematic calls for them to be connected to J4/9 and J4/10 (Analog Spindle command).

This wire mixup may never have been noticed, as this repair and the other repairs on spindle drive board seemed to never have been completed.

### Issue 3) Modify Machine Parameters

No Machine Parameters were present for this machine. We rebuild them based on Machine (2) parameters

To enter individual Machine Parameters.

- Press MOD (the bottom-right one)
- Walk down to Code, and enter code 95148
- You can walk up/down, or use GOTO
- When done, press ENT and then END
- Depending on the parameter changed, the machine may reset

### Spindle Direction Parameters

It turns out Machine (1) has X and Y spindles turning the opposite direction from Machine (2), whose machine parameters we copied. So we had to change the spindle and position count directions

	Old	New	
MP20	1	0	X counting direction
MP21	1	0	Y counting direction
MP24	0	1	X drive polarity
MP25	0	1	Y drive polarity

### Changed Calibration Parameters

Software limits were tuned to avoid running into hardware limit switch

	Old	New	
MP44	+8.500	+6.600	X+ limit
MP45	-448.600	-450.500	X- limit
MP46	+6.500	+7.200	Y+ limit
MP47	-298.600	-297.900	Y- limit
MP48	+8.000		Z+ limit
MP49	-119.100		Z- limit

### Changed Configuration Parameters

	Old	New	
MP92	0	3	3=English/Decimal point; 0=Dutch/Comma
MP217	0 P	0 P	0 = Klartext Dialog; 1=ISO G-codes
MP222	168	168	V24 RS232 definitions (see manual)
MP223	0		0=Normal, 1=Blockwise transfer (seems to work with 0 too though??)

#### Issue 4) Safety Guard

Unlike Machine (2), this Machine (1) has no factory build in Safety Guard system.

Instead, a Guard was added later, by disconnecting two wires connected to the topmost clamp 90 (0V), and reconnecting these using a series of external Guard switches. These two wires connect to the regulated and unregulated 24V supplies, so no relays could operate (wire 100 unregulated 24V) and the TNC155 receives no control voltage (wire 65 regulated 24V).

Clamp 90 is a set of 3 clamps bridged together, and in the topmost clamp were 2 (two) wires under a single clamp. The Guard and the switches were no longer present, and the wires simply twisted together. We removed these dangling wires, and reconnected both 90 wires directly to the topmost 90 clamp.

HOWEVER: because this Machine (1) TNC-155 controller received the Machine Parameters from Machine (2) which has a factory build Guard, we also needed to connect TNC-155 position J5/5 to position J2/1 (24V) to enable the software guard.

If a true guard is to be re-added, it may be best to nicely route position J5/5 via wire 77 to currently free clamp 77 in the clamping cabinet and use a relay to connect it to the wire 65 regulated 24V

on wire then onward to clamp 39 and connect this to either , and perform further Guard wiring inside this clamp cabinet. This would make the wiring somewhat similar to Machine (2) which seems to be a factory fitted Guard

To protect the TNC, maybe even use an additional relay numbered 17CR to link wires 77 and 65, again the relay itself switching on wire 100 unregulated 24v and a series of guard switches via wire 39 to ground, similar to the factory fitted Guard of machine (2). Also, either interrupt the same two 90 wires again (or only interrupt 89 spindle start like the factory guard) so there is a hardware guard as well as a software guard.

#### Issue 5) TNC-155 cabinet Fan was replaced

It worked, but was very noisy, the new one is more silent.

### Issue 6) MTI Spindle drive Interface board Thyristor

The main Thyristor was fully shorted without visible signs. Likely this was a result of the snubber capacitor that had in the past burned and was replaced, as this capacitor has the explicit function to protect the thyristor. Likely the repair was never completed and the machine never used again, as evident by the still present shorted thyristor.

The BTW68-1200Q high voltage thyristor was replaced, as well as the two blown 5A ceramic fuses near the thyristor.

As part of the diagnosis, we measured operating voltages on the MTI-1 board, with machine turned on but no spindle command given. Below values fix1 for reference:

	B (1) (Faulty)	B (2) (working)	B (1) (fix1)	B (1) (fix2)		B (1) (Faulty)	B (2) (working)	B (1) (fix1)	B (1) (fix2)
<b>1</b>	0v	0v	0v	0v	<b>18</b>	0v	0v	0v	0v
<b>2</b>	0v	0v	0v	0v	<b>19</b>	23v	23v	23v	23v
<b>3</b>	0v	0v	0v	0v	<b>20</b>	<b>5v</b>	23v	<b>10v</b>	23v
<b>4</b>	0v	0v	0v	0v	<b>21</b>	23v	23v	23v	23v
<b>5</b>	0v	0v	0v	0v	<b>22</b>	0v	0v	0v	0v
<b>6</b>	0v	0v	0v	0v	<b>23</b>	0v	0v	0v	0v
<b>7</b>	0v	0v	0v	0v	<b>24</b>	24v	24v	24v	24v
<b>8</b>	1v	1v	1v	1v	<b>25</b>	0v	0v	0v	0v
<b>9</b>	0v	0v	0v	0v	<b>26</b>	24v	24v	24v	24v
<b>10</b>	-24v	-24v	-24v	-24v	<b>27</b>	24v	24v	24v	24v
<b>11</b>	21.5v	21.5v	21.5v	21.5v	<b>28</b>	<b>0v</b>	1v	1v	1v
<b>12</b>	<b>5v</b>	0v	<b>10v</b>	0v	<b>29</b>	<b>0v</b>	1v	1v	1v
<b>13</b>	0v	0v	0v	0v					
<b>14</b>	0v	0v	0v	0v					
<b>15</b>	<b>5v</b>	22.5v	<b>10v</b>	22.5v					
<b>16</b>	<b>5v</b>	0v	<b>10v</b>	0v					
<b>17</b>	23v	23v	23v	23v					

After repair, spindle still did not work, see next issue.

### Issue 7) Spindle armature incorrectly wired

It turned out wires 276 and 277 were swapped inside the spindle motor armature. This caused the field winding drive to be open on one wire, and nearly shorted on the other (as it went via the main winding instead), causing the top fuse to blow again. The bottom fuse remained good. Likely this was a separate issue from the blown thyristor. Remeasured voltages as fix2 in above table.

The incorrect wiring is further indicator that a previous repair was never repeated, and this machine may have been unused (and unusable) for a very long time.

After repair, spindle finally did work. (For a short while, see next issue).

### Issue 8) MDI-1 board transformer failed

After running for about 2 hours, the MDI-1 board transformer failed. There were no shorts, nor any overloads. Replacing it with transformer from identical machine (2) had it operational for at least 24 hours. So we assume either aging of the transformer, or maybe it had taken a hit when the original snubber circuit failed.

The transformer is a OEP (Oxford Electrical Products) M1818/6. It is likely a 6VA transformer (similar to other M18xx models on the internet, as well judging size and the /6 suffix)

By schematic, it is a 415V in (1989 UK standard) and triple 16V-0V and 18V-0V-18V out transformer. Likely 16V/250mA and 18V/0/18V-75mA out. The dc coil resistances match this current distribution, and it makes sense as the 16V drives relay coils, but the 18V only some OpAmps.

An off the shelf replacement could not be found, so eventually we contacted a company specialized in custom winding transformers, and they build a transformer based on our specs. The transformer worked correctly, except one winding was phased incorrectly (wound in the incorrect direction) causing a missed timing pulse. This was fixed by rerouting resistor R1 to the other pin of the winding.

While rebuilding this supply, it was discovered the “common” failure for this board was an undersided pair of zener diodes, used to radiate off extra voltage. While that had not happened here, we pre-emptively replaced them with a heavier ones extra heat dissipation. Newer factory variants of this MTI boards used a 7812/7912 based setup instead.

Now finally the machine spun up and most functions worked.

### Issue 9) Intermittent ‘Auxiliary function complete’ feedback signal

Wire/clamp 87 provides Mxx “function complete” feedback signal from KTK spindle drive to TNC-155. This works for M03/M04 (spindle start), but not for M00/M05 (spindle stop). The pulse is actually there, and well formed, but the TNC-155 is not responding.

This results in a blinking asterisk character on screen and a halted program, whenever M00 or M05 command are issued

This turned out to be a faulty relay 16CR

## Addendum

After a while of ad-hoc usage, no further issues were founds on either machines