H-2000-6040-0A-C

Probe Systems

Installation Manual for Machine Tools

RENISHAW®

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The software you have purchased is used to control the movements of a machine tool. It has been designed to cause the machine to operate in a specified manner under operator control, and has been configured for a particular combination of machine tool hardware and controller. Renishaw have no control over the exact program configuration of the controller, with which the software is to be used, nor of the mechanical layout of the machine. Therefore, it is the responsibility of the person placing the software into operation to:

- ensure that all machine safety guards are in position and are correctly working before commencement of operation;
- ensure that any manual overrides are disabled before commencement of operation;
- verify that the program steps invoked by this software are compatible with the controller for which they are intended;
- ensure that any moves, which the machine will be instructed to make under program control, would not cause the machine to inflict damage upon itself or upon any machine in the vicinity;
- be thoroughly familiar with the machine tool and its controller, and to know the location of all emergency stop switches.

Equipment Registration Record

Please complete this form (and Form 2 overleaf if applicable) after the Renishaw equipment has been installed on your machine. Keep one copy yourself and return a copy to your local Renishaw Customer Support office (refer to the manual for the address and telephone number). The Renishaw Installing Engineer should normally complete these forms.

MACHINE DETAILS

Machine Description .....

Machine Type .....

Controller .....

Special Control Options .....

.....

.....

RENISHAW HARDWARE

Inspection Probe Type .....

Interface Type .....

Tool Setting Probe Type .....

Interface Type .....

RENISHAW SOFTWARE

Inspection Disk(s) .....

.....

.....

.....

Tool Setting Disk(s) .....

.....

.....

SPECIAL SWITCHING M CODES (OR OTHER) WHERE APPLICABLE

Switch (Spin) Probe On .....

Switch (Spin) Probe Off .....

Start/Error Signal .....

Dual Systems Only

Switch On Inspection Probe .....

Switch On Tool Setting .....

Other .....

.....

ADDITIONAL INFORMATION

☐ Tick box if Form 2 overleaf has been filled in.

Customer Name .....

Customer Address .....

.....

.....

.....

Customer Tel. No. .....

Customer Contact Name .....

Date Installed .....

Installing Engineer .....

Date of Training .....

Software Deviation Record

Standard Renishaw Kit No.	**Software Disk Nos.**
Reason for Deviation	
Software No. and Macro No.	**Comments and Corrections**

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Glossary of Terms – Abbreviations and Definitions

Before You Begin

This Installation Manual contains detailed information about how to install Renishaw probe systems.

Split into 13 self-contained chapters, the manual is structured to provide the information that you require to install the probe systems hardware and software effectively.

- *Chapter 1 – Installing Hardware and Software* provides you with some guidelines to be observed when installing and checking the probe system and associated software.

- *Chapter 2 – Calibrating the Probe* explains why your tool setting or inspection probe must be calibrated before you start using it.

- *Chapter 3 – Fanuc Connection Diagrams* shows how to connect Renishaw interfaces to a Fanuc controller.

- *Chapter 4 – Fanuc Diagnostic and Location Chart and High Speed Skip* contains useful diagnostic and high speed skip information for machine tools fitted with Fanuc controllers.

- *Chapter 5 – Fanuc Machine Parameters* describes the parameters that are relevant when installing a Renishaw probe system at a Fanuc controller.

- *Chapter 6 – Fanuc Software Installation* describes how to install retrofitted Inspection Packages on Fanuc controllers. This covers Optical Transmission and Inductive Transmission systems.

- *Chapter 7 – Yasnac Installation* describes how to connect the Renishaw interface to machine tools fitted with Yasnac controllers in readiness for installing the probe software.

- *Chapter 8 – Mazak Installation* describes how to connect the Renishaw interface to machine tools fitted with Mazac controllers in readiness for installing the probe software.

- *Chapter 9 – Tosnuc 600M/800M Installation* describes how to connect the Renishaw interface to machine tools fitted with Tosnuc controllers in readiness for installing the probe software.

- *Chapter 10 – Sharnoa Tiger 5 Installation* describes how to connect the Renishaw interface to machine tools fitted with the Sharnoa Tiger 5 controller in readiness for installing the probe software.

- *Chapter 11 – Meldas Installation* provides useful information that will assist you to install your Renishaw probe systems software on machine tools that are fitted with Meldas controllers.

- *Chapter 12 – Fadal CNC 88/32MP Installation* describes how to connect Renishaw interfaces to machine tools fitted with Fadal controllers in readiness for installing the probe software.

- *Chapter 13 – Okuma Machining Centres Installation* describes how to connect the Renishaw interfaces to Okuma controllers in readiness for installing the probe software.

Measurement Values Used in this Manual

Throughout this manual, metric units of measurement, e.g. millimetres, are used in the examples. The equivalent inch measurements are shown in brackets.

List of Associated Publications

When you are installing or customising the Renishaw probe systems software, you may find it useful to refer to the following Renishaw publications:

- *Tool Setting for Machining Centres Programming Manual* (Renishaw Part No. H-2000-6082).
- *Inspection Plus Software Programming Manual* (Renishaw Part No. H-2000-6031).
- *Probe Installation Manual for HAAS VF Series Machines* (Renishaw Part No. H-2000-6066).
- *Probe Software for Machine Tools – Data Sheet* (Renishaw Part No. H-2000-2289).

Warnings, Cautions and Notes

Throughout this manual, warnings, cautions, and notes have the following meanings:

Warning – this is information which, if disregarded, could lead to the injury or death of an individual.

Caution – this is information which, if disregarded, could lead to damage to equipment or to software or stored data.

Note – this provides additional information to assist the reader when eading a particular paragraph.

Software Kit

Details of the Renishaw Inspection and Tool Setting software kits are contained in the data sheet titled *Probe Software for Machine Tools* (Renishaw Part No. H-2000-2289). The data sheet lists the Renishaw Part No. for each software kit and the total amount of memory required by the software.

Renishaw Customer Services

Calling a Renishaw Subsidiary Office

If you have a question about the software, first consult the documentation and other printed information included with your product.

If you cannot find a solution, you can receive information on how to obtain customer support by contacting the Renishaw subsidiary company that serves your country.

When you call, it will help the Renishaw support staff if you have the appropriate product documentation at hand. Please be prepared to give the following information (as applicable):

- The version of the product you are using (see the *Equipment Registration Record* form).
- The type of hardware that you are using (see the *Equipment Registration Record* form).
- The exact wording of any messages that appear on your screen.
- A description of what happened and what you were doing when the problem occurred.
- A description of how you tried to solve the problem.

Chapter 1

Installing Hardware and Software

Before you start to install the hardware and your Renishaw software, take time to read this chapter. It provides you with some guidelines to follow when installing and checking the equipment and software.

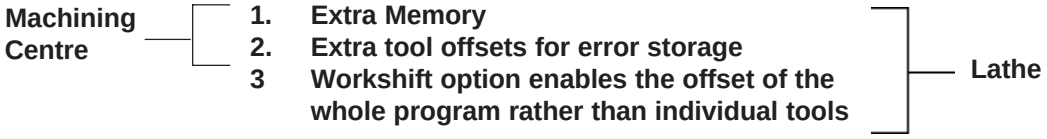
Contained in this Chapter

1.1 Introduction

This installation manual covers the fitting of Renishaw probe systems to the following control systems:

Controller	Models Supported
Fadal	CNC88
	32MP
Fanuc	FS 6-M, 6-T
	FS 10-M, 11-M, 12-M, 16M, 18M 15M/10-T 11-T, 12-T, 15-T, 16T, 18T
	FS 0-M, 0-T (Controls fitted with custom macro 'B' only)
	FS 0-M, 0-T (Mate controls cannot be fitted with custom macro 'B')
Mazak	M2
	M32
Meldas	M310
	M320
	M330
	M335
	M3
	M520
Okuma	OSP5020
Sharnoa	Tiger 5
Tosnuc	600M
	800M
Yasnac	MX1
	MX2
	MX3
	M80 (I80)

1.2 Desirable Control Options



1.2.1 General

Where combined inspection and toolsetting packages are required, a spare M code can be used for switching purposes. This is not fitted in the software.

Ensure that the correct hardware has been supplied and is compatible with your requirements.

It is assumed that the installation will be installed by a competent person who is familiar with both the machine tool and Renishaw equipment.

1.2.2 Wiring Connections

Details provided in *Chapter 3 – Fanuc Connection Diagrams* show the necessary connections that are required. Useful information is also provided in *Chapter 4 – Fanuc Diagnostic and Location Chart and High Speed Skip*.

The termination of all relevant connections must, however, be clearly established by liaison with the machine tool builder, and the wiring and connection diagrams supplied with the machine.

Check with the machine tool builder whether the P.M.C. ladder work is complete for skip and I/O. The ladder can be displayed on some controls and the connections can be checked.

Ensure that input addresses are not being used for other purposes.

1.2.3 Cable Routing

Cable routing is important. Cables should be installed to avoid high current sources such as 3-phase transformers or axis drive motors. Signal interference can occur as a result of bad cable routing.

1.2.4 Hardware Installation

The siting of equipment and all necessary installation adjustments to the hardware is to be found in the documentation supplied with the hardware.

1.2.5 Machine Parameters

The parameters settings must be set as described in *Chapter 5 – Fanuc Machine Parameters.*

1.3 Installing the *Tool Setting* Software for Machining Centres

This section describes how you load and customise the *Tool Setting* software. The software is supplied with standard settings, but these may be adjusted to suit specific machines during installation.

The information in this section supplements the information contained in the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082).

1.3.1 Checks and Adjustments

The checks and adjustments described below do not apply to machines that are fitted with Haas controllers. If your machine is fitted with a Haas controller, you should refer to the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082) for information applicable to this type of controller.

- Check that the probe system is functional and that the stylus faces have been set parallel to the axes. You should find this described in the appropriate *Probe Installation Manual*.

- Set the software variable base number in macro O9799. You will find a description of how to edit the base number setting in the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082).

- Set the macro variables to suit your machine. You will find a description of how to do this in in the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082).

- Check for an active tool offset. You will find a description of how to do this in section *1.3.2 – Active Offset Software Adjustments* .

- Configure the tool select macro if you intend using macro O9853. You will find a description of how to modify the tool select macro in the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082).

- Calibrate the probe fully using macros O9851 and O9852. You will find a description of how to calibrate your probe in the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082).

- Set a tool using the manual-jog macro cycles O9851 and O9852 to establish tool geometry values. You will find this described in the manual *Tool Setting for Machining Centres – Programming Manual* (Part No. H-2000-6082).

- Adjust the back-off distance #506 using macro cycle O9851. You will find this described later in section *1.3.4 – Adjusting Back-Off Distance* #506.

- Finally test the Auto-Setting cycle O9853 using the same tool.

1.3.2 Active Offset Software Adjustments

Carry out the following test during installation of the software to check for safe probe cycle operations.

Perform this test away from the probe and any other obstruction.

1. Enter value(s) into an active tool offset register, e.g. offset number 1.

   Example: 25mm (1.0in) in the geometry offset.
   5mm (0.2in) in the wear offset (if applicable).

2. Run the safe operation test as shown below.

```
%
O0001(REN SAFE OPERATION TEST)
G65P9851K1.     (Any small value in K is suitable – the
                 default value is 1mm [0.04in])
M30
%
```

   The Z or spindle axis should move down towards the stylus a total distance of 14mm (0.56in), i.e. by the software default amount.

3. If the distance travelled includes the tool offset amount(s) corrective action is required (see section *1.3.3 – Software Adjustment* later in this chapter).

Repeating the Test

Repeat the test described in steps 1 to 3 above for all possible error causing conditions.

Typical test conditions include:

- Immediately after a power up situation.
- Immediately after a previous program has finished.
- Pressing the reset button before this test.
- Trying a program G28G91Z0 return before the test.
- Trying a manual return sequence before the test.
- Trying any other typical preferred ways of working on your machine.

The purpose is to give confidence that the software is safe to use for all normal operating conditions. Any error-causing conditions can either be corrected at this stage, or at least you will be aware of any sequence to avoid.

1.3.3 Software Adjustment

Mazak/Meldas Controls

The software is supplied as standard to read any active tool offset amount(s) by reading the last active H word (this assumes the last H offset is still active). This is done because there is no system variable to read directly the active tool offset amount.

Fanuc/Yasnac/Haas Controls

The software is supplied as standard to read the active tool offset amount using variable #5083.

This method normally works on all Fanuc controls (not Mazak/Meldas). However, due to the machine builder parameter settings this may also give problems, particularly if the geometry or wear offset is not included in the active offset amount.

In case of difficulty, this can be changed to the Mazak/Meldas method by deleting or commenting out the following line at the end of macro O9799.

```
N110
#149=#5083        Delete or comment out this line (#149=#5083)
#31=#0
M30
```

If this change does not resolve the problem(s), it may be necessary to be aware of the error causing condition(s), and work around them.

G91G28 Return Problems

If the G28G91Z0 return causes a problem, this can usually be avoided by using a G53G90Z0 return (see the manual *Tool Setting for Machining Centres – Programming Manual* [Renishaw Part No. H-2000-6082]).

1.3.4 Adjusting Back-off Distance #506

The static or non-rotating length setting uses the standard Renishaw two-touch method of measurement.

A back-off distance factor #506 is provided for adjusting the move distance off the surface prior to the final measuring move.

The software loads a default value of 0.5 when first run. This stored value in #506 should be optimised for minimum cycle time.

Adjust the back-off distance factor #506 as follows:

Repeat the static length setting cycle O9851, reducing the #506 value each time until the tool just clears the stylus surface prior to the second touch.

NOTE: When the value is too small, a 'Probe Open' alarm results.

1.4 Installing the *Inspection Plus* Software

This section describes how you load and customise the *Inspection Plus* software. It supplements the information described in the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031).

1.4.1 Installing the Software

It is important that the software is installed to suit the type of controller and options available. Do this as described below:

1. First, refer to the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031) to determine whether the *Inspection Plus* software is suitable for your needs.

2. Decide which cycles you require before proceeding. These are covered in the preliminary part of the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031).

3. Load the basic cycles on file 40120519.

   (1) Delete any unwanted O98-- series cycles.

   (2) If the vector cycles are to be used, delete the following macro:

   O9803 (macro O9804 is used instead)

   Otherwise delete the following macros:

   O9727 O9731 O9804 (these macros are used only for vector cycles)

   (3) If the print option is not to be used, delete the following macro:

   O9730

4. Establish which of the Option 1 file 40120520 cycles you require. Load the Option 1 file if required. Delete all unwanted macros from the control before loading further macros.

5. Establish which of the Option 2 file 40120521 cycles you require. Load the Option 2 file if required. Delete all unwanted macros from the control.

1.4.2 Establishing #506 Back-off Distance

Run the Optimisation macro to establish the #506 back-off distance and #119 fast feedrate.

Refer to the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031) for a description on the use of macro variables and Optimisation macro O9836.

For small and medium size machines, i.e. machines having less than 1000mm (40in) of axis travel, the standard feedrates as supplied are normally acceptable. This macro may be deleted by the operator after optimisation is completed.

1.4.3 Settings Macro O9724

If the default values are not suitable, you will need to change the Settings macro O9724. Refer to the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031) for a description of macro O9724.

Set the following Settings macro options:

- Work offset type
- Tolerance alarms or flag only (FMS type application)
- Tool offset type

The examples in this section are for general guidance only. Please note that the exact programming format may not suit either your machine set or recommended method as specified by your machine builder.

1.5 Testing the Installation

When the power is switched on, the interface should be operational and respond to the probe conditions. All signal conditions and status of the LEDs on the front panel are described in the Probe and Interface User's Guide supplied with the equipment. At this stage, it is advisable to check the machine diagnostics to establish whether the signals are being received by the machine.

When checking the machine diagnostics, take note of the following points:

1. Fanuc Logic
   0 (0) is the low state (0V)
   1 (1) is the high state (+24V or +5V) dependent on whether normal or high speed skip is used.

2. When the skip signal is already high, the machine does not move under the G31 skip command. This is not applicable to Yasnac controls and the Meldas M310 control.

3. The machine normally responds to a rising edge signal (0V to +V) under the G31 skip command. This can be modified on some controls – see section 5.9 titled *Parameters Related to Multi-Channel Skip 10-11-12-15 M/T* in *Chapter 5 – Fanuc Machine Parameters*.

4. When the Renishaw interface is in an error state, e.g. due to transmission failure, the status relay output is forced high even if the probe stylus is not deflected.

5. The Renishaw skip relay (when used) is a pulsed output which responds to every probe change of state (seated/deflected). The Fanuc diagnostic changes 0-1-0, but when checking this on the diagnostic screen, the change of state may not be seen each time due to the response time of the screen.

The final checks on the system are described in *Chapter 6 – Fanuc Software Installation.*

1.6 Input Voltage and Supply

It is important on all controls that the voltage used to drive the probing input is taken from the correct source. In most cases this is decided by the machine tool builder (for Fanuc High Speed Skip information, see the end of this section).

Figures 1.1 and 1.2 show typical power supply connection arrangements.

The machine tool builder's wiring manuals should be used to check which power supply is used for the probe input. This power supply usually supplies all the other inputs and will be stabilised.

On systems with I/O boxes, the inputs may be either 100 – 120Va.c. or 0V/24Vd.c.

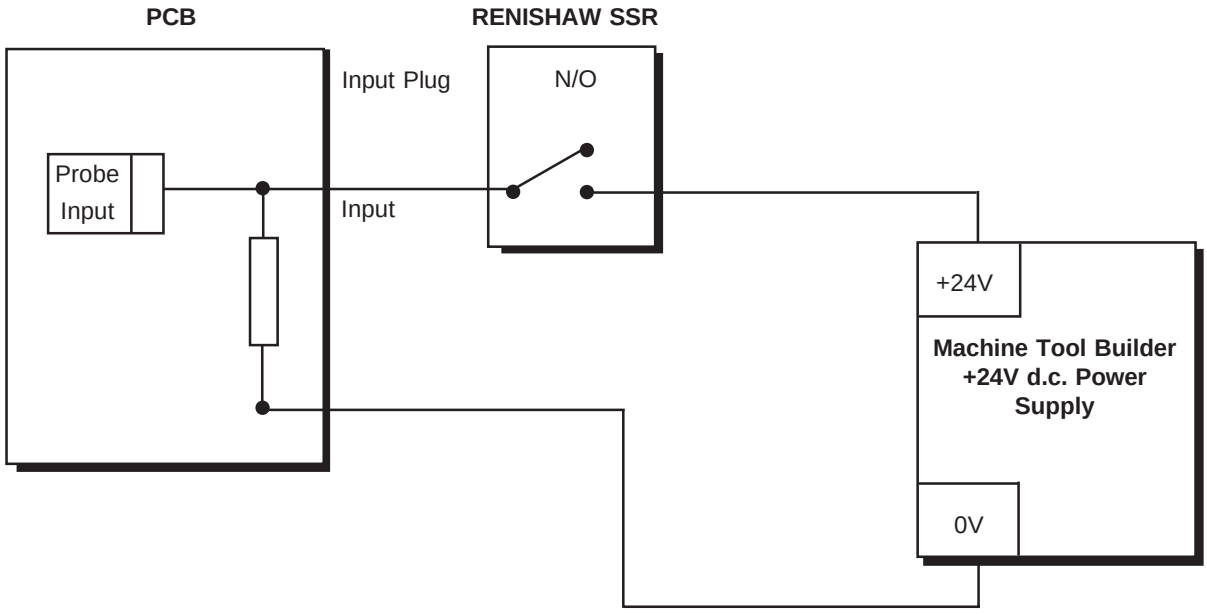


Figure 1.1 Probe Input Power Connections – 24V Common

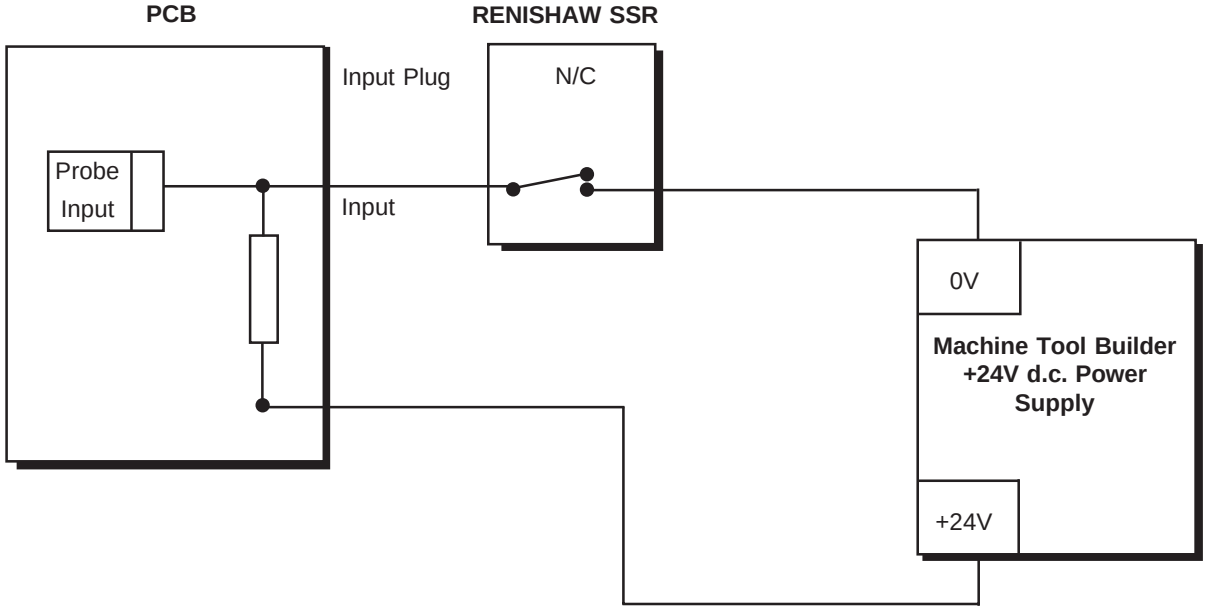
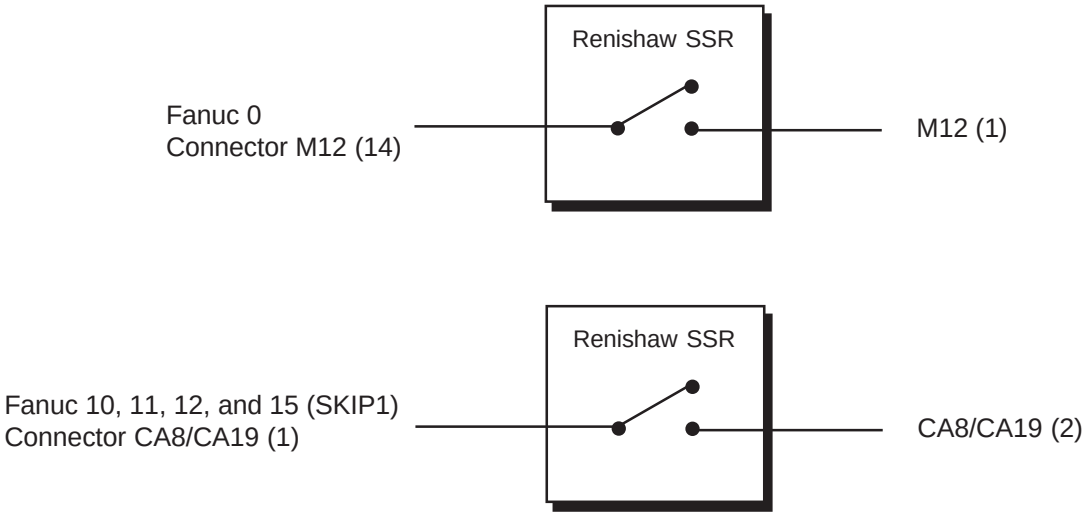


Figure 1.2 Probe Input Power Connections – 0V Common

High Speed Skip (Fanuc)



Chapter 2

Calibrating the Probe

Before you start to use your Renishaw software, take time to read this chapter. It will provide you with a basic understanding of the importance of accurately calibrating the probe you intend to use for either tool setting or measuring. Only when the probe is accurately calibrated can you achieve total quality control over your manufacturing process. This chapter also provides you with some guidance regarding the most suitable operating conditions for your probe.

Contained in this Chapter

2.1 Calibrating a Tool Setting Probe

2.1.1 Why Calibrate Your Tool Setting Probe?

In the manual *Tool Setting for Machining Centres – Programming Manual* (Renishaw Part No. H-2000-6082) you will find details of how to calibrate your Renishaw tool setting probe. But why is it so important that your probe is calibrated?

When your probe is assembled and mounted on the machine table, it is necessary to align the stylus faces with the machine axes to avoid probing errors when setting tools. It is worth taking care with this operation – you should try to get the faces aligned to within 0.010mm (0.0004in) for normal use. This is achieved by manually adjusting the stylus with the adjusting screws provided, and using a suitable instrument such as a DTI clock mounted in the machine spindle.

When the probe has been correctly set up on the machine, it is time to calibrate the probe. Calibration cycles are provided for this task. The purpose is to establish the probe stylus measuring face trigger point values under normal measuring conditions. The calibration values are stored in macro variables for computation of the tool size during tool setting cycles.

Values obtained are axis trigger positions (in machine co-ordinates). Any errors due to machine and probe triggering characteristics are automatically calibrated out in this way. These values are the electronic trigger positions under dynamic operating conditions, and not necessarily the true physical stylus face positions.

NOTE: Poor repeatability of probe trigger point values indicates that either the probe/stylus assembly is loose or a machine/probe fault exists. Further investigation is required.

As each Renishaw tool setting probe system is unique, it is imperative that you calibrate it in the following circumstances:

- If it is the first time your probe system is to be used.
- If a new stylus is fitted to your probe.
- If it is suspected that the stylus has become distorted or that the probe has crashed.

2.1.2 Notes on Tool Speed and Feed Rates

CAUTION: Setting tools by rotating against the stylus is suitable for most tools. However, this operation for some tools, such as carbide tipped and delicate cutting teeth, may suffer from cutting edge deterioration as a result of contact with the stylus under these conditions.

The following parameters for operating conditions have been found by experience to suit Renishaw tool setting probes. Improvement and optimisation may be possible for specific applications.

The table mounted probe is suitable for setting tool lengths non-rotating. Cycles are also provided with the capability to set rotating tools for length and radius.

First Touch Spindle RPM

RPM for the first move onto the probe is calculated from a surface cutting speed of 60.0 metres/min (197.0 ft/min). This is maintained within the range 150 rpm to 800 rpm and relates to a range of 24.0mm to 127.0mm (0.95 to 5.0in) diameter cutters. The surface cutting speed is not maintained outside this range.

First Touch Feed Rate

The feed rate is calculated as follows:

F= .16 x rpm F units mm/min (diameter set).
F= .12 x rpm F units mm/min (length set).

Second Touch Spindle RPM

800 rpm.

Second Touch Feed Rate

4.0mm/min feed rate (0.12in/min) resolution 0.005mm/rev (0.00020in/rev).

2.1.3 Tool Offset Methods

The *Tool Setting* software runs with the following tool offset methods:

1. Positive type tool offsets (gauge line to tool tip).

2. Master type tool offsets (master tool has 0 (zero) length offset, all other tools are referenced to it).

NOTE: It is not possible to run this software with 'air gap' type tool offsets.

'Air gap' description:

Negative tool lengths
The spindle axis move distance necessary to reach the reference surface with the tool point.

This method requires recalibration at each job set up. The master tool 'air gap' length also changes for each job set up.

2.2 Calibrating a Measuring Probe

2.2.1 Why Calibrate your Measuring Probe?

In the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031) you will find a description of how to calibrate your Renishaw measuring probe. But why is it so important that your probe is calibrated?

When you assemble your Renishaw probe into its machine shank/holder, it is *not* necessary for the probe stylus to run true to the spindle centre line. A small amount of run-out can be tolerated, but it is good practice to get the stylus mechanically on-centre to reduce the effects of spindle and tool orientation errors. Without calibration of the probe the run-out will lead to inaccurate results. By calibrating your probe, the run-out is automatically accounted for. The 'Calibration in a Bored Hole' cycle (Macro O9802) provides the data to allow for this run-out.

As each Renishaw probe system is unique, it is imperative that you calibrate it in the following circumstances:

- If it is the first time your probe system is to be used.
- If a new stylus is fitted to your probe.
- If it is suspected that the stylus has become distorted or that the probe has crashed.

- At regular intervals to compensate for mechanical changes of your machine tool.

- If repeatability of relocation of the probe shank is poor. In this case, the probe may need to be recalibrated each time it is selected.

Three different operations are used to calibrate a probe. They are:

- Calibrating in a bored hole;

- Calibrating in a ring gauge; and

- Calibrating the probe length.

2.2.2 Calibrating in a Bored Hole

Calibrating your probe in a bored hole automatically stores values for the offset of the stylus ball to the spindle centre line. The stored values are then automatically used in the measuring cycles. They compensate the measured values so that they are relative to the true spindle centre line.

2.2.3 Calibrating in a Ring Gauge

Calibrating your probe in a ring gauge of a known diameter automatically stores one or more values for the radius of the stylus ball. The stored values are then automatically used by the measuring cycles to give the true size of the feature. The values are also used to give true positions of single surface features.

NOTE: ***The stored radii values are based on the* true *electronic trigger points. These values are different from the physical sizes.***

2.2.4 Calibrating the Probe Length

Probe length calibration on a known reference surface stores the length based on the electronic trigger point. This is different from the physical length of the probe assembly. Additionally, this operation can automatically compensate for machine and fixture height errors by adjusting the probe length value that is stored.

2.2.5 Calibration Cycles

There are four calibration cycles provided with the *Inspection Plus* software. These may be used in conjunction with one another for complete calibration of the probe. The four macros are summarised below. For further details, you should refer to the manual *Inspection Plus Software – Programming Manual* (Renishaw Part No. H-2000-6031).

Macro O9801 This is used to establish the probe length in its tool shank.

Macro O9802 This is used to establish the stylus off-centre values.

Macro O9803 This is used to establish the stylus ball radius values. It is suitable for all measuring cycles *except* O9821, O9822 and O9823.

Macro O9804 This is used to establish the vector stylus ball radius values. It is suitable for *all* measuring cycles, *including* O9821, O9822 and O9823.

For complete calibration of a probe system, you must use macros O9801, O9802, and either O9803 or O9804.

The Renishaw calibration cycles are split into separate cycles for flexibility. If, however, the calibration feature is accurately known for both size and position, e.g. a ring gauge where the size is known, and the position is accurately found using a Dial Test Indicator, it is then possible for you to write a program which completes the full calibration procedure in one operation by calling all of the above macros.

Chapter 3

Fanuc Connection Diagrams

This chapter contains the connection diagrams which show how to make the connections to a Fanuc controller.

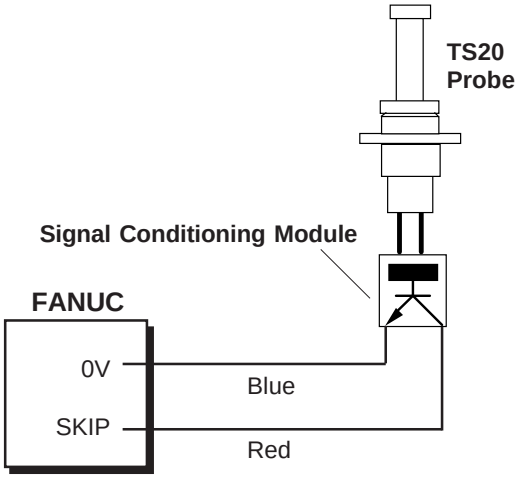
Contained in this Chapter

Appendix

3.1 TS20 Retrofit Tool Setting Connection to Fanuc Skip

0V COMMON CONNECTIONS

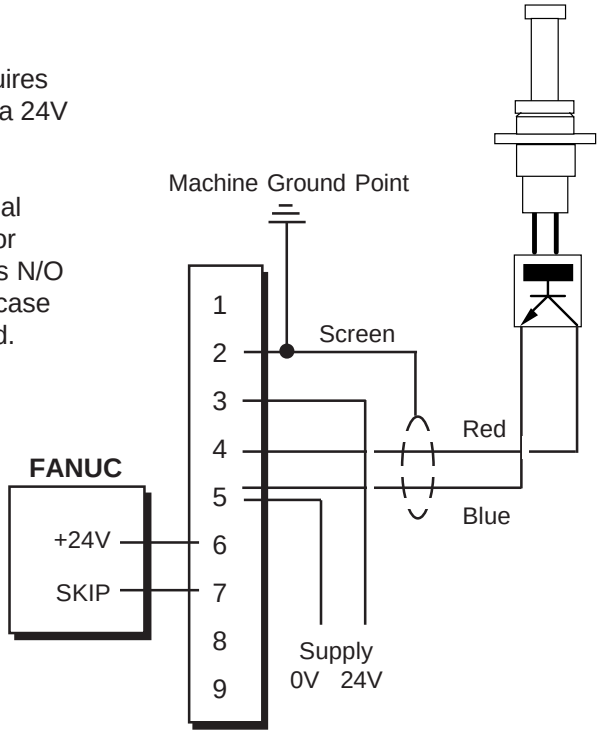
This is the preferred connection as it provides the necessary rising edge signal.



24V COMMON CONNECTIONS

The standard output of the TS20 requires to be converted to allow operation of a 24V common connection.

If required, the conversion of the signal can be made by the use of a convertor circuit from Renishaw, which provides N/O and N/C voltage free outputs. In this case the connection diagram below is used.

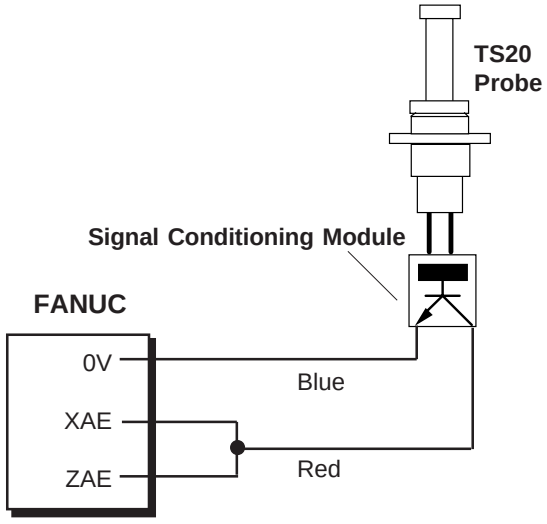


For additional information regarding the SSR Convertor see User's Guide H-2000-5011

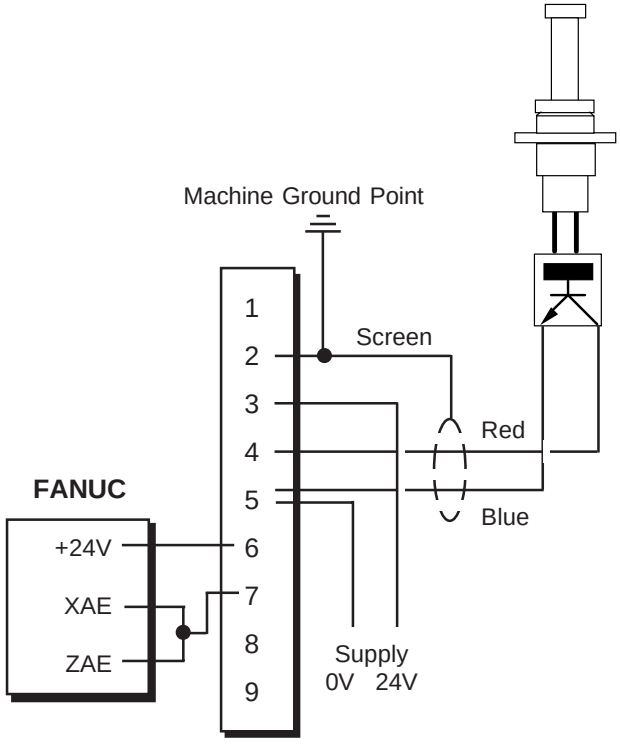
3.2 Connection to Automatic Tool Offset (XAE, ZAE)

0V COMMON CONNECTIONS

This is the preferred connection as it provides the necessary rising edge signal.



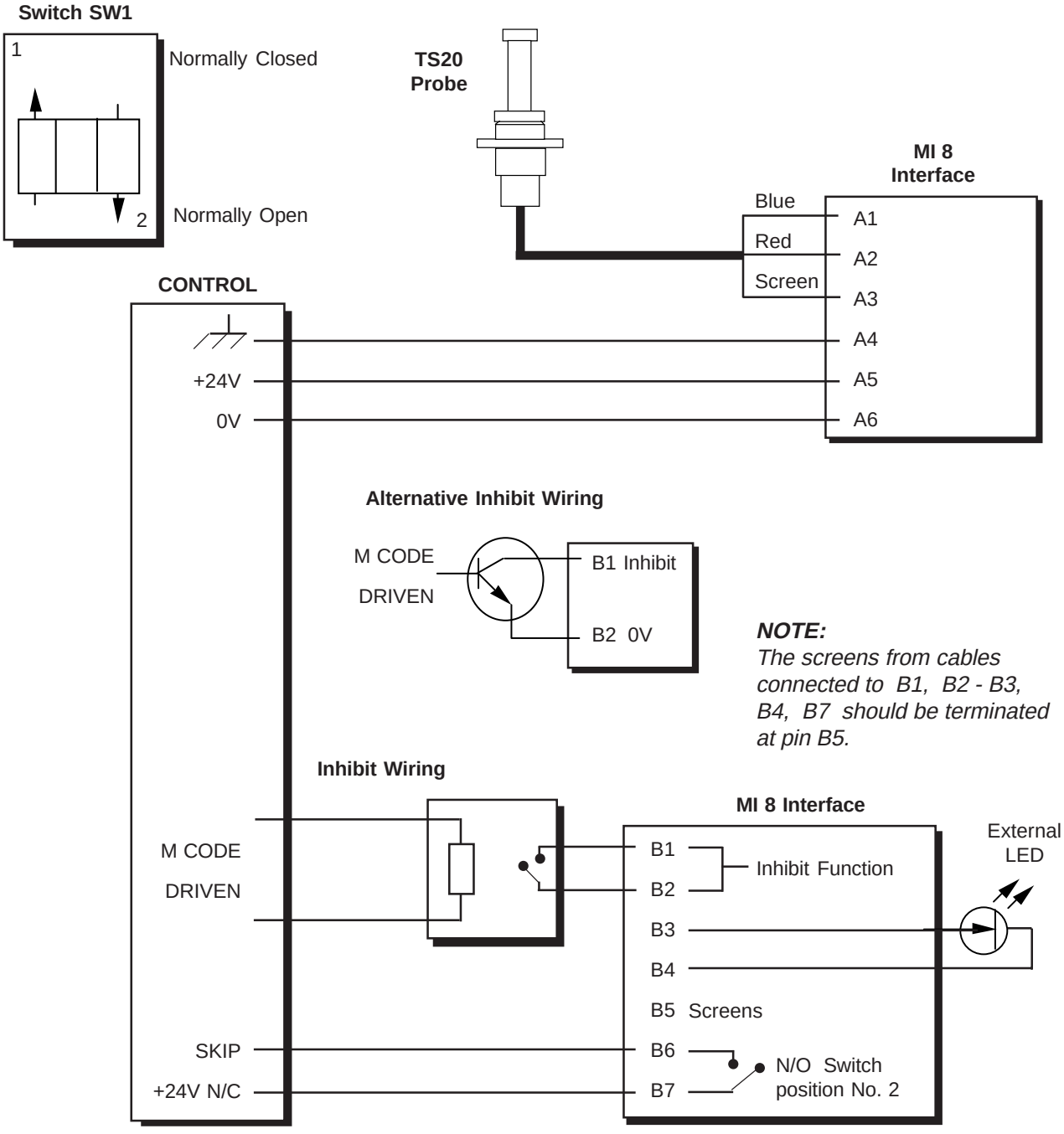
24V COMMON CONNECTIONS



For additional information regarding the SSR Convertor see User's Guide H-2000-5011

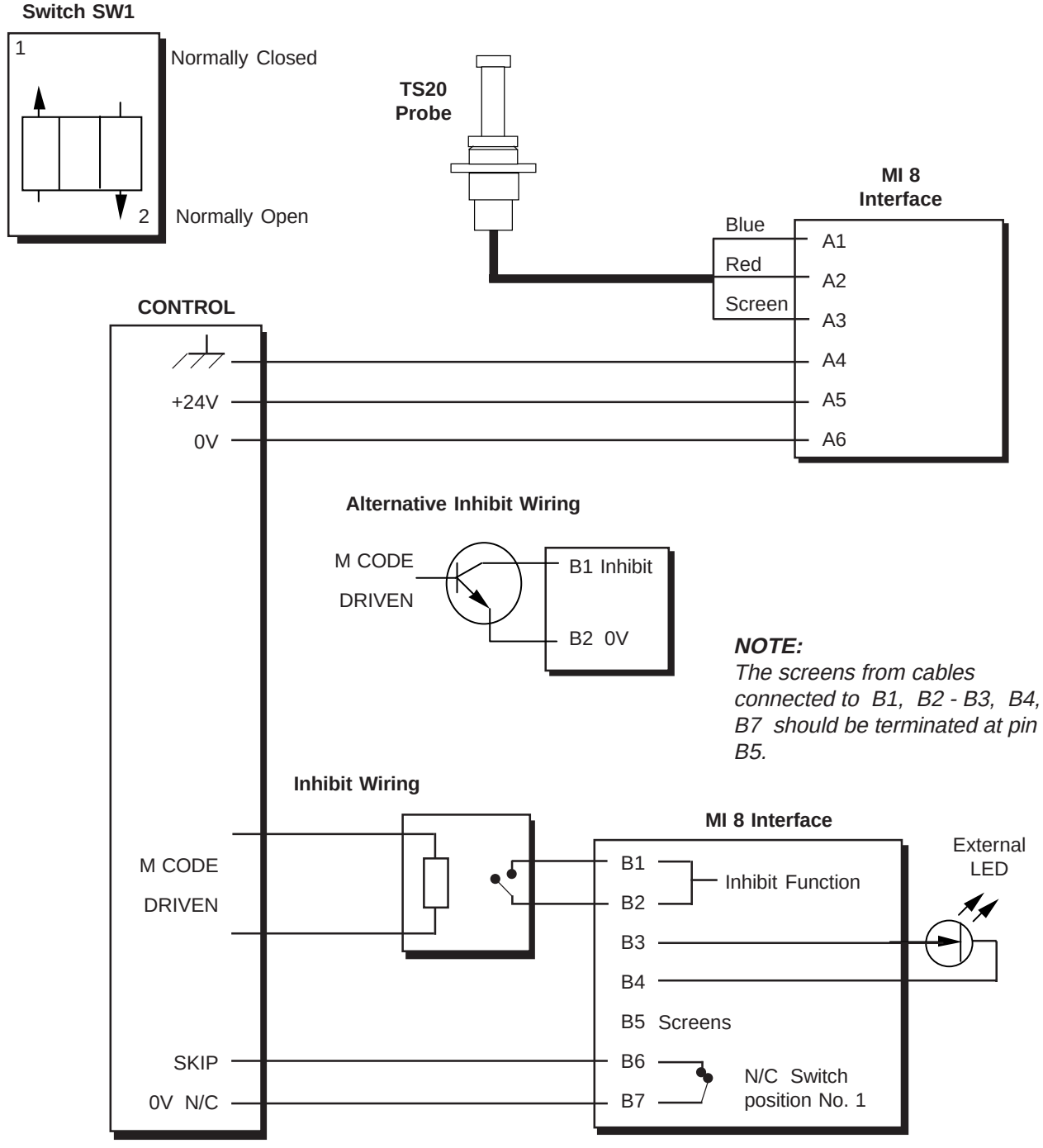
3.3 MI 8 Interface – Skip Signal 24V Common

RETROFIT HARD WIRED TOOL SETTING



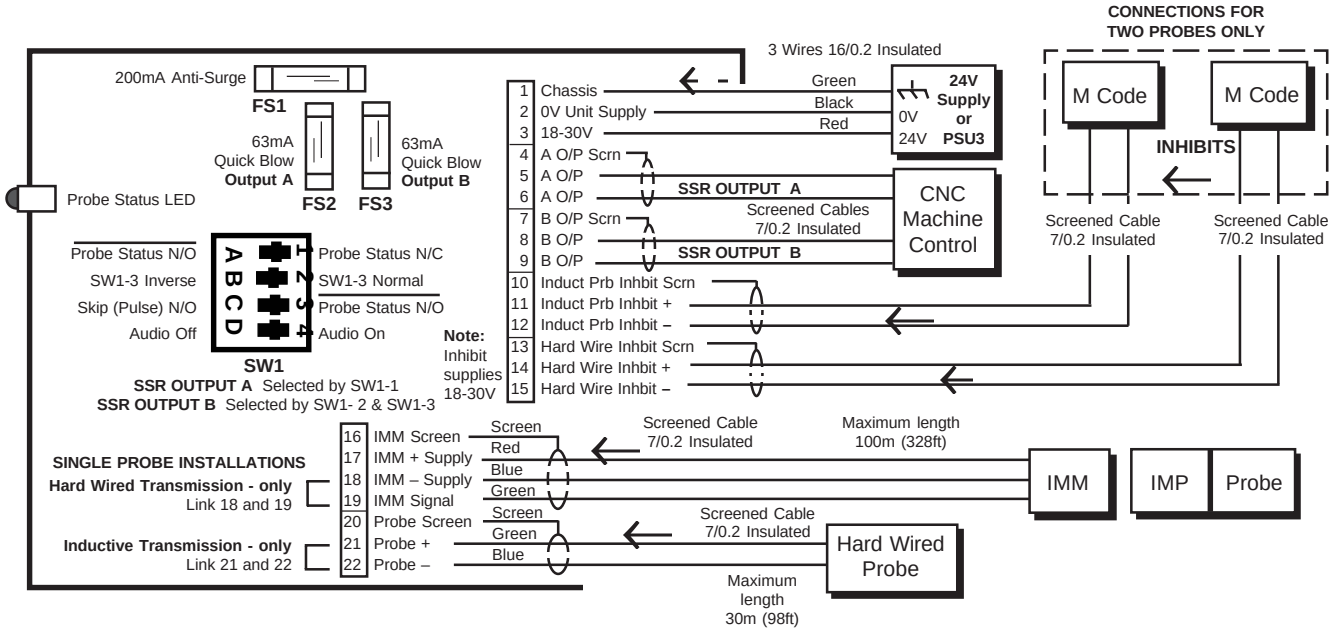
3.4 MI 8 Interface – Skip Signal 0V Common

RETROFIT HARD WIRED TOOL SETTING



3.5 MI 5 Interface Outputs

CAUTION: The wiring configuration of this unit differs from earlier models.

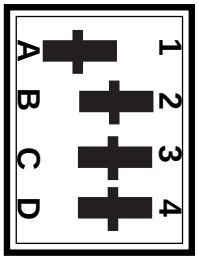


3.6 MI 5 Interface

RETROFIT INDUCTIVE AND HARD WIRED

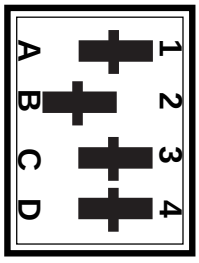
Switch SW1

Switch setting for two N/O Status Relays :



Switch SW1

To change output pins 5 and 6, to Status Relay N/C set SW1 as opposite :

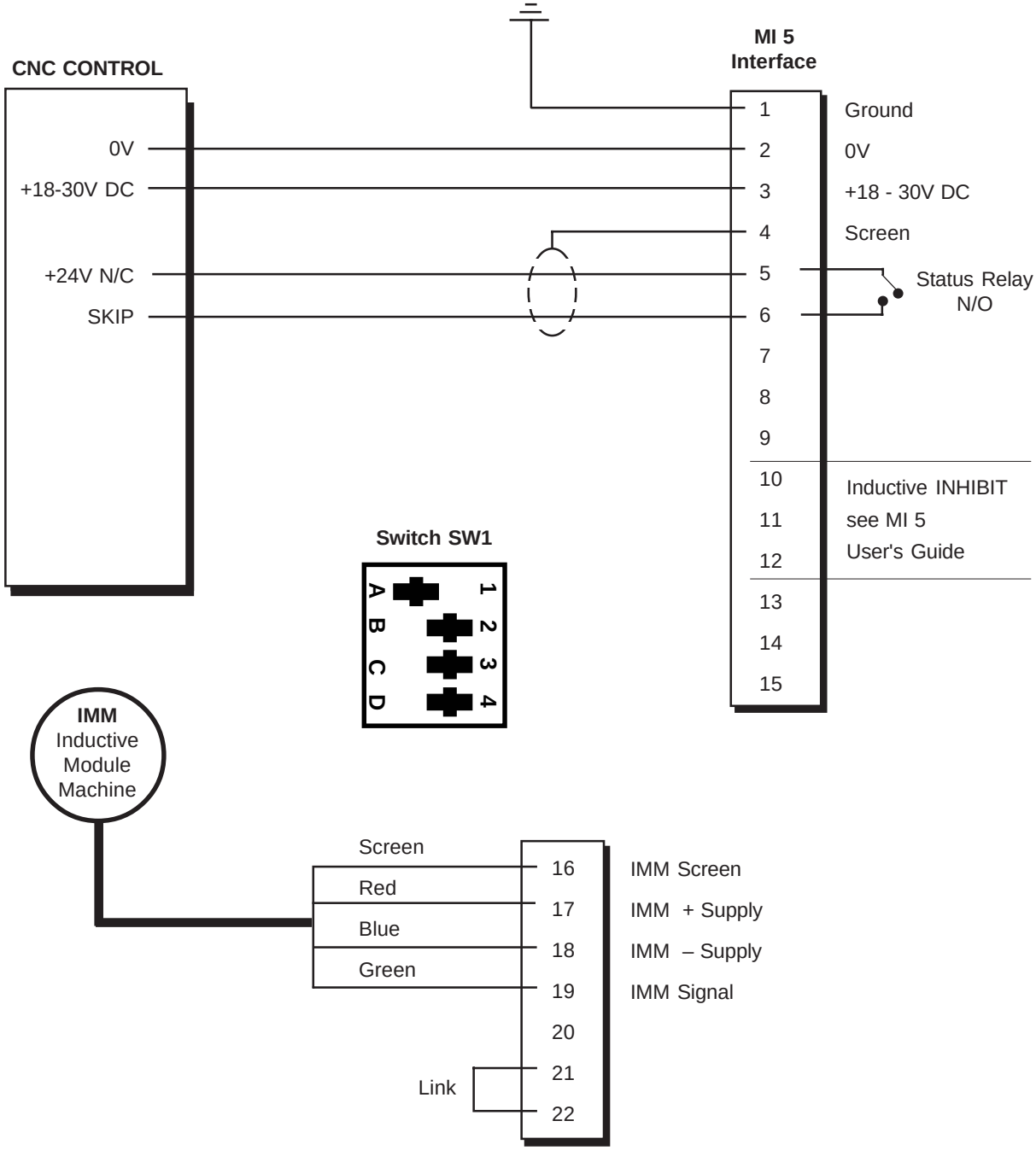


OPTIONS		SW1				
Output Pins 5 and 6	Output Pins 8 and 9	1	2	3	4	Audio (4)
Status N/C	Status N/O					On Off
Status N/C	Skip N/O					On Off
Status N/O	Skip N/O					On Off
Status N/O	Status N/O					On Off
Status N/O	Skip N/C					On Off
Status N/C	Skip N/C					On Off
		A	B	C	D	

The chart shows switch selectable positions which will enable the correct outputs to be established.

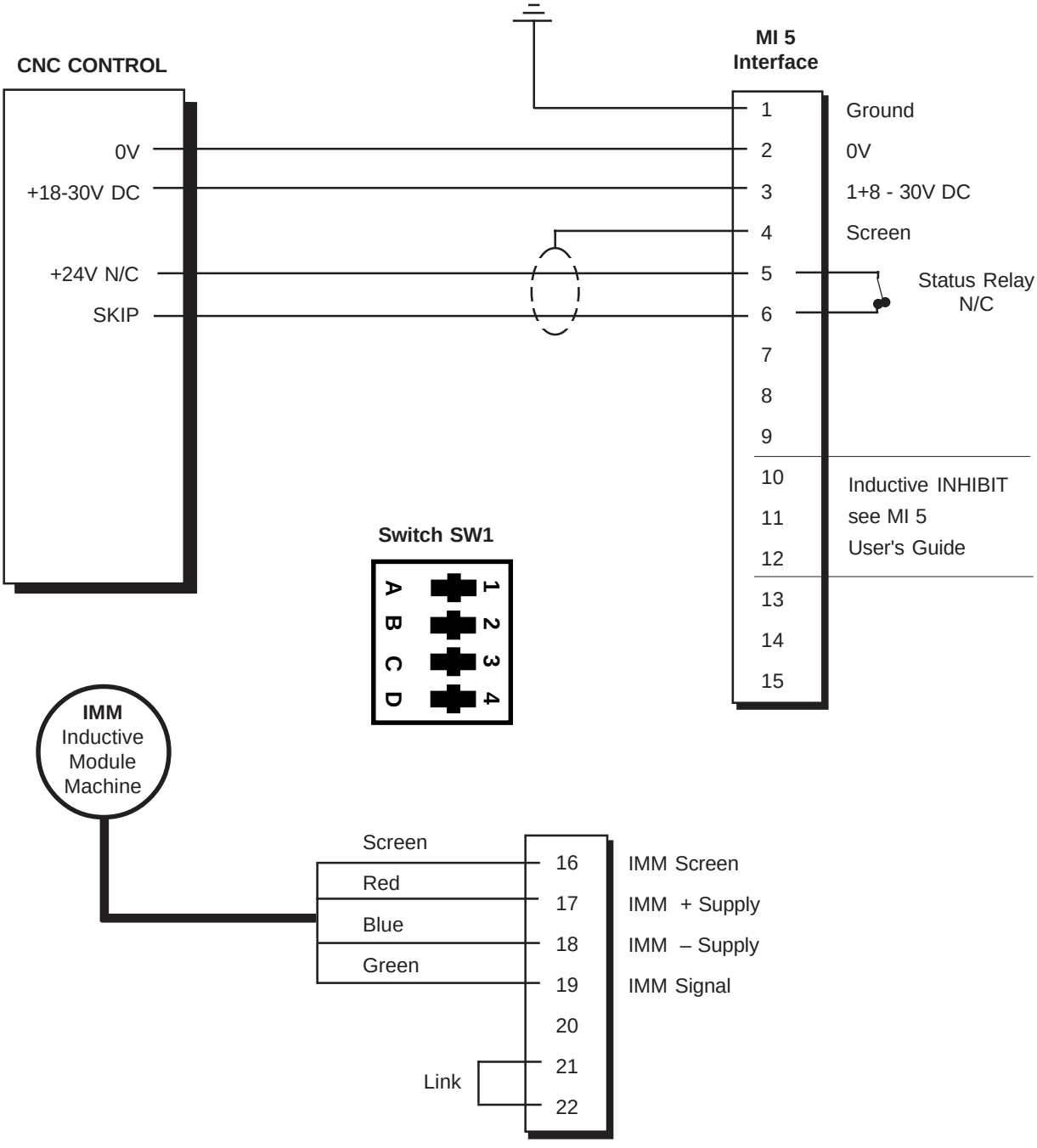
3.7 MI 5 Interface – Skip Signal 24V Common

RETROFIT INDUCTIVE

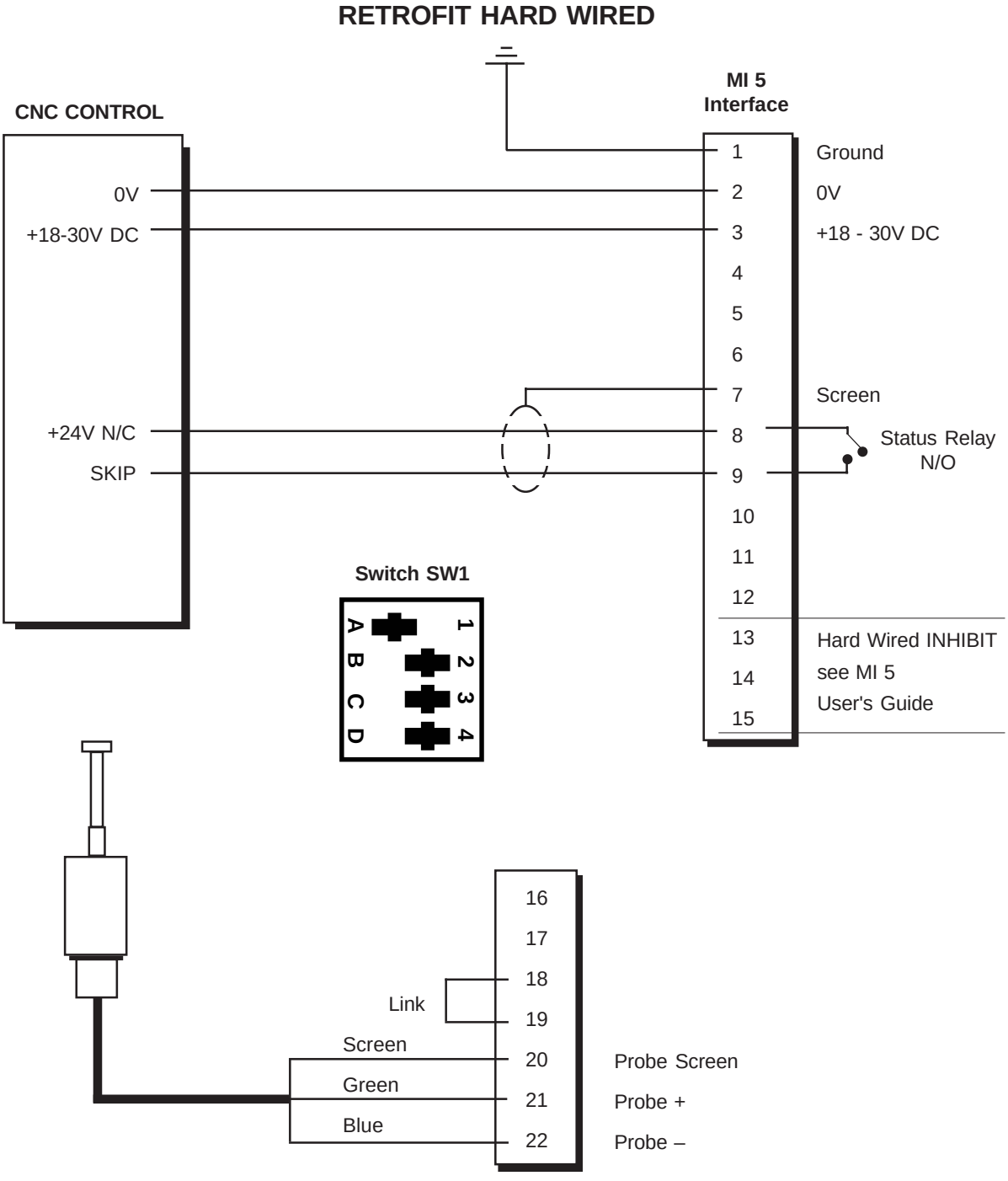


3.8 MI 5 Interface – Skip Signal 0V Common

RETROFIT INDUCTIVE

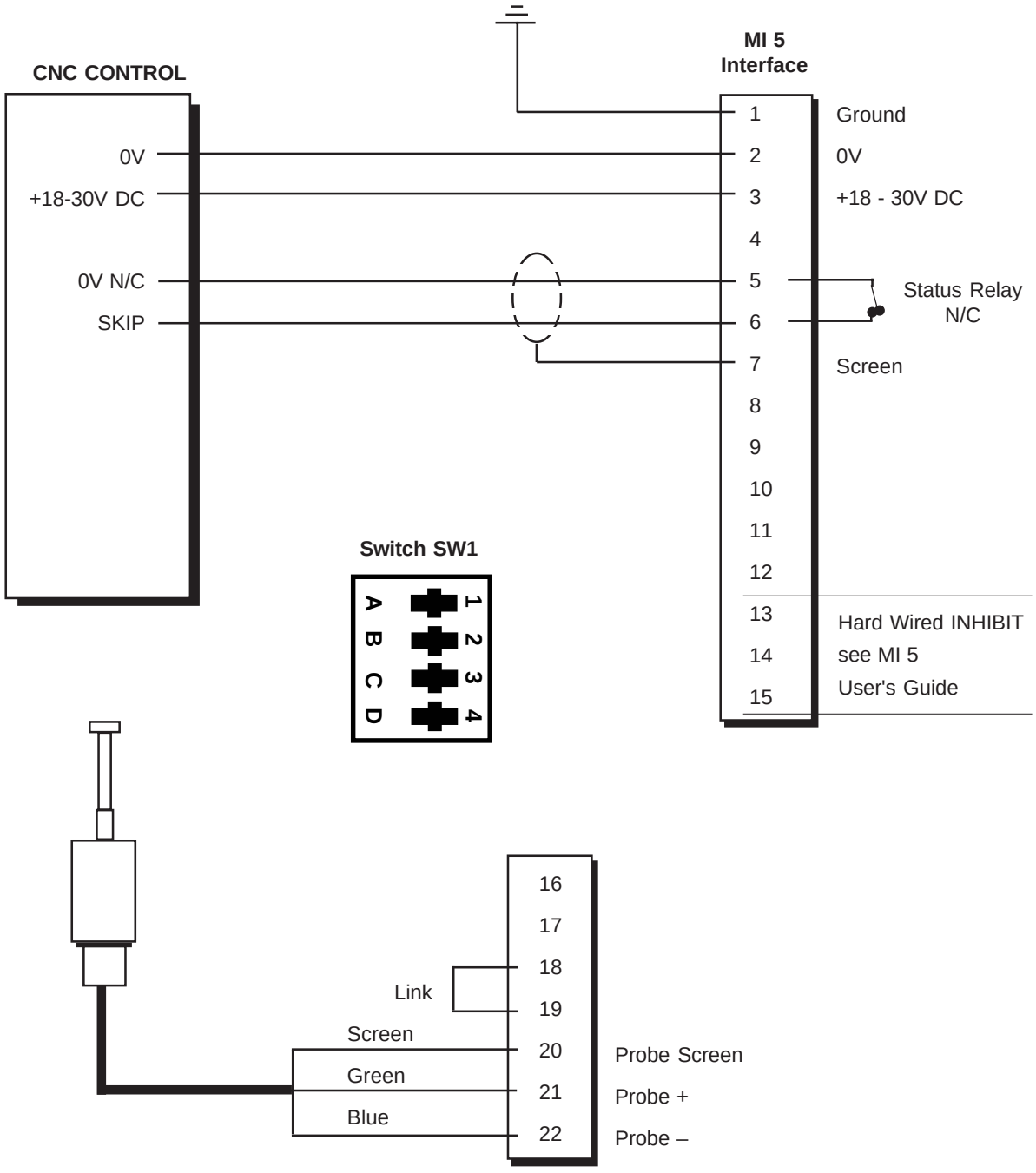


3.9 MI 5 Interface – Skip Signal 24V Common



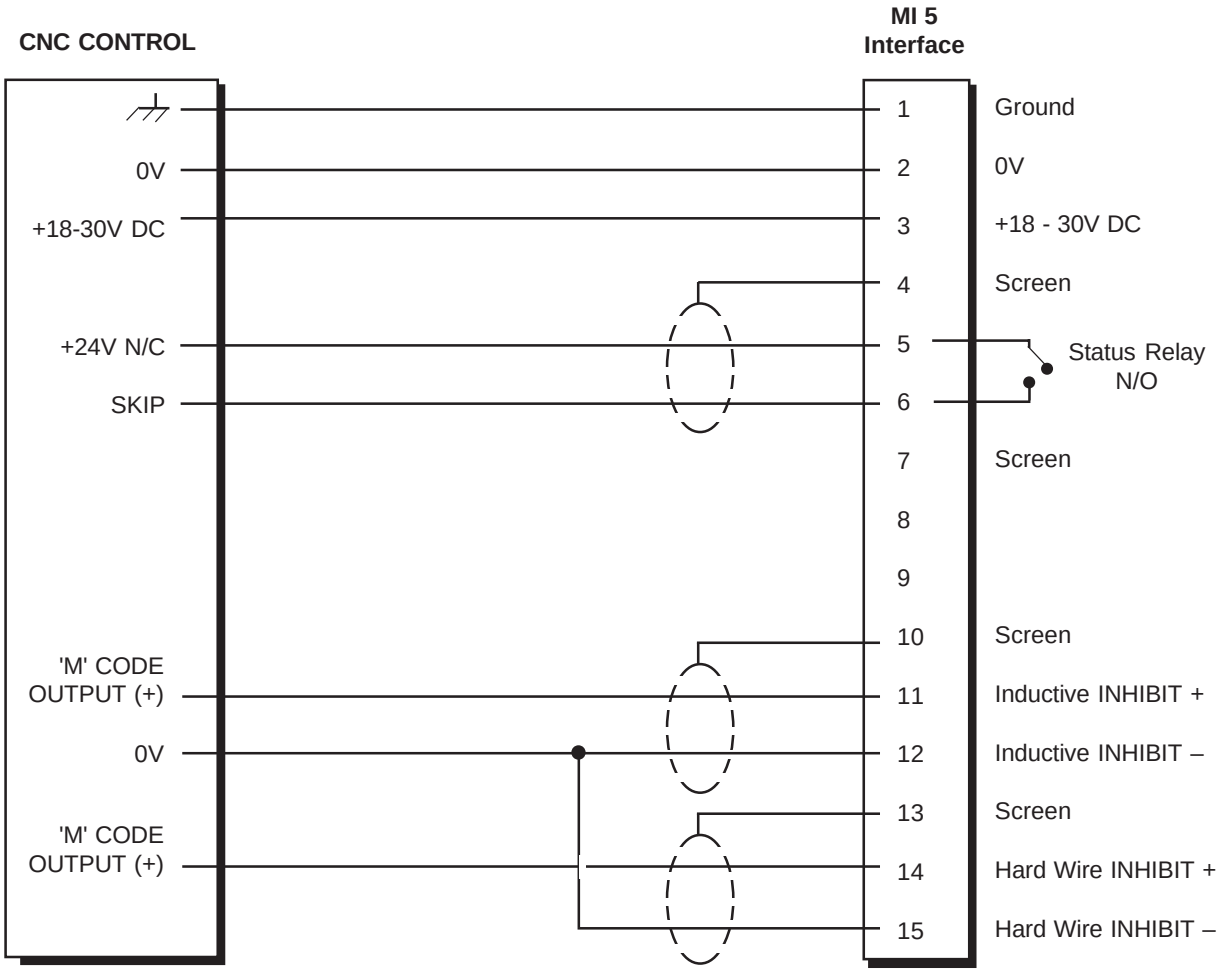
3.10 MI 5 Interface – Skip Signal 0V Common

RETROFIT HARD WIRED



3.11 MI 5 Interface – Skip Signal 24V Common

RETROFIT INDUCTIVE AND HARD WIRED



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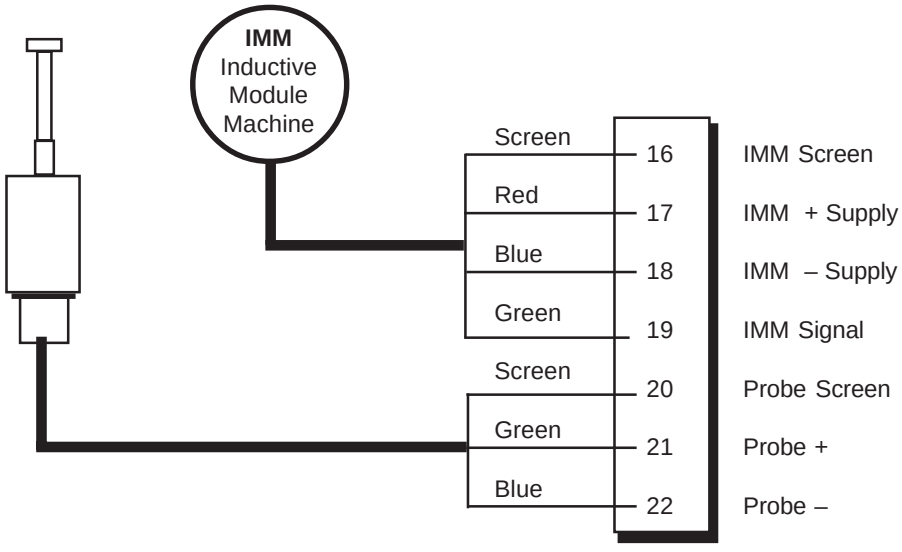
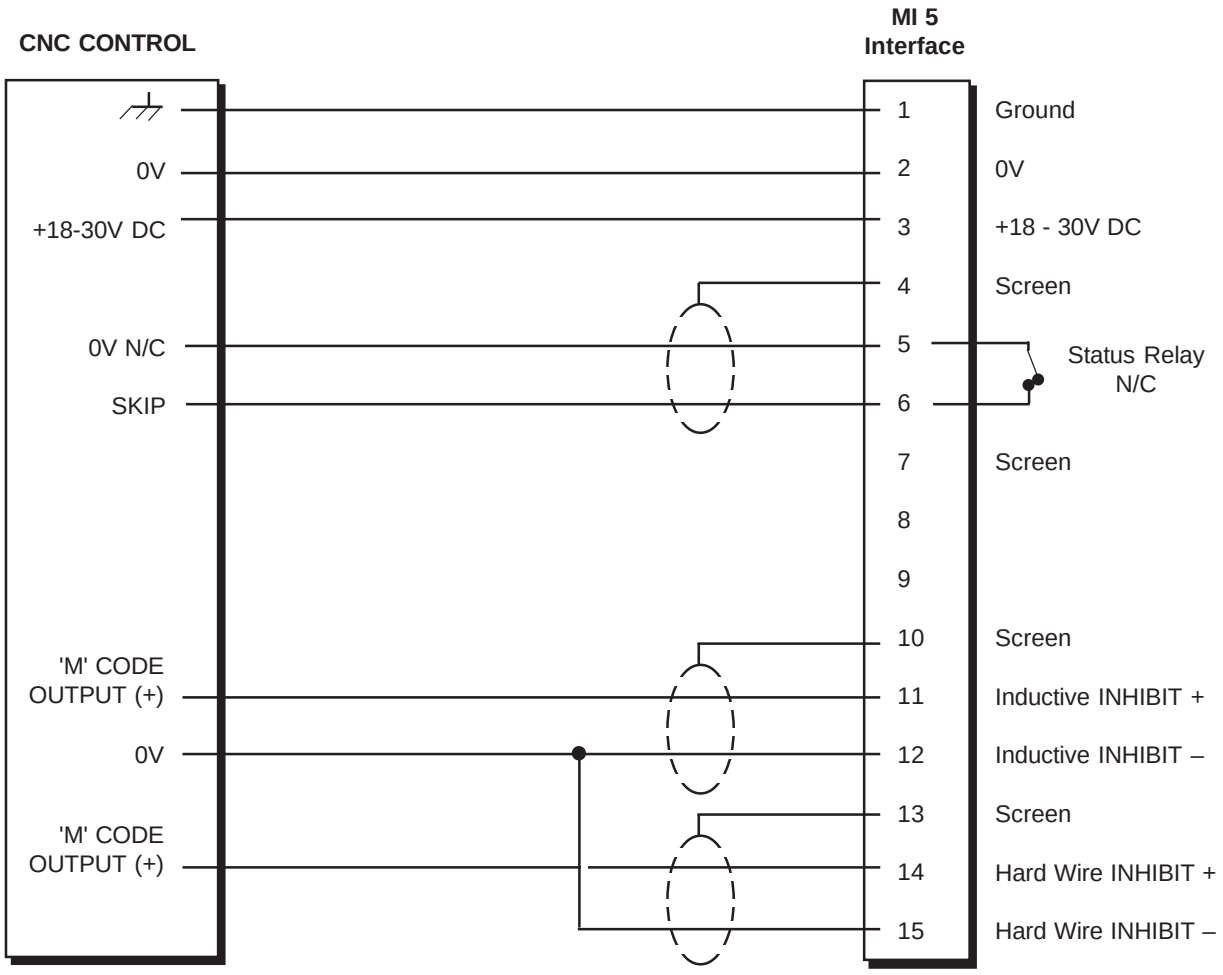


3.12 MI 5 Interface – Skip Signal 0V Common

RETROFIT INDUCTIVE AND HARD WIRED



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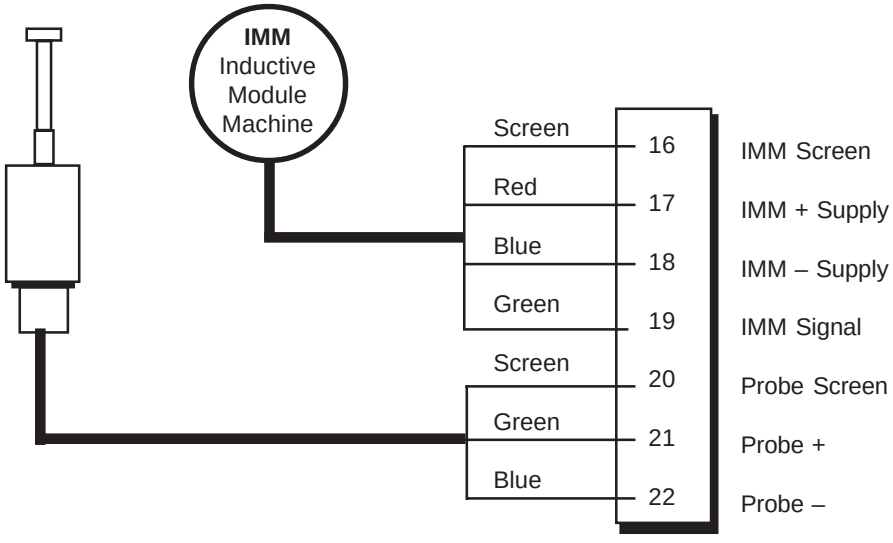
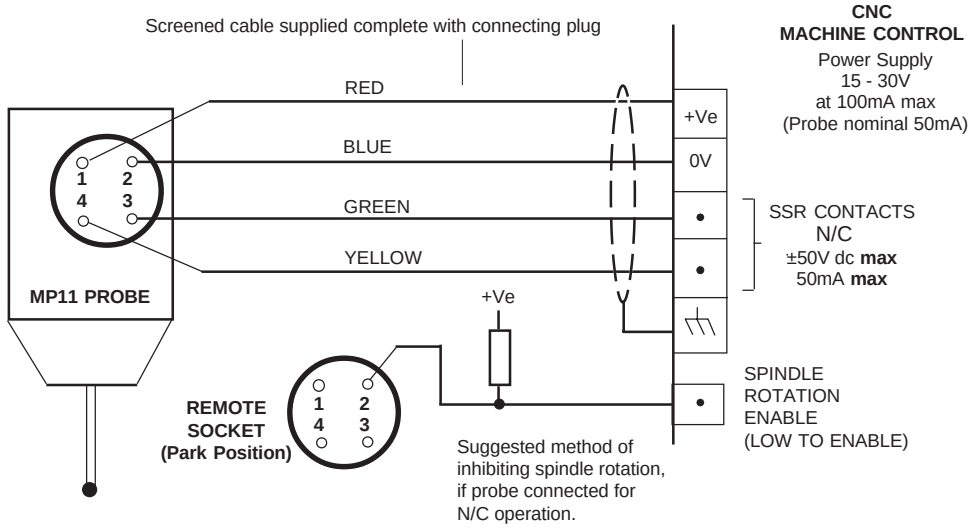


3.13 MP11 Probe Connections

3.13.1 Wiring Diagram for Relay Normally-Closed (N/C) Contacts

WARNING – OPERATOR SAFETY

It is recommended that a fail safe SPINDLE ROTATION INHIBIT is built into the system. This is one example, where the probe cable is plugged into a remote socket before spindle rotation is enabled. This prevents spindle rotation when the probe is used.



IMPORTANT :

1. The SSR will be permanently damaged if ±50V dc is exceeded across socket pins 3 and 4 or the current exceeds 50mA. (i.e. ensure the SSR supply is current limited).

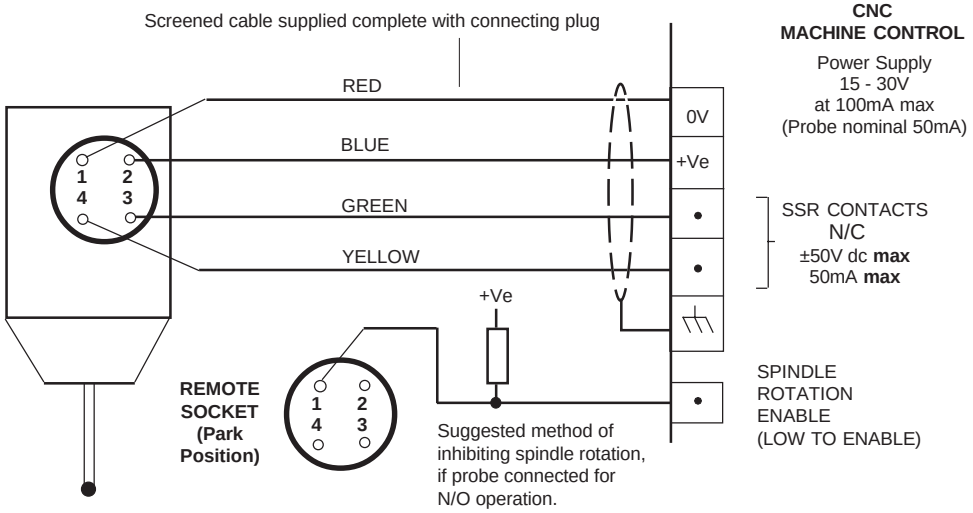
2. The probe power supply must not exceed 30V dc.

3. Route the cable away from high current sources. e.g. high-current cables, axis drive motors, three phase transformers, etc.

3.13.2 Wiring Diagram for Relay Normally-Open (N/O) Contacts

WARNING – OPERATOR SAFETY

It is recommended that a fail safe SPINDLE ROTATION INHIBIT is built into the system. This is one example, where the probe cable is plugged into a remote socket before spindle rotation is enabled. This prevents spindle rotation when the probe is used.



IMPORTANT :

1. The SSR will be permanently damaged if ±50V dc is exceeded across socket pins 3 and 4 or the current exceeds 50mA. (i.e. ensure the SSR supply is current limited).

2. The probe power supply must not exceed 30V dc.

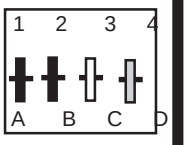
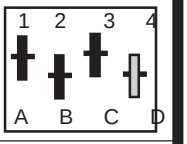
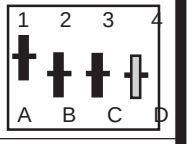
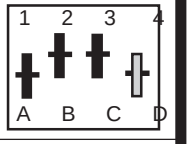
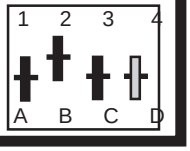
3. Route the cable away from high current sources. e.g. high-current cables, axis drive motors, three phase transformers, etc.

3.14 MI 12 Switch Settings

SWITCH SW 3
This switch enables Normally Open and Normally Closed options to be selected for skip and status.

SW3

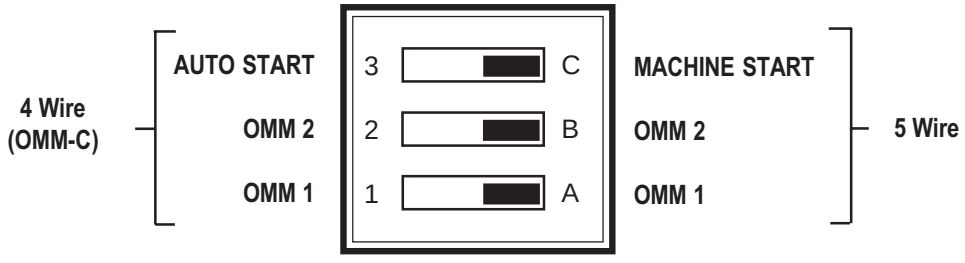
SW3 is factory set to Option 1.

OPTION	TERMINALS 14 & 15	TERMINALS 23 & 24	SW3
1	PROBE STATUS N/O	$\overline{\text{PROBE}}$ STATUS N/C	
2	$\overline{\text{SKIP}}$ N/C	$\overline{\text{PROBE}}$ STATUS N/C	
3	SKIP N/O	$\overline{\text{PROBE}}$ STATUS N/C	
4	PROBE STATUS N/O	$\overline{\text{SKIP}}$ N/C	
5	PROBE STATUS N/O	SKIP N/O	

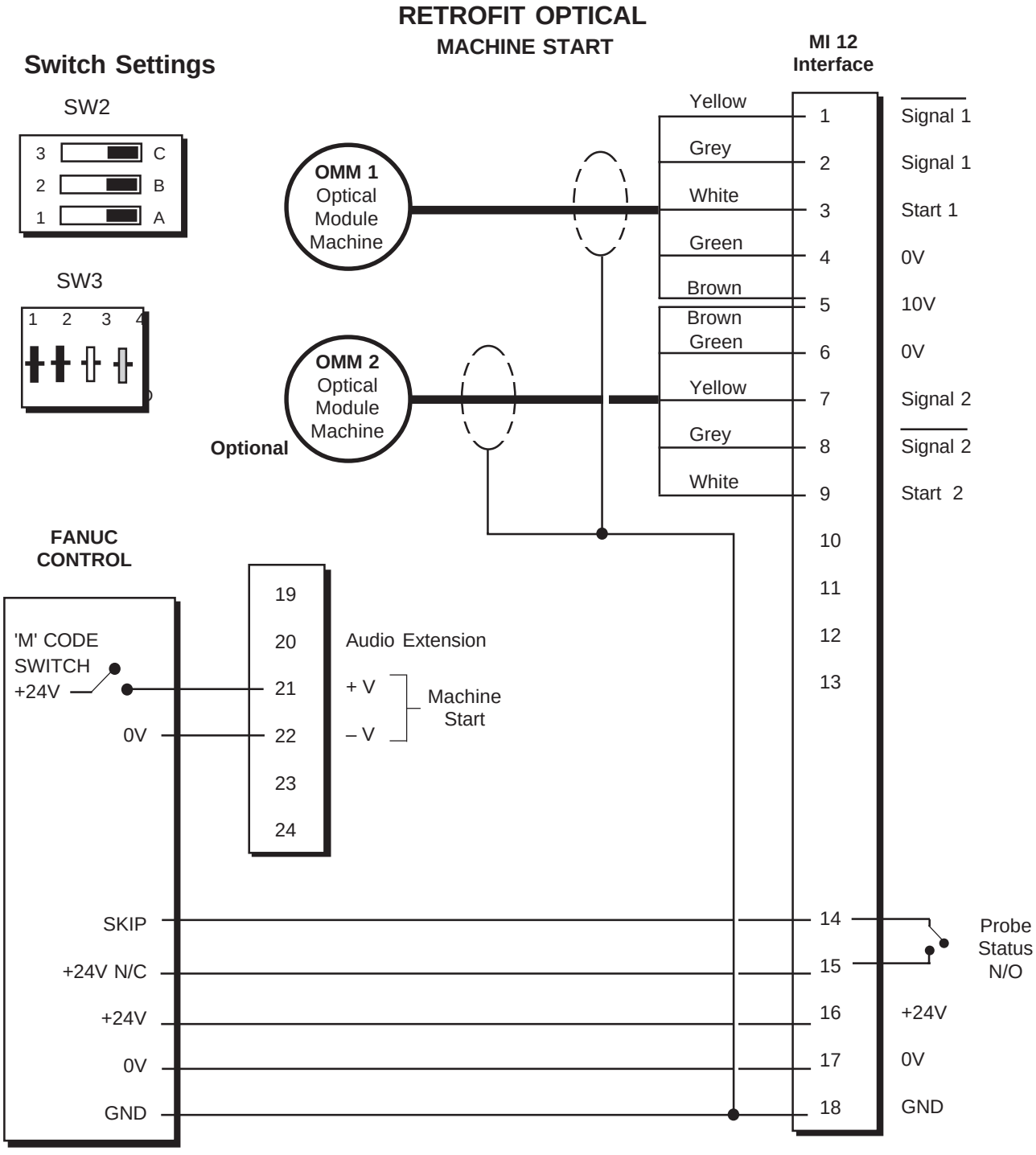
KEY	
N/O	Normally Open.
N/C	Normally Closed.
	Switch must be in position shown.
	Switch can be in either position.
	Bleeper on/Bleeper off. Factory set to Bleeper on.

SW2

SW2 is factory set to Machine Start and 5 Wire OMM's.



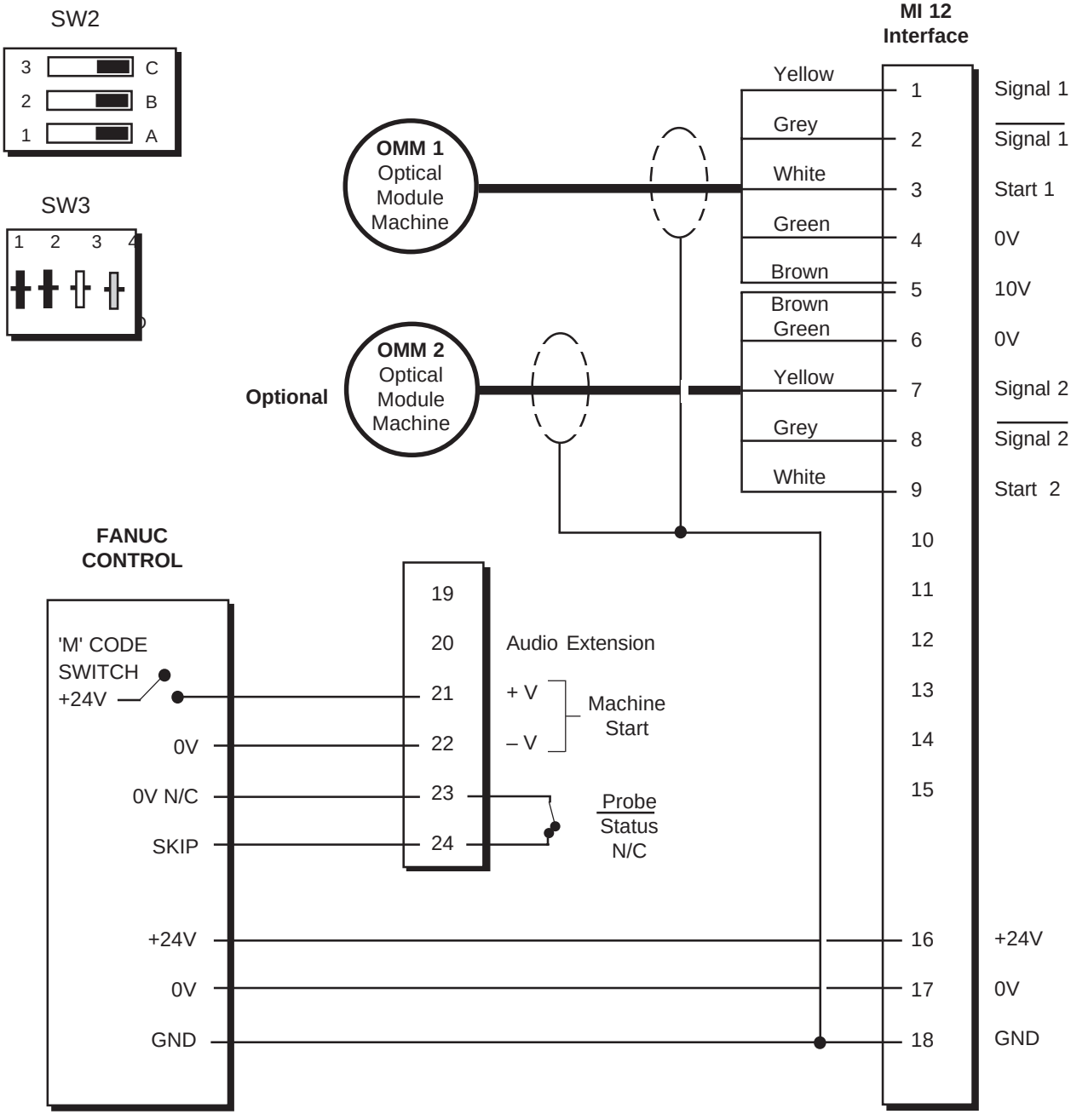
3.15 MI 12 Interface – Skip Signal 24V Common



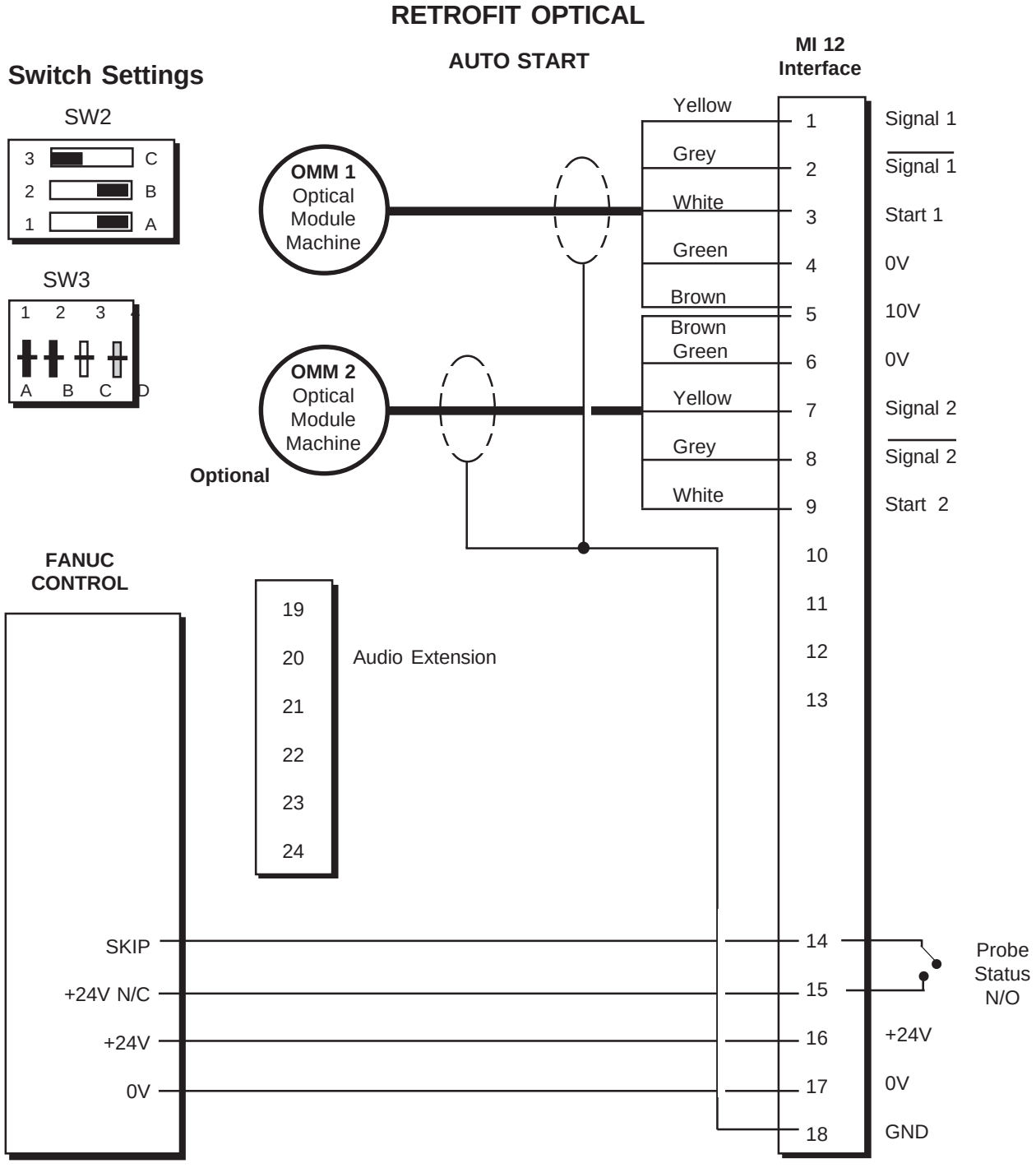
3.16 MI 12 Interface – Skip Signal 0V Common

RETROFIT OPTICAL
MACHINE START

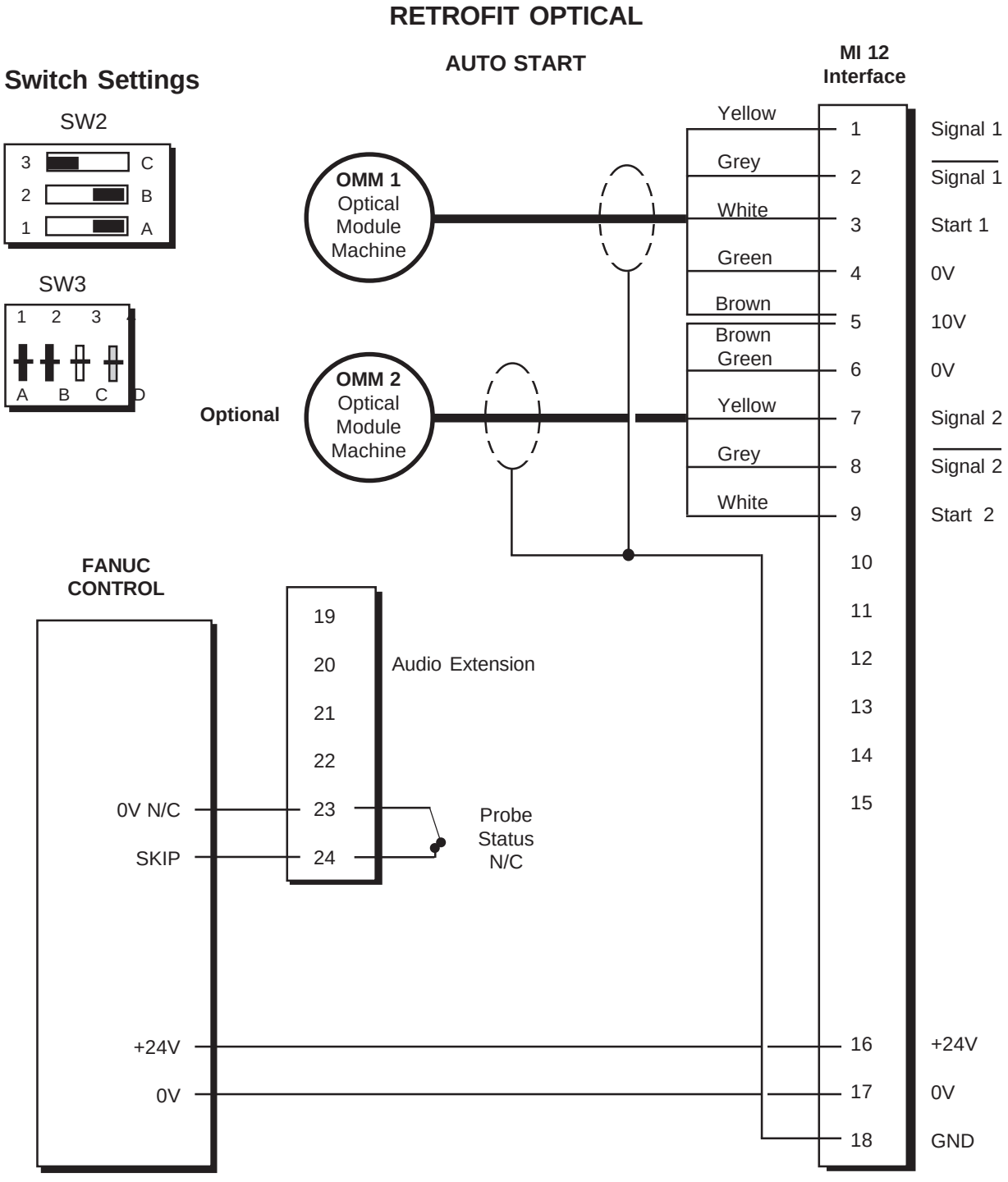
Switch Settings



3.17 MI 12 Interface – Skip Signal 24V Common

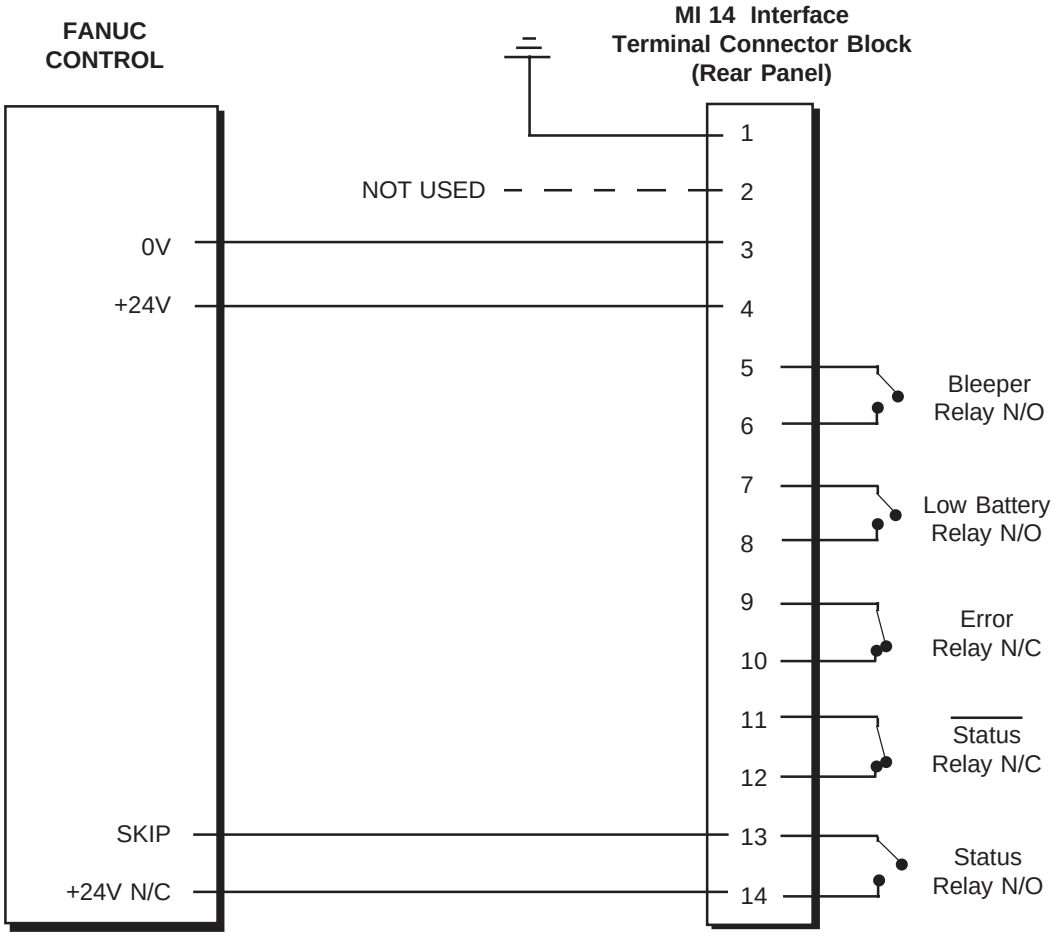


3.18 MI 12 Interface – Skip Signal 0V Common



3.19 MI 14 Interface – Skip Signal 24V Common

RETROFIT



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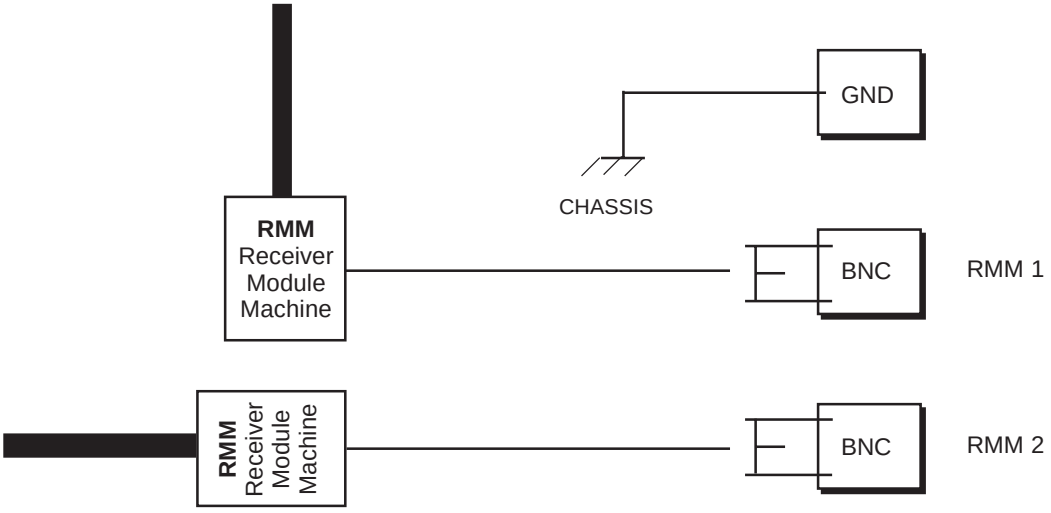
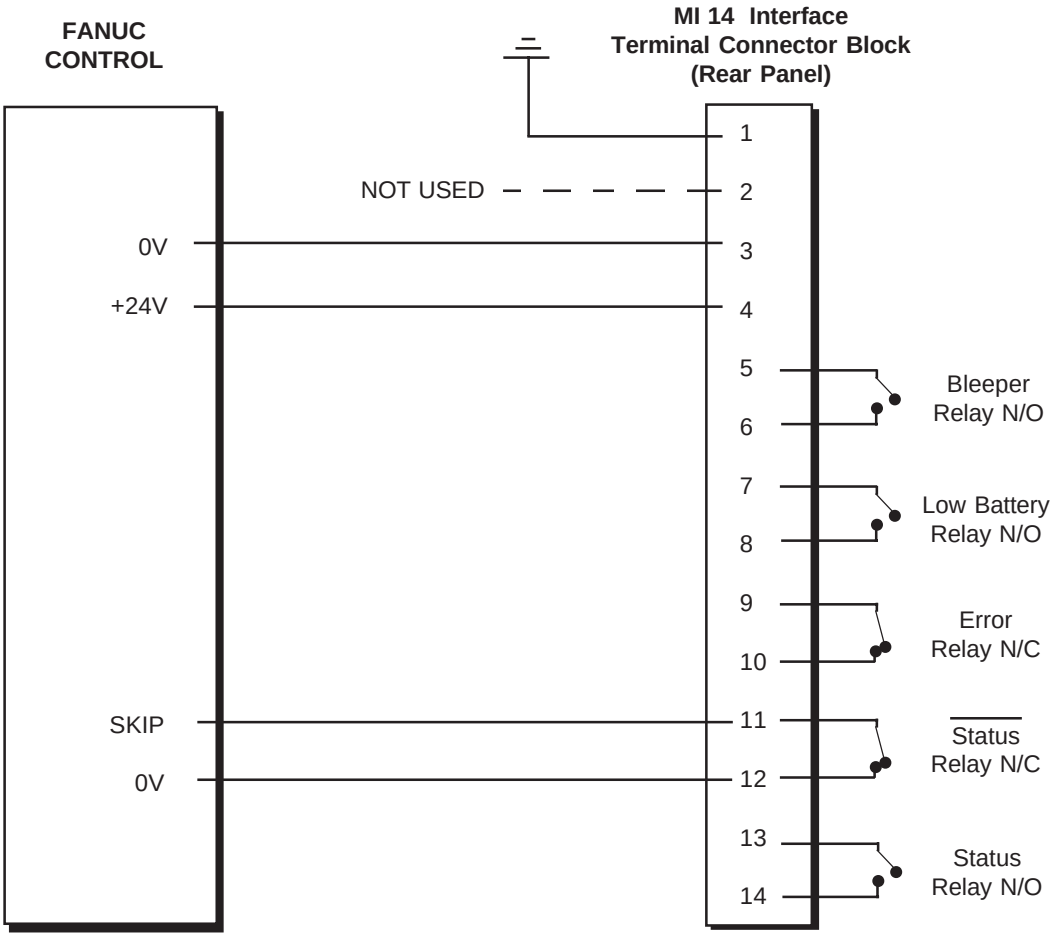


Terminals 7 to 10 can be linked to give machine alarms.
Terminals 5 and 6 can be linked to an external bleeper.
Terminals 11 and 12 give the inverse of terminals 13 and 14.

For specification of relays refer to MP3 RMP/RMM Manual

3.20 MI 14 Interface – Skip Signal 0V Common

RETROFIT



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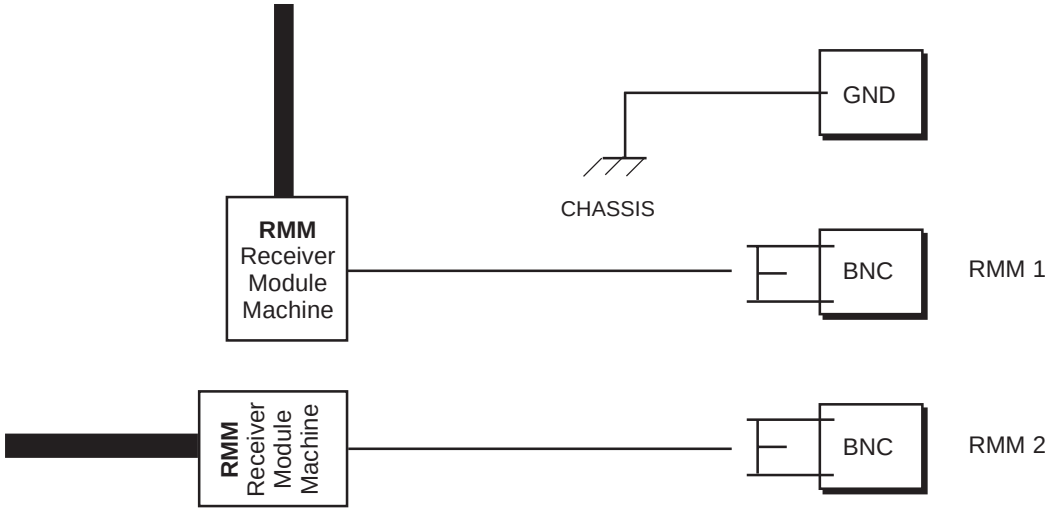
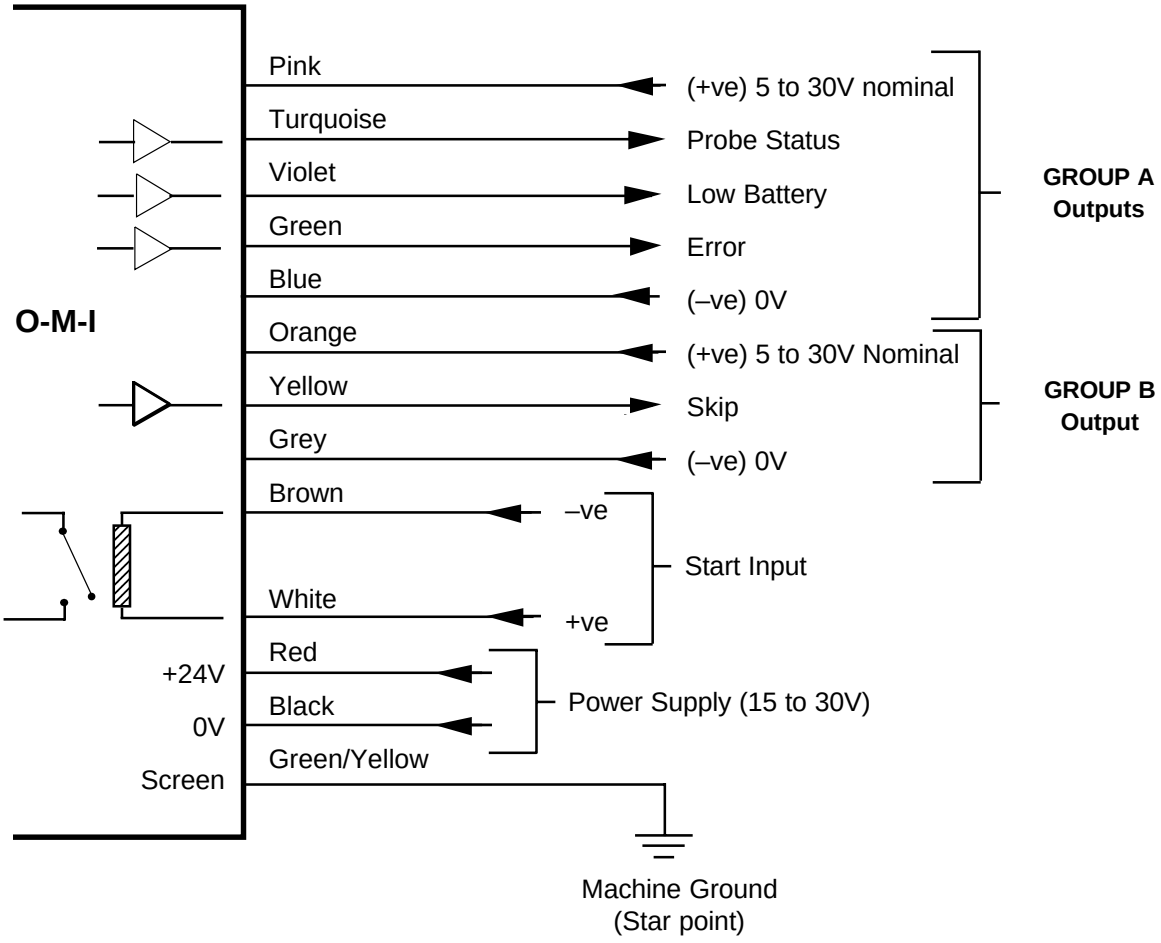


Terminals 7 to 10 can be linked to give machine alarms.
Terminals 5 and 6 can be linked to an external bleeper.
Terminals 11 and 12 give the inverse of terminals 13 and 14.

For specification of relays refer to MP3 RMP/RMM Manual

3.21 Outputs from O-M-I

The diagram below shows the O-M-I wiring configuration with the output groupings.



NOTES:

1. ***The total output load for Group A outputs should not exceed 100mA.***
2. ***If EMC problems exist, then disconnecting the screen may improve performance.***
3. ***If an electrical connection exists between the O-M-I body and the machine structure, then breaking the screen connection will break any ground loop that exists.***
4. ***O-M-I screen is connected to the O-M-I body.***

3.21.1 External Remote Audible Indicator

The Skip Output (B) can be utilized to operate an external remote audible indicator.

The audible indicator must comply with the output transistor specification

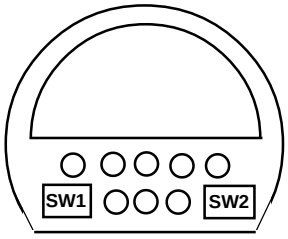
i.e. 50mA peak
36V peak

Pulse duration is 41ms ±1%.

3.21.2 Wiring Chart for O-M-I Cable

COLOUR	SIGNAL
Red	+24V (supply)
Black	0V (supply)
White	Start (+ve)
Brown	Start (–ve)
Grey	Output B (+ve)
Yellow	Skip (Output B)
Orange	Output B (+ve)
Blue	Outputs A (–ve)
Green	Error (Outputs A)
Violet	Low Bat (Outputs A)
Turquoise	Probe Status (Outputs A)
Pink	Outputs A (+ve)
Green/Yellow	Machine Earth

3.22 O-M-I Switches SW1, SW2 and Start Input

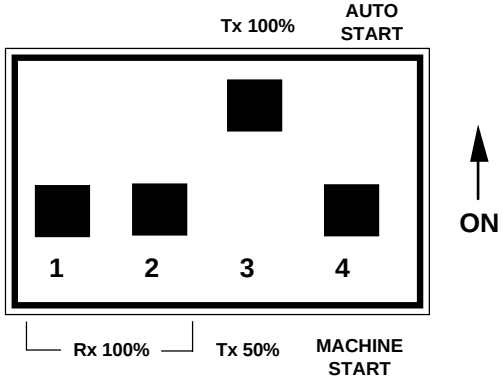


To gain access to switches SW1 and SW2, remove the O-M-I window and label – see pages User's Guide.

SWITCH SW1

Factory setting shown

Rx (Reception) = 100%
Tx (Transmission) = 100%
Machine Start
(see range setting diagram page 16)



AUTO START selection causes the system to send a START signal at one second intervals, and does not require a CNC machine control input.

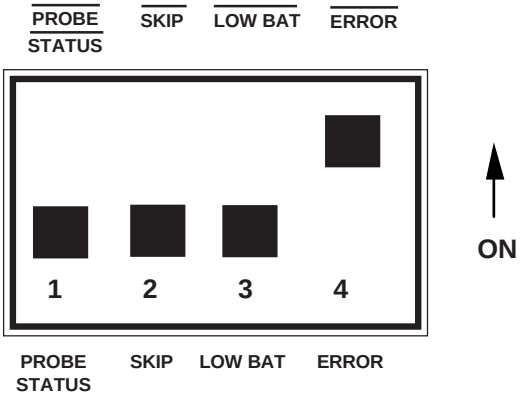
AUTO START should only be used when no output from the machine control is available. If this mode is selected, care should be taken to ensure system signals are not receivable by probing systems on other machines or in the tool changer.

To initiate a MACHINE START signal, an input of between 4.25V at 1mA and 30V at 7mA is required between the START wires (WHITE +ve and BROWN –ve).
(This is TTL compatible when connected between +5V and TTL output).
This is an isolated input.

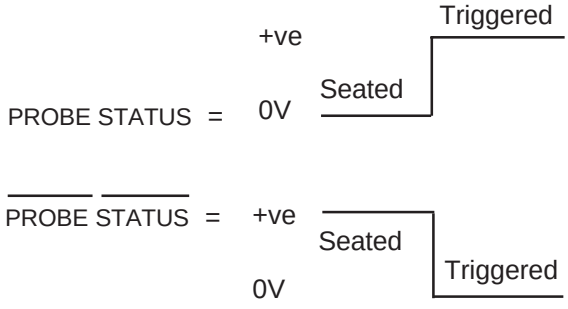
The MINIMUM pulse width is ONE MILLI-SECOND (1mS).

SWITCH SW2
Output Configuration
Factory setting shown

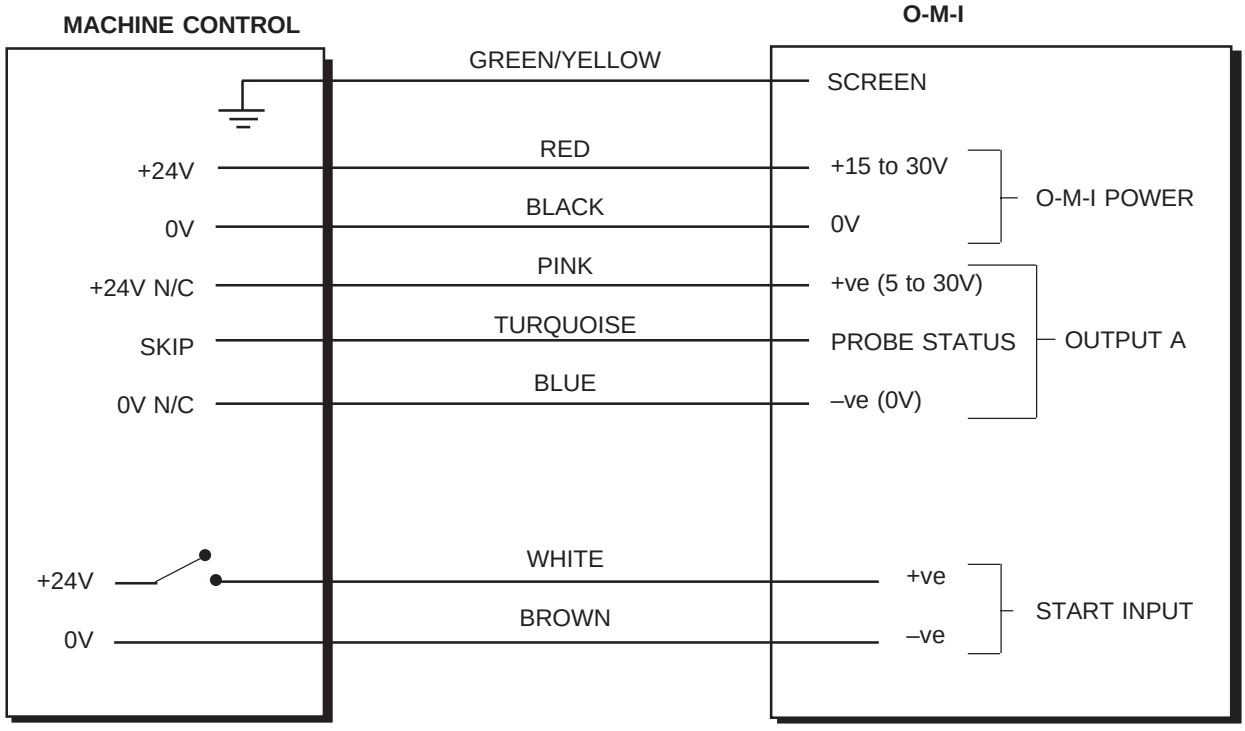
Machine Start
Probe Status (Normally Low)
Low Battery (Normally Low)
$\overline{\text{Error}}$ (Normally High)
Skip (Normally Low)



ON

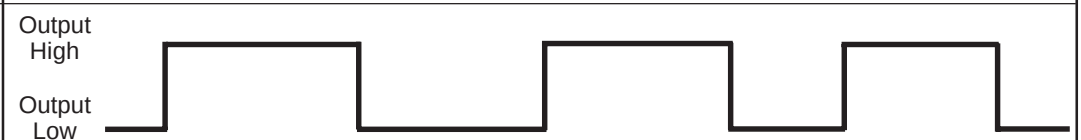
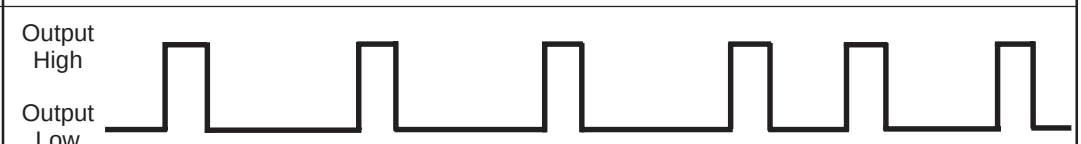
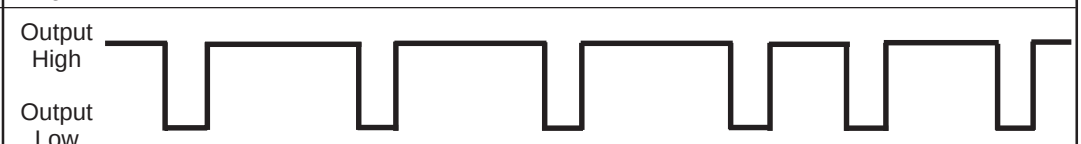
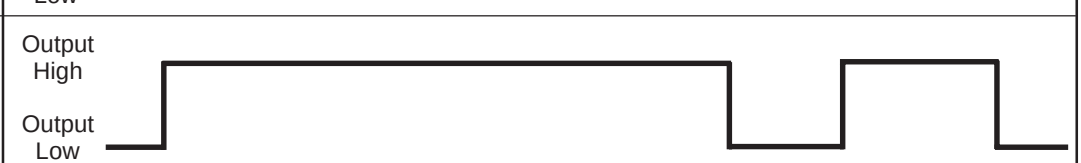
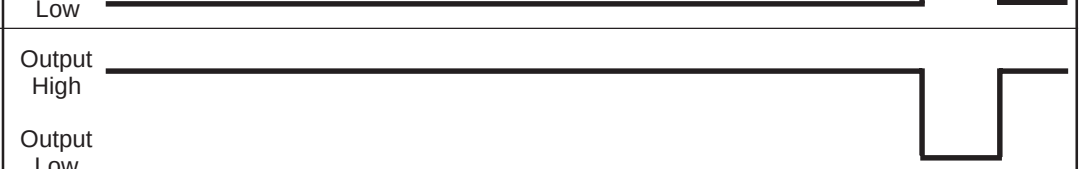


3.23 O-M-I – 0V and 24V Common Skip Signals using Retrofit Software Only



The above diagram will suit both +24V and 0V common skip signals, without any adjustment to O-M-I switch SW2

3.24 O-M-I Output Waveforms

O-M-I OUTPUTS		PROBE
OPTO COUPLED TOTEM-POLE TRANSISTOR OUTPUTS		Power Off; Probe Switch on; Seated; Probe Trigger; Triggered; Probe Reseat; Seated; Error e.g. Beam cut; Error Clear; Low Battery; Probe Switch off
PROBE STATUS	Normally Low	
$\overline{\text{PROBE}}$ STATUS	Normally High	
SKIP	Normally Low	
$\overline{\text{SKIP}}$	Normally High	
ERROR	Normally Low	
$\overline{\text{ERROR}}$	Normally High	
LOW BATTERY	Normally Low	
$\overline{\text{LOW}}$ BATTERY	Normally High	

Output High / Output Low

The output signals from the O-M-I must be compatible with the machine control input.

NOTE: SKIP and $\overline{\text{SKIP}}$ output pulses are of 41ms ±1% duration.

SIGNAL DELAYS

1.	**Transmission Delay**	:	Probe Trigger to output change of state = 144µs ±5%.
2.	**Start Delay**	:	Time from initiation of Start Signal to valid signal transmission = 410ms.

Appendix

Using Multi-Channel Skip Option – G31.1 G31.2 G31.3 or G31.4.

Inspection Probe

Effective isolation of signal can be achieved by using this option. It is recommended that the inspection probe be installed using G31 (G31.1) skip.

Tool Setting Probe

The tool setting probe should be installed using G31.2 G31.3 or G31.4 skip.

This will require changes to the tool setting software.

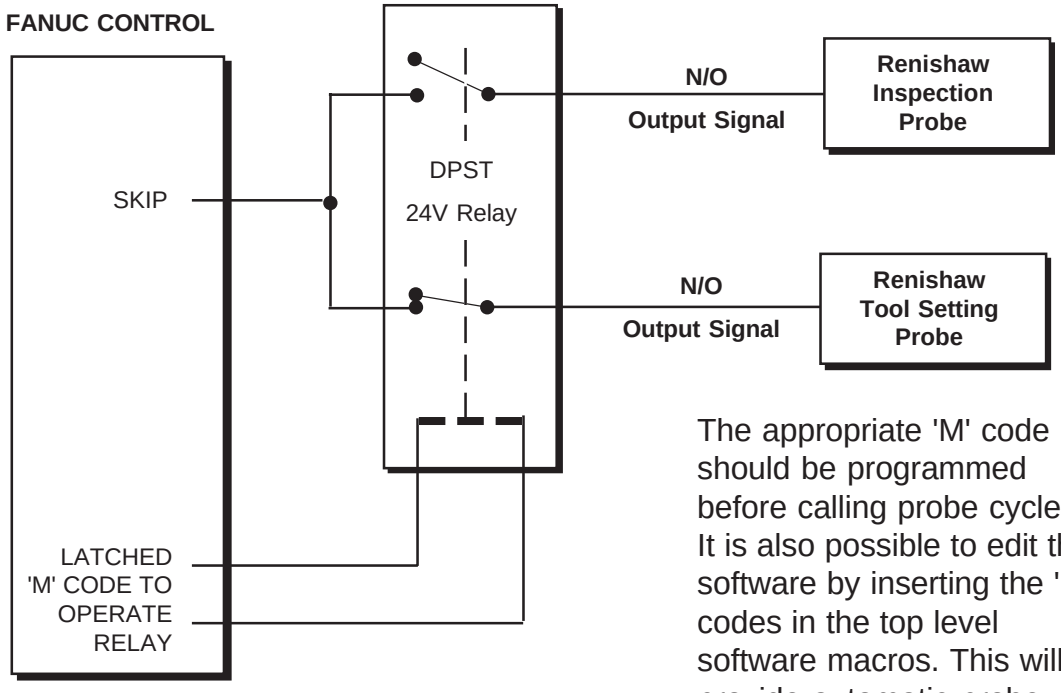
Edit all G31 command lines to G31. as required.

See the diagnostic and location section for relevant information. The software macro list will be found in the tool setting section of the programming manual for Machining Centres.

Appendix

Using 'M' Codes

Where spare 'M' codes are available it will be possible to isolate the output signals from each interface by use of 'M' codes.
The method of operation will depend on the type of 'M' code available.



The appropriate 'M' code should be programmed before calling probe cycles. It is also possible to edit the software by inserting the 'M' codes in the top level software macros. This will provide automatic probe selection.

Manual Selection

A similar arrangement as described above, but with a manually operated switch, can be used to select either probe prior to use.

Appendix

High Speed Skip

It should be noted that all connection diagrams shown in this section refer to use of standard skip using 24V logic (0V common or 24V common).

When using High Speed Skip the connection diagrams are still relevant, but reference to 0V N/C and 24V N/C supplying Fanuc skip should be ignored. The relevant supply will be provided on the High Speed Skip connector (see *Chapter 4 – Fanuc Diagnostic and Location Chart and High Speed Skip)*.

When multi channel skip is required to drive tool setting and inspection probing, the software programs can be edited to suit whichever channels are to be used.

Both tool setting and inspection software programs use the G31 skip function code.

Renishaw recommend that any necessary alteration should be made to the tool setting software. This will make editing easier.

When G31 occurs in the toolsetting software, this may be edited in the normal way (make sure program protection is set to allow for editing) to any of the desired channels (G31.1 G31.2 G31.3 G31.4).

Please make sure a test is carried out in a safe condition before running the software. This can be done by writing a small program or by M.D.I. mode, to establish the correct channel is operating successfully (see *Chapter 6 – Fanuc Software Installation*).

Appendix

Printer Interface Notes

The Renishaw Print Macro is formatted to output data to 80 characters per line (page width).

Connection to the machine will make use of an RS232 serial port. Your printer must have this option installed.

You will require a suitable communication cable with a 25 way D-type connector at the machine end. A typical configuration is shown below (refer to your printer documentation for cable configuration).

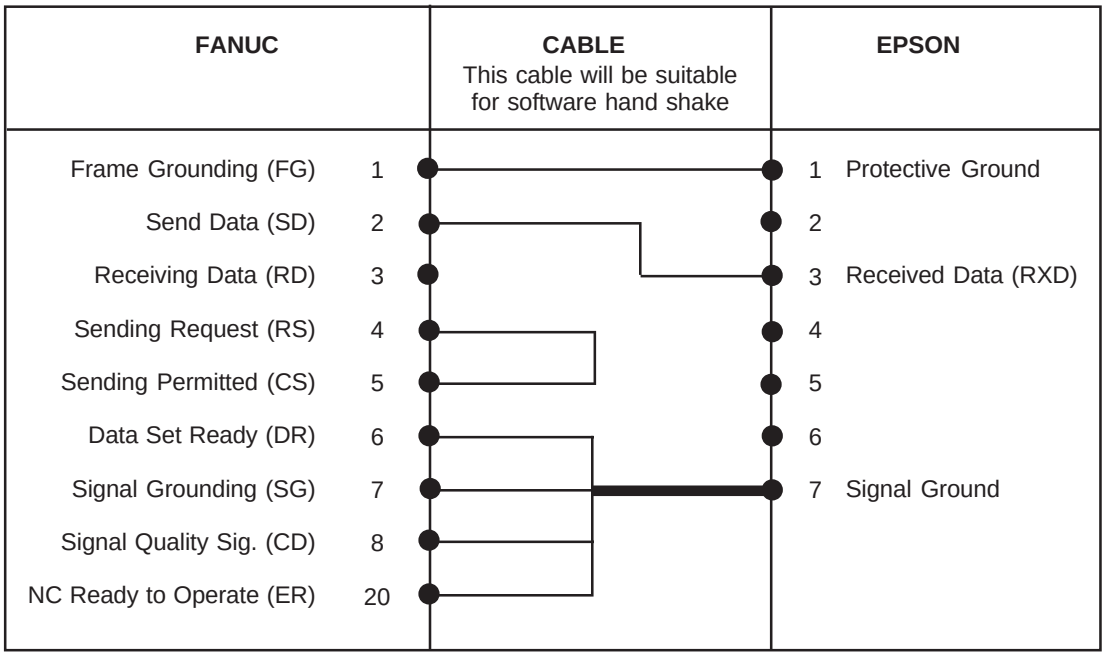
The printer and machine parameters must be set so that the communication protocol is matched.

Set the following characteristics:

1.	**Number of start bits**	– signals to mark the start of each character.
2.	**Number of stop bits**	– signals sent to mark the end of each character.
3.	**Number of data bits**	– character signals to be printed.
4.	**Speed of communication**	– Baud rate – approximately the same as the number of bits per second.
5.	**Reliability of communication**	– A parity bit can be sent.

Additional DIP switch settings are usually available on the printer for setting things like character type, spacing etc. (see the Printer Documentation).

Example : Fanuc to Epson Printer, cable connections 25-way D-Type connectors.



Chapter 4

Fanuc Diagnostic and Location Chart and High Speed Skip

This chapter provides useful diagnostic and high speed skip information for machine tools fitted with Fanuc controls.

Contained in this Chapter

4.1 Diagnostic and Location Chart

This reference chart provides useful diagnostic and location details. Full connection details will be found in the relevant Fanuc connection manual.

It is important to study the Machine Tool Builder (MTB) documentation and connection diagrams before any installation is made.

	O-M/T A/B/C	**6-M/T**	**10-11-12-15M/T**			**16-M/T A 18-M/T A**
			Connection Unit 1 FS6	**I/O Card FS3**	**I/O Unit Modules**	
G31 Skip	Input / Output C2 PCB MI 8 pin 49 X8.7	Connection Unit 1 CO1 Pin 4 DGN 43.6	Connection Unit 1 CO1 Pin 4 X11.6 DGN 410.3	Built-in I/O MI 8 Pin 49 X4.7	X11.6 G0.3	X1004.7 or X4.7 C51 - B23
User Input UI 0 (#1000)	X* G130.0	Connection Unit 2 CO9 Pin 4.5 DGN 122.0	Connection Unit 2 CO9 Pin 45 DGN 423.0	X* DGN 423.0	X* G51.0	X* G54.0
User Input UI 1 (#1001)	X* G130.1	Connection Unit 2 C09 Pin 43 DGN 122.1	Connection Unit 2 CO9 Pin 43 DGN 423.1	X* G423.1	X* G51.1	X* G54.1
User Input UI 2 (#1002)	X* G130.2	Connection Unit 2 CO9 Pin 41 DGN 122.2	Connection Unit 2 CO9 Pin 41 DGN 423.2	X* G423.2	X* G51.2	X* G54.2
User Output UO 14 (#1114)	Y* F163.6	Connection Unit 2 C12 Pin 50 DGN 081.6	Connection Unit 2 C12 Pin 50 DGN 514.6	Y* DGN 514.6	Y* F50.6	Y* F56.6
User Output UO 15 (#1115)	Y* F163.7	Connection Unit 2 C12 Pin 43 DGN 081.7	Connection Unit 2 C12 Pin 43 DGN 514.7	Y* DGN 514.7	Y* F50.7	Y* F56.7
X* and Y* = Signal location may vary						

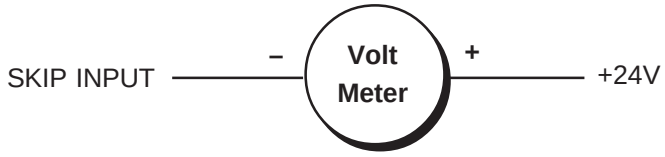
	O-M/T A/B/C	6-M/T	10-11-12-15M/T			16-M/T A 18-M/T A
			Connection Unit 1 FS6	I/O Card FS3	I/O Unit Modules	
Automatic Tool Offset XAE (G36) (AE1) Lathe only	Input / Output C2 PCB M18 Pin 15 Address X8.0	Connection Unit 1 CO3 Pin 22 DGN 040.3	Connection Unit 1 CO3 Pin 22 X8.3 DGN 416.2	MI 8 Pin 15 X4.0	X8.3 G1.2	X4.0 (G37 X_) C51-A20
Automatic Tool Offset ZAE (G37) (AE2) Lathe only	Input / Output C2 PCB M18 Pin 46 Address X8.1 DGN 008.1	Connection Unit 1 CO3 Pin 37 DGN 040.4	Connection Unit 1 CO3 Pin 37 X8.4 DGN 416.3	MI 8 Pin 46 X4.1	X8.4 G1.3	X4.1 (G37 Z _) C51 - B20
X* and Y* = Signal location may vary						

NOTE: The chart shows fixed input addresses (X - -) when using the Programmable Machine Controller (PMC). These addresses are assigned to fixed pins and connectors. Check with Machine Tool Builder, since these addresses may have been used for another purpose.

4.1.1 Checking the Skip Voltage

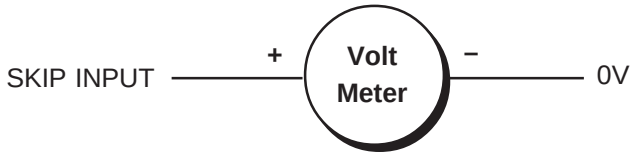
It is recommended that the level on the skip input is checked prior to connecting to it. Carry out the following tests as shown below:

+24V COMMON SYSTEM



Reading = +24V

0V COMMON SYSTEM



Reading = +24V

If the reading on the voltmeter is not +24V, check the plug in which skip is located to see whether it has been configured for +24V common or 0V common.

If it has not been configured, then make the links as shown in section 4.1.2 (next page).

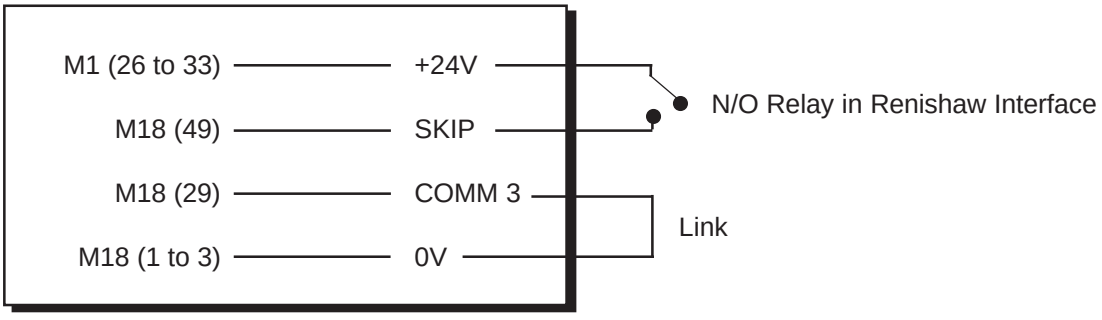
The above does not apply to :

- High Speed Skip.
- Fadal probe input.
- Sharnoa probe input.

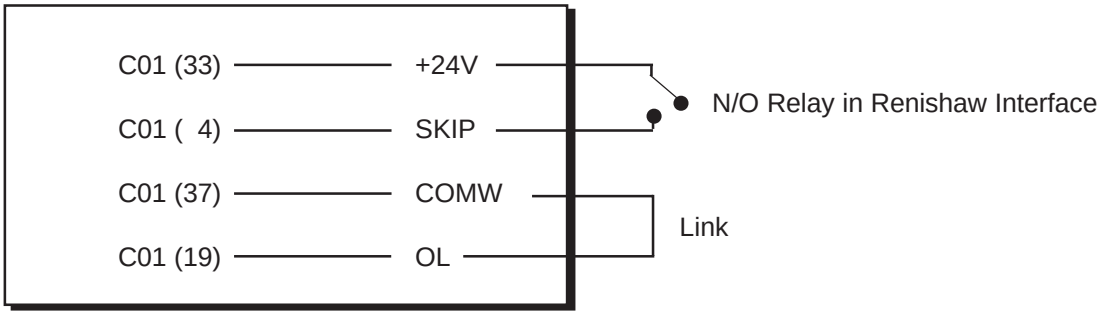
4.1.2 Fanuc Standard Skip

When using standard skip on the Fanuc control, it may be necessary to link certain pins in the plug used for skip. If the machine tool builder has not made these links, they will not be required when I/O modules are used.

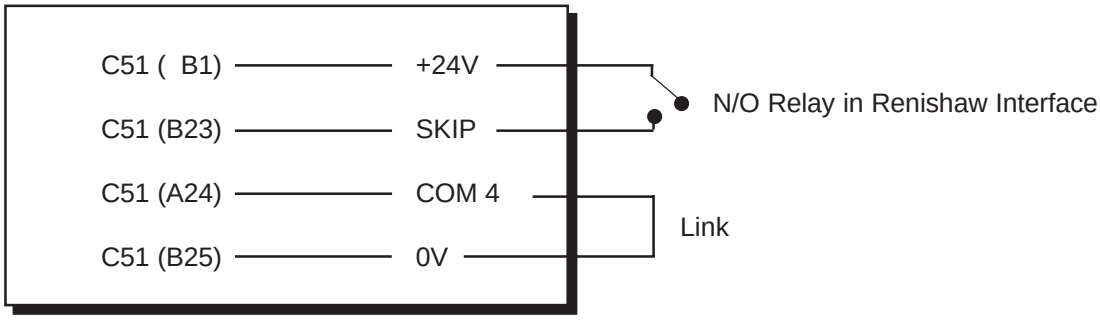
FANUC 0 CONTROL – MI 8 PLUG



FANUC 6, 10, 11, 12 and 15 CONTROLS – C01 PLUG



FANUC 16 and 18 CONTROLS – C51 PLUG



4.2 I / O Unit

When using the I / O unit the input address (X - -) must be assigned as designated inputs for skip, XAE (AE1), ZAE (AE2) respectively.

High speed skip connection is independent of the PMC. There are no diagnostic locations assigned for this function.

4.3 High Speed Skip 10-11-12-15M/T

CONNECTIONS

Connector	CA8	MRE20 - RMD	Fanuc 10
	CA8	MR20-RM	Fanuc 11
	CA19	01PO2 (Slot location)	Fanuc 12
	CA8	01P26 (Slot location)	Fanuc 15

Example - Connector - Fanuc 11

Pin numbers 1-20	1	HS01
	2	0V
	3	HS04
	4	0V
	5	
	6	0V
	7	
	8	HS02
	9	0V
	10	
	11	0V
	12	
	13	
	14	HS03
	15	
	16	
	17	0V
	18	
	19	
	20	0V

NOTE: It is essential that 0V is taken from the connector (5V logic).

The High Speed Skip connection is independent of the PC. It is not necessary to make PC changes.

4.4 High Speed Skip 0 M/T (C Series)

CONNECTIONS

Connector M12 Pin 14 (5 volt logic)

Pin 1 (GRD)

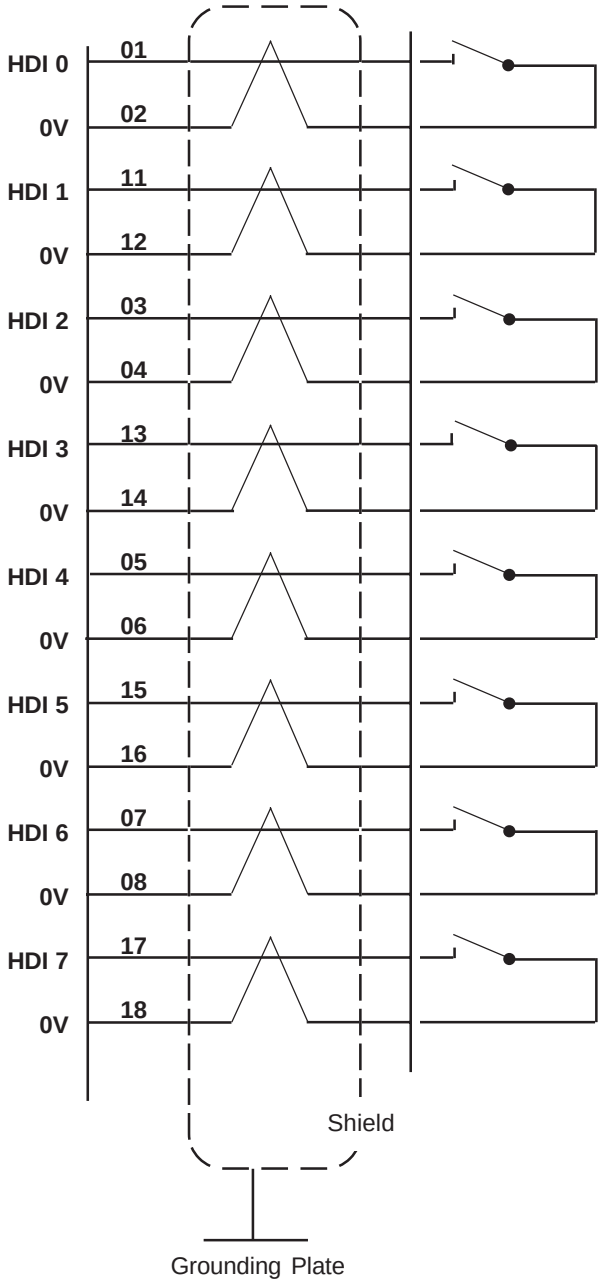
4.5 High Speed Skip – Fanuc 16 and 18 M/T

CONNECTION FOR HIGH SPEED SKIP SIGNAL as follows

CNC (Option 2A/2B board or I/O card E to H)

JA5	(PCR-EV20MDT)
1	HDI 0
2	0V
3	HDI 2
4	OV
5	HDI 4
6	0V
7	HDI 6
8	0V
9	
10	
11	HDI 1
12	0V
13	HDI 3
14	0V
15	HDI 5
16	0V
17	HDI 7
18	0V
19	
20	

CABLE CONNECTION



CAUTIONS

Connection to high speed skip is straight forward when the machine builder has provided the option.

The task of retrofitting the option may not be possible if the machine builders system configuration does not permit its use.

Relevant hardware options installed are no guarantee that the option will work.

Consultation with the machine builder is essential, before attempting an installation.

Chapter 5

Fanuc Machine Parameters

The parameters described in this chapter are those which are relevant when making an installation at a Fanuc controller.

Contained in this Chapter

5.1 Parameters

Full parameter descriptions and methods of changing values are to be found in the relevant Fanuc Operators Manual.

It is important when changing parameters to only change the parameter bits stated.

Do not change any blank parameters in the following documentation.

It is good practice to record parameter changes together with the old values.

5.2 Parameters for G Codes 0-6-10-11-12-15 M/T

G codes may be set for the simplified calling of macro programs.

The following parameters can be set. The G codes are optional – 3-figure codes have been chosen to avoid clashes with standard G codes.

The G code calls given in the charts opposite are only recommended codes, and are subject to the availability of free G codes.

Should there be any doubt as to the availability of free G codes, the programs can be called by using G65 instead of the simplified macro call.

Example

G65 P9010 (WEB/PKT) Xx or Yy Mm Ss Tt etc.

G PARAMETERS			RENISHAW PROGRAM	G CODE	
0M	**10/11/12/15M**	**6MB**		**0/10/11/12/15M**	**6MB only**
220	7050	0323	**9010**	110	70
221	7051	0324	**9011**	111	11
222	7052	0325	**9012**	112	12
223	7053	0326	**9013**	113	13
224	7054	0327	**9014**	101	101
225	7055	0328	**9015**	105	05
226	7056	0329	**9016**	106	06
227	7057	0330	**9017**	107	07
228	7058	0331	**9018**	118	68
229	7059	0332	**9019**	119	69

M CODE PARAMETERS				0M	10/11/12/15/M	6MB
	7072	321	**9002**		119	29
	7073	322	**9003**		105	28
231	7081		**9021**	119		
232	7082		**9022**	105		

Simplified calling of the macro programs is not applicable to controls with Macro A installations.

NOTE: M code parameters

6MB
Control system users must use:
G65 P9021 to switch the system ON,
and
G65 P9022 to switch the system OFF.

6MB users can adopt M codes for switching ON/OFF.
First verify with your OEM that two M codes are available for use. This will require a change to the macro program numbers. Program 9021 will change to 9002 and M29 can be used. Program 9022 will change to 9003 and M28 can be used to switch the probe OFF.

G PARAMETERS			RENISHAW PROGRAM	G CODE	
0T	**10/11/12/15T**	**6T**		**0/10/11/12/15T**	**6T**
220	7050	0323	**9010**	G101	
221	7051	0324	**9011**	G124 *	
222	7052	0325	**9012**	G125 *	
223	7053	0326	**9013**	G106	G13
225	7055	0328	**9015**	G113	
226	7056	0329	**9016**	G110	G06
227	7057	0330	**9017**	G107	G07
228	7058	0331	**9018**	G118	G18
229	7059	0332	**9019**	G119	

Simplified calling of the macro programs is not applicable to controls with Macro A installations.

NOTE: * denotes that these codes are used for HPA Tool Setting Software.

Other G codes are used for Inspection Software.

5.3 Parameters for 0 M/T

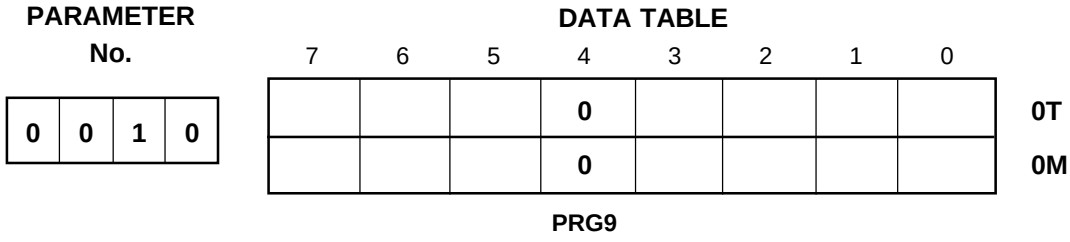
See the relevant G code parameter charts.

Parameter Write Enable (PWE)

1 must be set to enable parameter edits. This will be seen on Parameter (setting 2) page – refer to the Fanuc operators manual for details on PWE.

Set the following parameters to ensure safe operation, loading software and editing of macro programs.

NOTE: When an error condition is present DO NOT attempt to press cycle start.
The probe must be taken to a safe position and the error corrected before proceeding.



PRG9

1: The sub-programs with programs numbers 9000 to 9999 are protected. The following edit functions are disabled.

a. Deletion of program 9000–9999.
b. Punch program 9000–9999.
c. Program number search.
d. Edit program after registration.

The following are possible

a. Registration of program (LOADING).
Registration by MDI key and through paper tape.
b. Collation of programs.

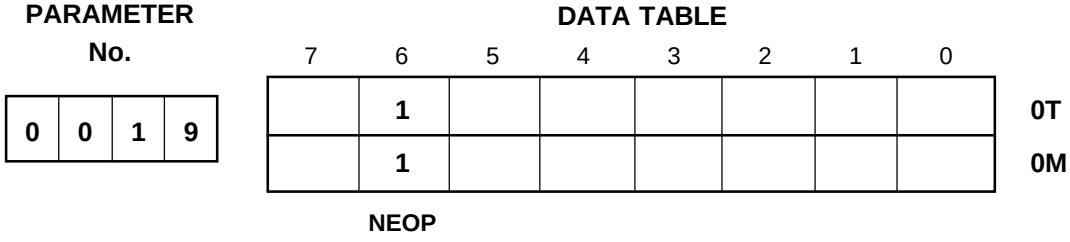
PRG9

0: The sub-programs with program numbers 9000 to 9999 can also be deleted.
EDITING and LOADING is possible.

More detailed information can be found in Fanuc operator manuals.

The setting is optional.

It should be noted when setting 0, programs can be deleted or edited.

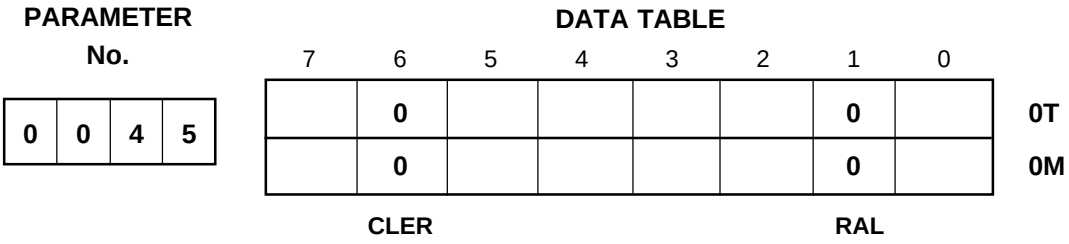


NEOP

1: M02, M30, and M99 DO NOT command the end of registration into part program storage editing area.
(M02, M30, M99 in any part program will NOT be recognised as end of program).

NEOP

0: M02, M30, and M99 command the end of registration into part program storage editing area.
(M02, M30, M99 in any part program will be recognised as end of program).



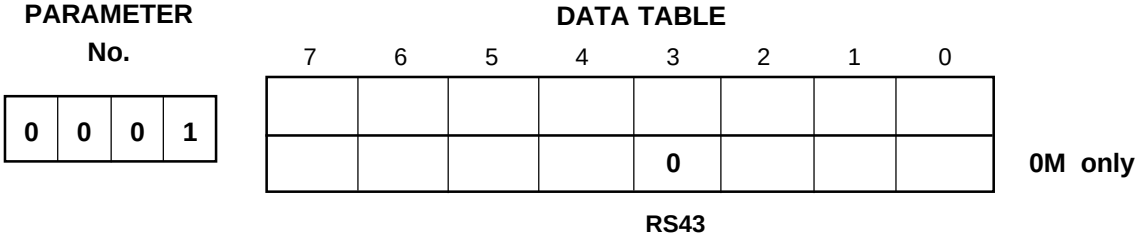
CLER
1: Selects clear conditions, using the reset button, external reset signal and emergency skip.

CLER
0: Selects reset conditions, using the reset button, external reset signal and emergency stop (*****).

RAL
1: Registers only one program for reading in reader/puncher

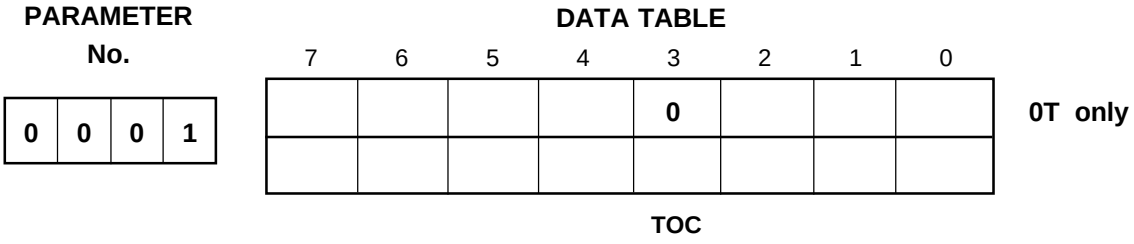
RAL
0: Registers ALL programs for reading in reader/puncher.
(Will allow a tape with multiple programs to read in). (*****).

(*****) Setting is recommended but not compulsory.



RS43
0: Offset vector in G43, G44 is RETAINED in reset state.
(Tool length offset is kept in reset condition).

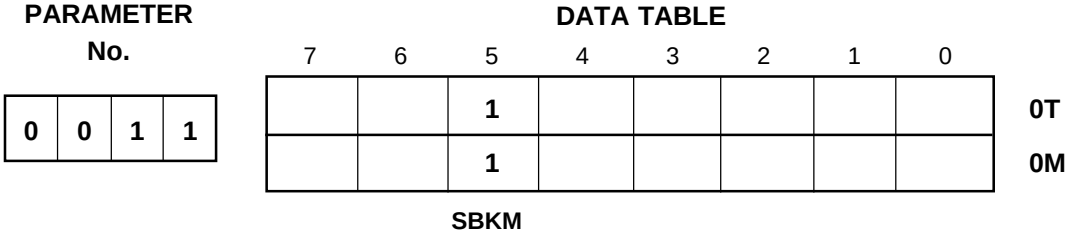
RS43
1: Offset vector in G43, G44 is CLEARED in reset state.
(Tool length offset is NOT kept in reset condition)



TOC
1: Offset is cancelled by reset button.

TOC
0: Offset is NOTcancelled by reset button.

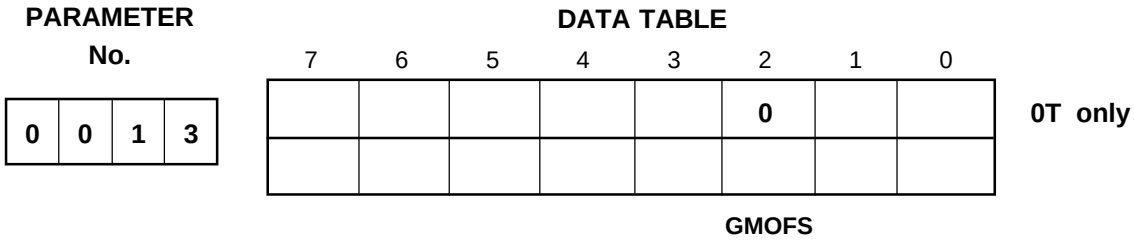
Setting is recommended but not compulsory.



SBKM
0: Machine is stopped in single block skip by macro command.(Operation of macro programs by single block is allowed).

SBKM
1: Machine is NOT stopped in single block skip by macro command. (Operation of macro programs by single block is not allowed).

Setting is optional.



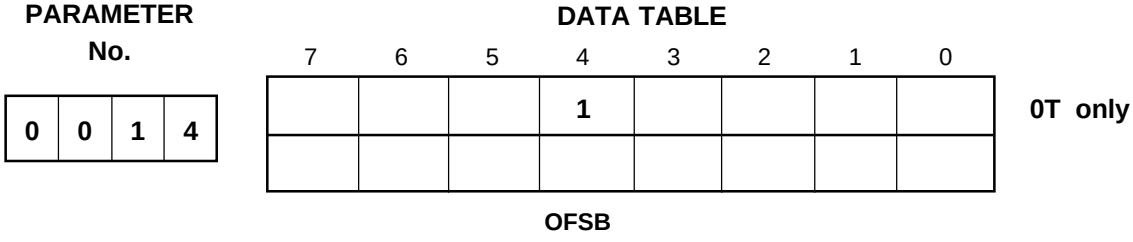
GMOFS

1: The tool geometry is cancelled with vector processing, i.e. tool movement.

GMOFS

0: The tool geometry offset is conducted by shifting of the co-ordinate system.

Setting is compulsory.



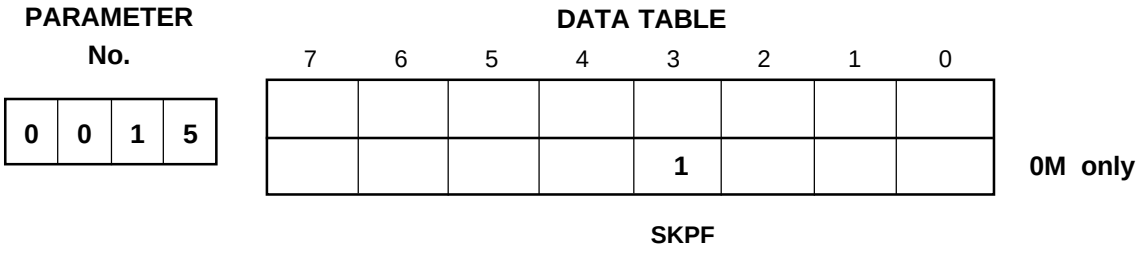
OFSB

1: The tool offset is conducted together with axis movement.

OFSB

0: Tool offset is conducted by the T code block.

Setting is recommended but is not compulsory.



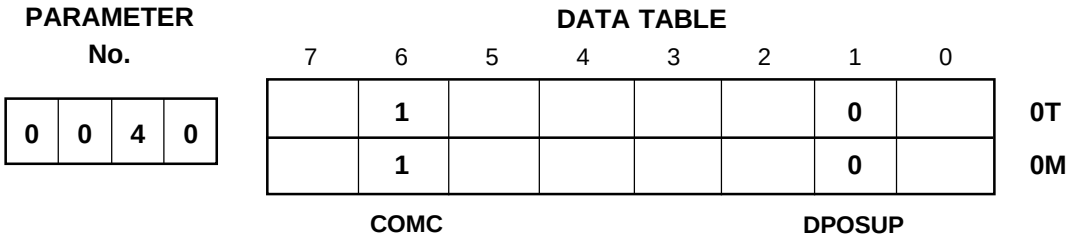
SKPF

1: Dry run override and automatic acceleration / deceleration is EFFECTIVE in skip function (G31).

SKPF

0: Dry run override and automatic acceleration / deceleration is INEFFECTIVE in skip function (G31).

Setting is recommended but is not compulsory.



COMC

1: Does NOT place common variables (#100 to #149) in <VACANT> state during resetting.

COMC

0: Places common variables (#100 to #149) in <VACANT> state during resetting.

DPOSUP

0: At data output by DPRINT command, a space is outputted for leading zero.

DPOSUP

1: At data output by DPRINT command, nothing is done for leading zero.

Setting is recommended but is not compulsory.

5.4 Appendix – Setting Parameters for RS232 Port (0 M/T)

These are normally set by the MTB, but it is often necessary to change the Baud Rate to suit different equipment.

Full descriptions will be found in the Fanuc Operators Manual. The following data is offered as a quick reference.

Setting Parameters (Setting 1 Page)

Input a 1 or 0 according to the following description.

TVON (Normally 0 for Renishaw)

TV check when registering a program from a paper tape into a memory.

1. Perform TV check
0. No TV check.

ISO (Set as desired)

Setting code, ISO or EIA, when punching in the memory onto a paper tape.

1. ISO code is output.
0. EIA code is output.

I/O (Set as desired)

Selecting I/O device for program input/output with I/O interface.

0. Select device (0) on channel 1 set by parameters
   (No. 0002, NFED, ASR33, STP2),
   (No. 0552, BRATE 0).

1. Select device (1) on channel 1 set by parameters
   (No. 0012, NFED, ASR33, STP2),
   (No. 0553, BRATE 1).

2. Select device (2) on channel 2 set by parameters
   (No. 0050, NFED, ASR33, STP2),
   (No. 0250, BRATE 2).

3. Select device (3) on channel 2 set by parameters
   (No. 0051, NFED, ASR33, STP2),
   (No. 0251, BRATE 3).

Parameters No. 0250 and 0251 are not applicable to 0TA

NOTE: A channel is a serial port, normally only one channel. For each channel there are two device configurations.

channel 1: device 0
device 1

channel 2: device 2
device 3
etc.

Set to Suit Equipment

SETTING VALUE	BAUD RATE
1	50
2	100
3	110
4	150
5	200
6	300

SETTING VALUE	BAUD RATE
7	600
8	1200
9	2400
10	4300
11	9600

The Following Parameters Must Be Set According To I/O Setting

Effective when parameter I/O is set to 0
Set as desired.

PARAMETER No.	DATA TABLE								
	7	6	5	4	3	2	1	0	
0 0 0 2	NFED					ASR33		STP2	0T
	NFED					ASR33		STP2	0M

Effective when parameter I/O is set to 1
Set as desired.

PARAMETER No.	DATA TABLE								
	7	6	5	4	3	2	1	0	
0 0 1 2	NFED					ASR33		STP2	0T
	NFED					ASR33		STP2	0M

NFED
1: Feed is **NOT** output before and after the program is output by using the reader/puncher interface.

NFED
0: Feed is output before and after the program is output by using the reader/puncher interface.

Set to 1 only if using print macro option, otherwise set as required.

ASR33
1: The 20mA current interface is used as the reader/puncher interface

ASR33
0: FANUC PRR, FANUC cassette, or portable tape reader are used as reader/puncher interface.
Set as required.

STP2
1: In the reader/puncher interface, the stop bit is set to 2 bits.

STP2
0: In the reader puncher interface, the stop bit is set to 1 bit.
Set as required

PARAMETER No.

0	0	3	8

DATA TABLE

7	6	5	4	3	2	1	0	
RSCMD1	**DEVFL1**	**RSCMD2**	**DEVFL2**		**RSCMD3**	**DEVFL3**		**0T**
RSCMD1	**DEVFL1**	**RSCMD2**	**DEVFL2**		**RSCMD3**	**DEVFL3**		**0M**

❀ ❀

RSCMD1 Setting I/O device of reader/ puncher interface.

DEVFL1 Channel 1

RSCMD2 Setting I/O device of reader/ puncher interface.

DEVFL2 Channel 2

RSCMD	DEVFL	I/O DEVICE USED
0	0	Bubble cassette, PPR
0	1	Floppy cassette
1	0	Paper tape reader ❀
1	1	paper tape reader, etc

❀ e.g. – normal setting for connecting a PC when the I/O is set to 0.

PARAMETER No.

0	0	5	5

DATA TABLE

7	6	5	4	3	2	1	0	
					0	**0**		**0T**
					0	**0**		**0M**
					PROTCA	**EXT**		

PROTCA

1: For protocol A communications, hardware handshaking.

0: For protocol B communications, software handshaking.

EXT

1: End control character shall be EXT.

0: End control character shall be CR.

PARAMETER No.	
0	0 5 7

DATA TABLE								
7	6	5	4	3	2	1	0	
			0					**0T**
			0					**0M**

CROUT

CROUT

In B/D Print, after data is outputted in ISO code.

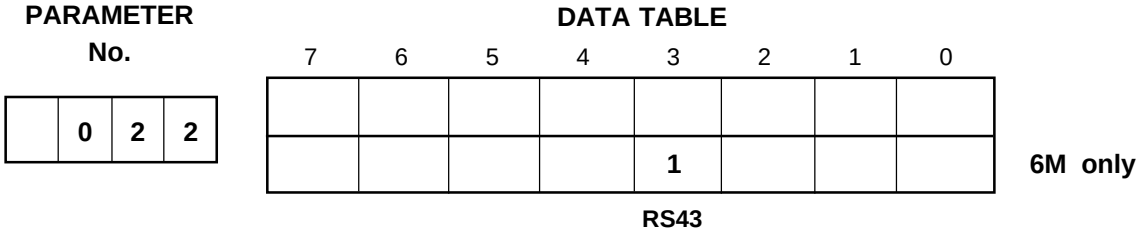
1: LF and CR are outputted.

0: Only the LF is outputted

5.5 Parameters for 6 M/T

See relevant G code parameter charts.

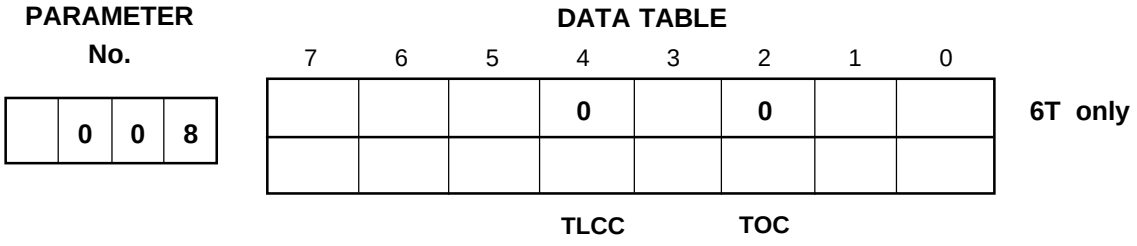
See the section titled *5.6 Appendix – Setting Parameters for RS232 Port (6 M/T)*.
Set the following parameters to ensure safe operation, loading software and editing macro programs.



RS43
1: Offset vector G43 and G44 modes are RETAINED on pressing RESET button.

RS43
0: Offset vector G43 and G44 modes are CLEARED on pressing RESET button.

Setting is recommended but is not compulsory.



TLCC
1: The new offset value is effective from the next block when the offset value is modified.

TLCC
0: The new offset value is effective from the T code when the offset value is modified.

TOC
1: Offset is cancelled by a reset operation

TOC
0: Offset is NOT cancelled by a reset operation.

Setting is recommended but is not compulsory.

NOTE:

No attempt must be made to press cycle start after a reset condition.
The probe must be taken to a safe position when an error is encountered.

PARAMETER No.

	0	**0**	**8**

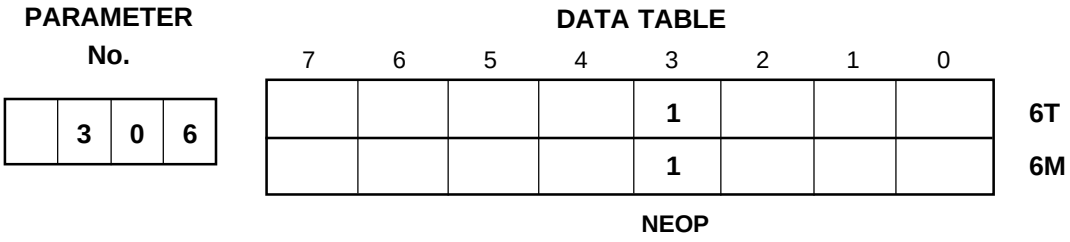
DATA TABLE

7	6	5	4	3	2	1	0	
								6M only

G44 **see chart** **G43**

PARAMETER SETTING		**INITIAL G CODE OF GROUP 08**
G44	**G43**	
1	0	G44
0	1	G43
0	0	G49

Setting is normally G43 set to 1



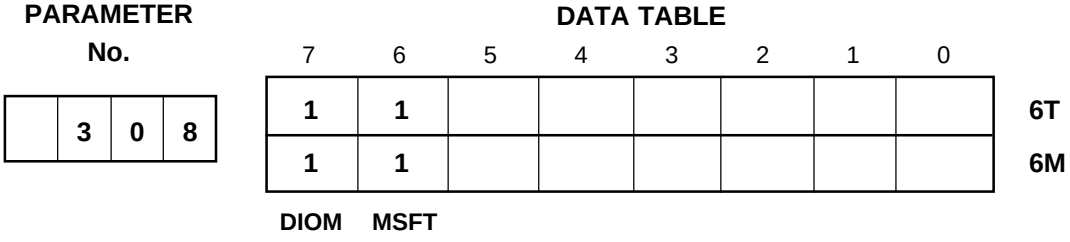
NEOP

1: When tape is registered in memory,M02, M30, and M99 are NOT counted as the program end.

NEOP

0: When a tape is registered in memory, M02, M30, and M99 are counted as the program end.

Setting is recommended while loading software



DIOM

1: DI and DO can be read and written by macro variables (NOT USED).

0: They can NOT be read and written by macro variables.

MSFT

1: When the option of user macro is equipped, shift key is valid.

0: Shift key is invalid.

Setting is compulsory

PARAMETER No.	
	3 1 8

DATA TABLE

7	6	5	4	3	2	1	0	
0	**1**	**0**						**6T**
0	**1**	**0**						**6M**
PRG9	**MSC9**	**MSD9**						

PRG9

1: Program numbers 9000 to 9899 can NOT be edited.

0: Program numbers 9000 to 9899 can be edited.

Re-setting of PRG9 to 1 is recommended to ensure no accidental editing deletion can take place.

MSC9

1: If the mode is single block mode during execution of program numbers 9000 to 9899, single block stop is EFFECTIVE in executing macro format of user macro.

0: If the mode is single block mode during execution of program numbers 9000 to 9899, single block is INEFECTIVE in executing macro format of user macro.

MPD9

1: The contents of the program is NOT displayed during execution of program numbers 9000 to 9899.

0: The contents of the program is displayed during execution of program numbers 9000 to 9899.

Setting is optional

Full descriptions of parameters can be found in Fanuc Operators Manuals

5.6 Appendix – Setting Parameters for RS232 Port (6 M/T)

It may be necessary to set certain parameters to write or read through the RS232 port.

Full descriptions are to be found in the relevant Fanuc Operators Manuals

The following data is offered as quick reference

Parameter Setting Procedure

1. Set the selector switch on master PCB to enable.

2. Set the mode to MDI.

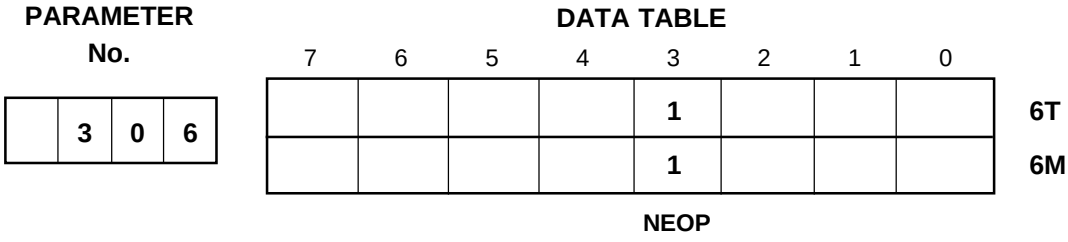
3. Press the **PARAM** button.

4. Key in **N** and **PARAMETER NUMBER TO BE SET** then press the **INPUT** button.
   (The page and cursor buttons can also be used).
   The cursor will be below the parameter required.

5. Press **P** and **DATA TO BE SET** then press the **INPUT** button.
   (It is good policy to record the existing setting before making any changes).

6. Turn the selector switch on master PCB to disable.

7. Press the **RESET** button to release alarm (100) status.



NEOP

1: When registering tape in memory M02, M30 or M99 is NOT counted as program end.

0: When registering tape in memory M02, M30 or M99 is counted as program end.

Set the Following Parameters as Desired

PARAMETER No.

	3	1	0

DATA TABLE

7	6	5	4	3	2	1	0	
		RSCB 1	**STP2 1**	**BAD 1**				**6T**
		RSCB 1	**STP2 1**					**6M**

PARAMETER No.

	3	1	1

DATA TABLE

7	6	5	4	3	2	1	0	
		RSCB 2	**STP2 2**	**BAD 2**				**6T**
		RSCB 2	**STP2 2**					**6M**

PARAMETER No.

	3	1	2

DATA TABLE

7	6	5	4	3	2	1	0	
		RSCB 3	**STP2 3**	**BAD 3**				**6T**
		RSCB 3	**STP2 3**					**6M**

PARAMETER No.	
	3 1 3

DATA TABLE

7	6	5	4	3	2	1	0	
		RSCB 4	STP2 4	BAD 4				6T
		RSCB 4	STP2 4					6M

RSCB 1, 2, 3, 4
Specifies whether or not control codes (DC1 - DC4) are used on I/O devices 1, 2, 3 and 4 respectively.

RSCB 1, 2, 3, 4
1: The control codes are NOT used.

0: The control codes are used.

STP2 1, 2, 3, 4
In order of I/O devices 1, 2, 3 and 4 specifies whether the stop bit is to be 2 bits or 1 bit.

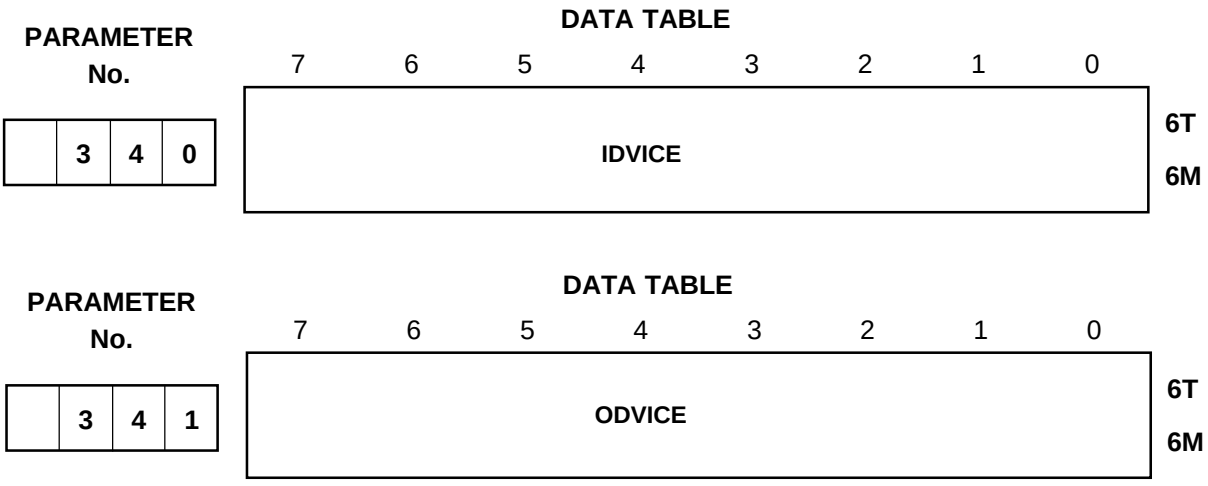
STP2 1, 2, 3, 4
1: The stop bit is to be 2 bits.

0: The stop bit is to be 1 bit.

BAD 1, 2, 3, 4 In order of I/O devices 1,2,3 and 4 specified as baud rate.

BAUD RATE	BAD 1	2	3	4
50	0	0	0	0
100	0	0	0	1
110	0	0	1	0
150	0	0	1	1
200	0	1	0	0
300	0	1	0	1

BAUD RATE	BAD 1	2	3	4
600	0	1	1	0
1200	0	1	1	1
2400	1	0	0	0
4800	1	0	0	1
9600	1	0	1	0

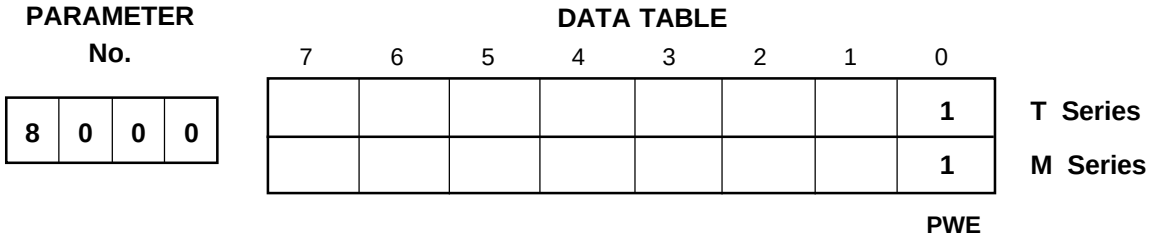


Set as desired

SET VALUE	I/O DEVICE
0	ON INPUT - TAPE RECORDER ON INPUT - FACIT PUNCHER
1	IN BOTH INPUT/OUTPUT - ASR33/ASR43 Parameters such as baud rate, etc. should be set in parameter No. 310.
2	IN BOTH INPUT/OUTPUT - RS232C Parameters such as baud rate, etc. should be set in parameter No. 311.
3	IN BOTH INPUT/OUTPUT - RS232C Parameters such as baud rate, etc. should be set in parameter No. 312.
4	IN BOTH INPUT/OUTPUT - RS232C Parameters such as baud rate, etc. should be set in parameter No. 313.

5.7 Parameters for 10-11-12-15 M/T

See the relevant G code parameter charts.



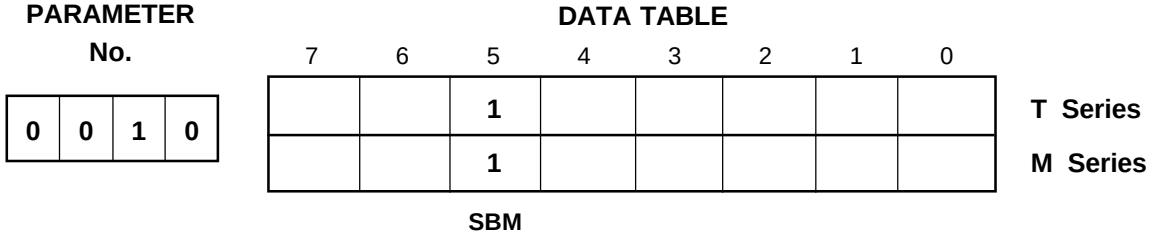
PWE

The tape entry or MDI entry of the parameters (parameters written as parameter entry) which cannot be set by the setting is FORBIDDEN or NOT FORBIDDEN :

PWE

0: FORBIDDEN
(Parameter changes NOT allowed).

1: NOT FORBIDDEN
(Parameter changes allowed).



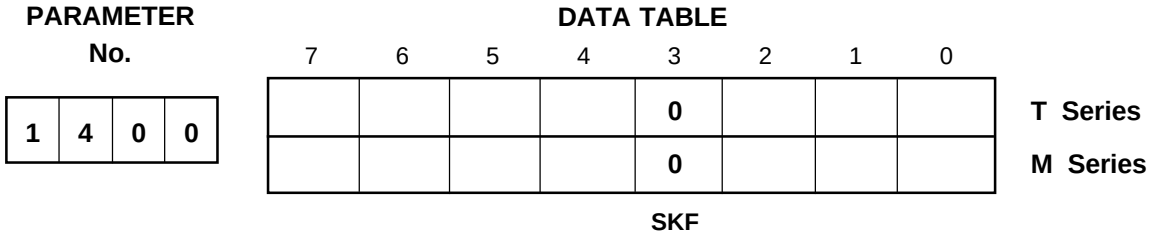
SBM All of the programs

Setting is optional

SBM

0: Do NOT perform single block stop in custom macro statement.

1: Perform single block stop in custom macro statement. (Used to debug custom macros).



SKF
Feed rate of skip function
(G31, G31.1, G32. 2, G31.3, G31.4)
(G31 is only available for 15-T and 15TT)

Setting is compulsory

SKF

0: F code rate specified in the program.

1: Rate established in the parameter (Data No. 1428 for M, 1427 for T)

PARAMETER No.			
2	2	0	0

DATA TABLE

7	6	5	4	3	2	1	0	
			1	**1**	**1**			**T Series**
			1	**1**	**1**			**M Series**
			NM9	**NPE**	**RAL**			

NM9

0: When programs are loaded, M99 is assumed as program end.

1: When programs are loaded, M99 is NOT assumed as program end.

This parameter is only valid if parameter NPE = 0.
In the case of program registration if it is required to assume M02 or M30 as the program end, but M99 is not the program end, then set
NPE = 0 and NM9 = 1.

RAL

0: When registering the program with external I/O devices control (both in foreground and background edition), or with cycle start signal.
– A single program is registered.

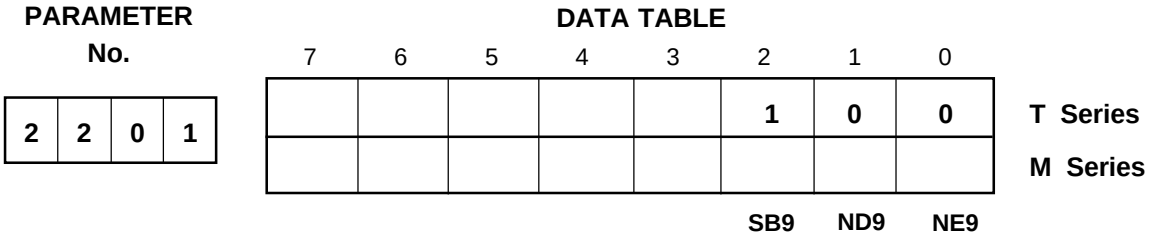
1: When registering the program with external I/O devices control (both in foreground and background edition), or with cycle start signal.
– All programs are registered.

NPE

0: When programs are loaded, M02, M30, or M99 should be assumed as program end.

1: When programs are loaded, M02, M30, or M99 should NOT be assumed as program end.
In this case a program number must exist in the first block of the program.

Setting is optional



SB9

0: In the macro statements of programs 09000–09999, single block stop is NOT performed.

1: In the macro statements of programs 09000-09999, single block stop is preferred.

Specify a 1 if it is necessary to debug programs 09000–09999.

Setting is optional.

ND9

0: Programs 09000–09999 are displayed during execution.

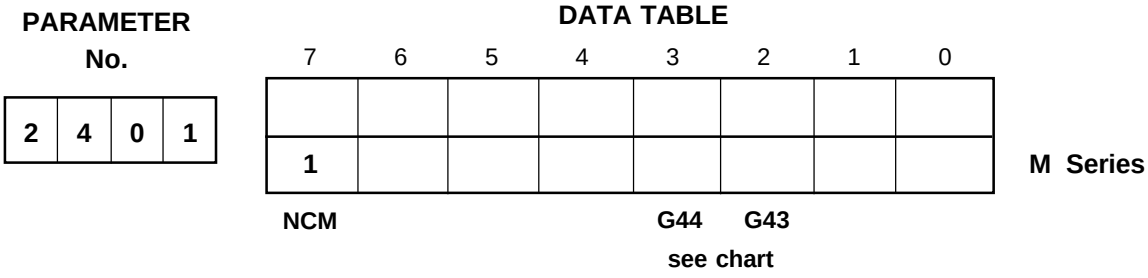
1: Programs 09000–09999 are NOT displayed during execution.

Specify 1 as programs such as custom macro programs need not be displayed during execution.

NE9

0: Programs 09000–09999 can be edited.

1: Programs 09000–09999 can NOT be edited.



NCM by reset

0: Clear.

1: Do not clear the next modal information.

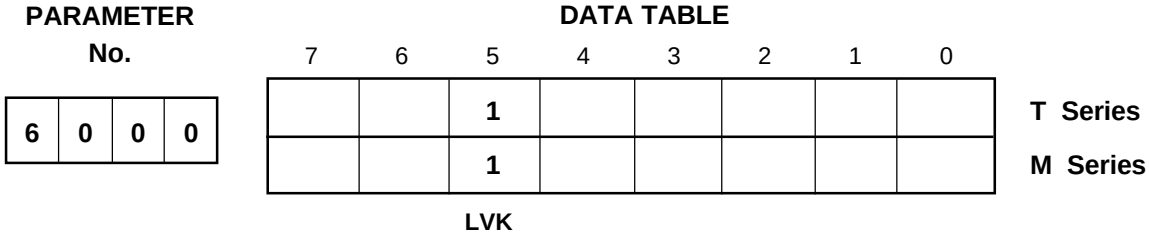
G00–G03	G96	G codes
G17–G19	G97	H codes
G54–G59	G90–G91	S codes
G93–G95	G43–G49	T codes

G43 and G44

Specify G43, G44 or G49 mode at power turn on or clear status (for FS10M, 11M, 12M)

G44	G43	G43, G44 or G49 Mode
0	0	G49 Mode
0	1	G43 Mode
1	0	G44 Mode

Either G43 or G44 should be set as required (Normally G43)



LVK

0: By resetting the tool length compensation (or tool offset for lathe system) vector is cleared.

LVK

1: By resetting the tool length compensation (or tool offset for lathe system) vector is maintained without being cleared.

Setting is recommended but is not compulsory.

PARAMETER No.			
7	0	0	0

DATA TABLE

7	6	5	4	3	2	1	0	
0	**0**		**0**					**T Series**
0	**0**		**0**					**M Series**
PRT	**CLV**		**CVA**					

PRT

0: Space is output when reading zero with DPRINT.

1: Nothing is output when reading zero with DPRINT.

The parameter PRT only becomes valid when using the Renishaw print option.

PRT setting is optional.

CLV

By resetting, common variables #100 – #199, #100 – #149 in 15-TT (common variables cleared by power off) of the custom macro are:

1: NOT cleared **0:** Cleared to zero

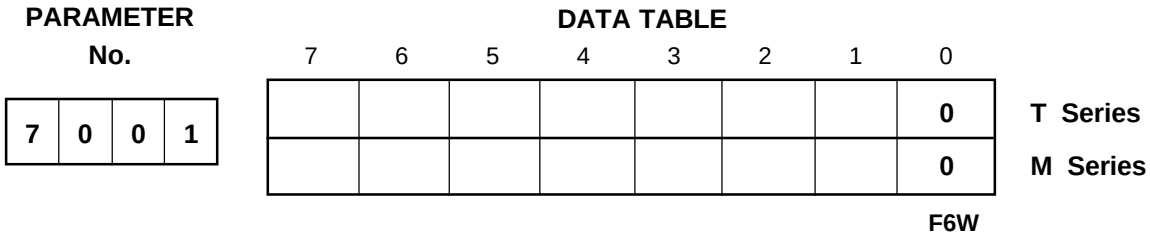
CLV setting is compulsory

CVA

0: The macro call argument is delivered in NC format.

1: The macro call argument is converted into macro format.

CVA setting is compulsory

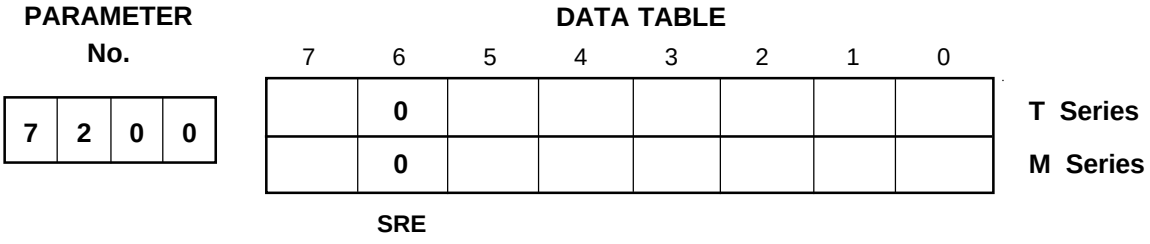


F6W
0: The system variable number of work offset amount is FS9 type.

F6W
1: The system variable number of work offset amount is FS6 type.

NOTE: FS9 type variable numbers can also be used when F6W = 1

Set as required

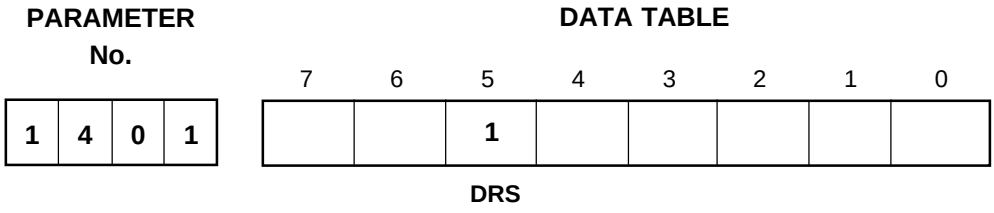


SRE
0: When high speed skip is used, check the input signal at rise-up time of signal.

SRE
1: When high speed skip is used, check the input signal at rise-down time of signal.

Setting is recommended

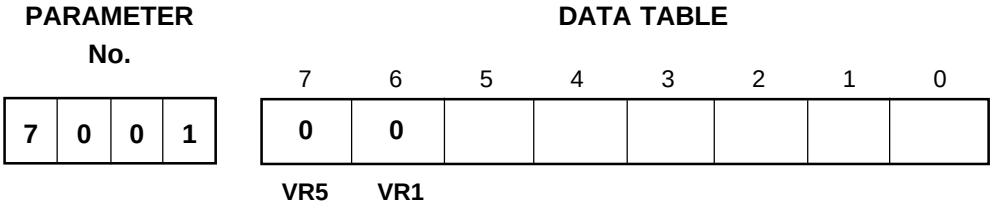
5.8 Additional Parameters for 15 M/T Series Only



DRS

0: At dry run stage the skip signal is ignored.

1: At dry run stage the skip signal is made valid.



VR5

0: Common variable number 500 is NOT used as the head number of common variable which can be referenced in COMMON.

1: Common variable number 500 is used as the head number of common variable which can be referenced in COMMON.

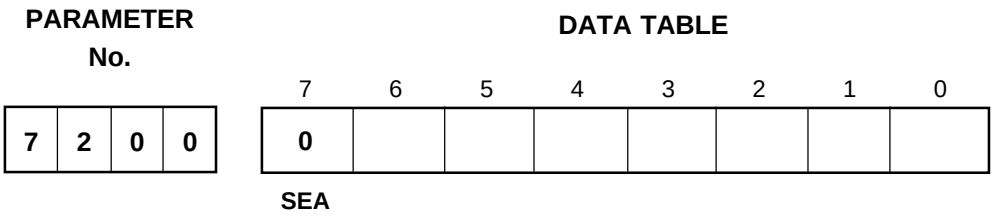
VR1

0: Common variable number 100 is NOT used as the head number of common variable which can be referenced in COMMON.

1: Common variable number 100 is used as the head number of common variable which can be referenced in COMMON.

VR1 and VR5 are not applicable to Fanuc 15TT.

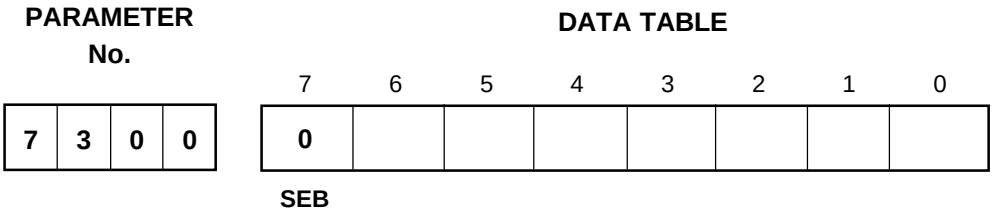
Setting is recommended



SEA
The servo delay and acceleration/ deceleration, when the skip signal or measurement position arrival signal is turned on during skip operation (15-M) or automatic tool offset (15-T / 15TT).

SEA
0: Are NOT considered.

1: Are considered and compensated (Type A).

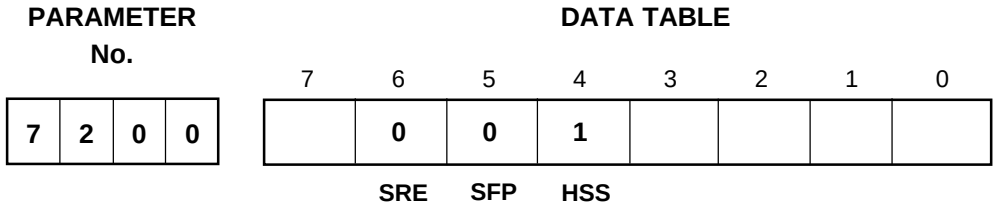


SEB
The servo delay and acceleration/ deceleration, when the skip signal or measurement position arrival signal is turned on during skip operation (15-M) or automatic tool offset (15-T / 15TT)

SEB
0: Are NOT considered.

1: Are considered and compensated (Type B).

5.9 Parameters Related to Multi-Channel Skip 10-11-12-15 M/T



HSS

0: The high speed skip signal is NOT used in the skip function. Conventional skip is used.

1: The high speed skip signal is used in the skip function.

Set as required.

SPF

The feedrate during execution of the multi-step function is:

0: The program – commanded F code speed.

1: The speed set by parameter (Data number 7211-7216).

Setting is compulsory.

SRE

When the high speed skip signal is used:

0: Check the input signal at rise-up time of signal.

1: Check the input signal at rise-down time of signal.

Set as recommended.

PARAMETER No.
7 2 0 1

DATA TABLE

7	6	5	4	3	2	1	0
2S4	2S3	2S2	2S1	1S4	1S3	1S2	1S1
G31.2				G31/G31.1			

Set Bit 0 to 1, otherwise set as required.

DATA TABLE

3	2	1	0
0	0	0	1

PARAMETER No.
7 2 0 2

DATA TABLE

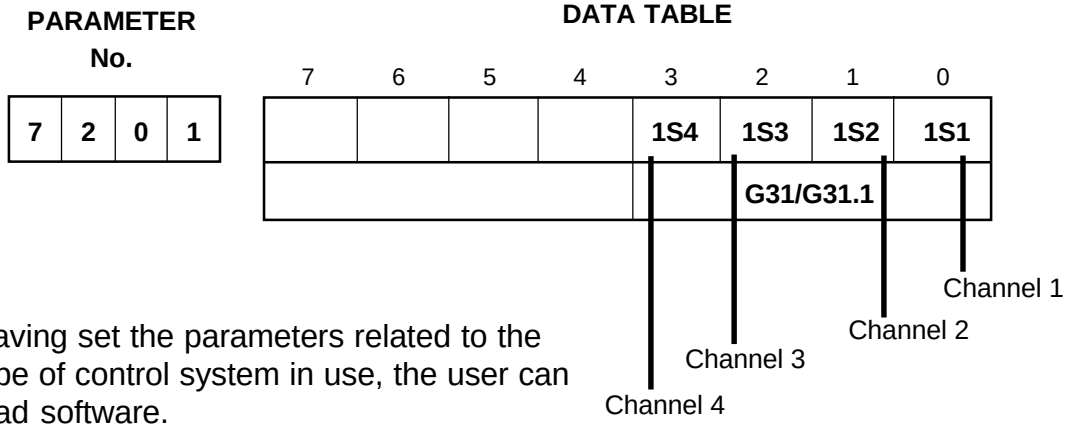
7	6	5	4	3	2	1	0
4S4	4S3	4S2	4S1	3S4	3S3	3S2	3S1
G31.4				G31.3			

Set as required.

SKIP 1	HIGH SPEED SKIP	BIT NAME	BIT NAME	BIT NAME	BIT NAME
SKIP 1	HDI 0	1S1	2S1	3S1	4S1
SKIP 2	HDI 1	1S2	2S2	3S2	4S2
SKIP 3	HDI 2	1S3	2S3	3S3	4S3

Multi-channel skip applies to conventional and high speed skip.
When conventional skip (G31) is used Parameter 7201 bit(s) 1 to 4 should be set to receive the correct channel(s).

When high speed skip is used the same rules apply. If channel 1 was used for conventional or high speed skip then setting parameter 7201 bit 0 to be 1 would allow either G31 or G31.1 to be used.



Having set the parameters related to the type of control system in use, the user can load software.
Test the installation for safe operation and make any edits required.

See Software Installation for guidance on software loading.

NOTE: Remember to reset PWE to 0.

5.10 Appendix – Setting Parameters for RS232 Port 10-11-12-15 M/T

Select - setting (handy) page
Move cursor to input device = i.e. (0:PTR 12:RS232C 10:RS232C 11:ASR 13:RS422)

Select type of input

Move cursor to output device = i.e. (12:RS232C 11:ASR 13:RS422)
Select type of output

Select - setting (settings) page
Input 5001
Press inp_no. Soft key
Screen will show :
Setting (RS232C)

Page information

			e.g.
5001	RS23C	1: DVC SLCT	1
5002	RS232C	2:	0
5011	ASR 33/43		0
5013	RS422		0

1 = set
0 = not set

Select desired RS232C interface to be used

Page over

				e.g.
5110	DVC1	1: DVC type	3	Control codes DC1-DC4- are used and feed is not punched corresponding to device number 1
5111		2: Stop bits	2	Number of stop bits corresponding to device number 1
5112		3: Baud rate	8	Baud rate corresponding to device number 1

5120	DVC2	1:
5121		2:
5122		3:
through to		
5160	DVC6	1:
5161		2:
5162		3:

PARAMETER 0000 should also be set to the required settings
– refer to Fanuc operators manual for further details.

Baud Rate Setting No.

PARAMETER
5112
5122
5123
5142
5152
5162

SETTING VALUE	BAUD RATE
1	50
2	100
3	110
4	150
5	200
6	300
7	600
8	1200
9	2400
10	4800
11	9600

Set to suit equipment

For further information regarding parameters relating to I/O interface (RS-232-C, RS-422, ASR 33/43) refer to Fanuc operators manual.

Parameter 7000 Bit-PRT is set to 0 (zero).

A space code is output for leading zeros. The user must select a device type and number through the setting page of the control.

This must be an RS232C interface, numbers 1-3. The corresponding device specifications must be set in the parameter according to the Fanuc manual.

Device specifications are important.

The data range for Parameter 5110 is 1-7, but print is controlled by 1-4.

DC1-DC4 Control Codes will turn on a tape punch for example, if it is off. If using a teletype, Data Dynamics Zip etc with attached punch, this could mean the punching of tape when it is not required.

Feed must not be used. The control will issue null code (feed) each time and the macro refers to POPEN and PCLOS if set to do so.

To prevent this, the feed must not be used. Therefore, the recommended range of I/O specification is 3-4 printing only. This may mean specifying a separate device type, if the RS232C is used for tape output.

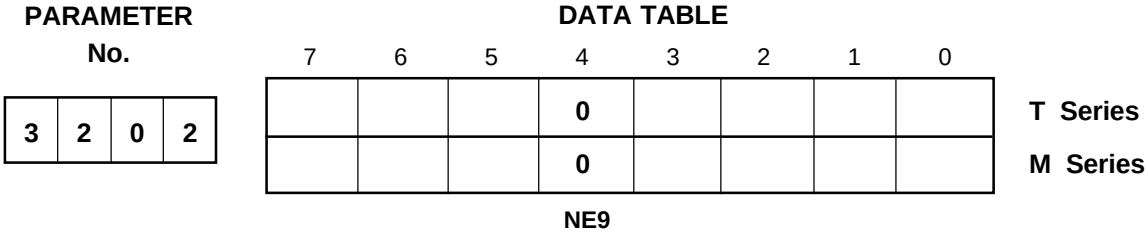
5.11 Parameters 16-18 M/T

G CODE PARAMETER
These can be set to allow a G code to call a macro program.

G Parameter	Renishaw Program	G Code	
		M	T
6050	9010	110	101
6051	9011	111	124*
6052	9012	112	125*
6053	9013	113	106
6054	9014	101	—
6055	9015	105	113
6056	9016	106	110
6057	9017	107	107
6058	9018	118	118
6059	9019	119	119

* Used for HPA (High Precision Arm - Tool Setting) software. All others are used for inspection software.

PARAMETER WRITE
This must be set to 1 to allow any parameter changes to be found on (SETTING [HANDY]).



NE9

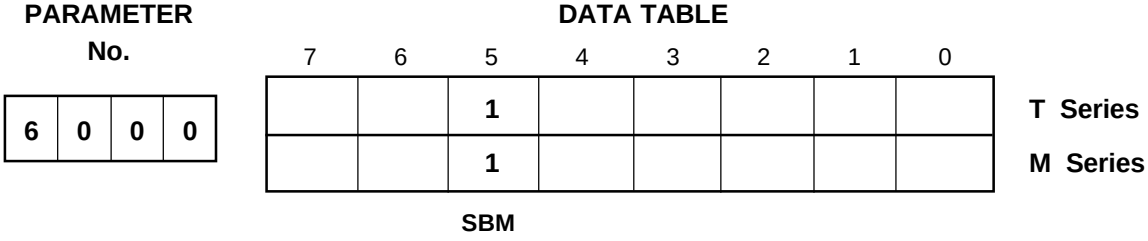
1: Programs with the number 9000 to 9999 are protected. The following functions are disabled.

a. Deleletion of programs 9000–9999.
b. Loading and punching programs 9000–9999.
c. Edit of programs 9000–9999.
d. Display of programs 9000–9999.

NE9

0: The inverse of **1**:

Setting of NE9 is optional.



SBM

1: Single block in custom macro is performed

SBM

0: Single block in custom macro is NOT performed.

Setting of SBM is optional.

PARAMETER No.
3 2 0 1

DATA TABLE

	7	6	5	4	3	2	1	0	
		1					**0**		**T Series**
		1					**0**		**M Series**
		NPE					**RAL**		

NPE
M02, M30, and M99 at program registration.

NPE
1: Completion of registration is NOT assumed.

0: Completion of registration is assumed.

RAL
Program registration by the reader/puncher interface.

RAL
1: Only one program is registered.

0: All programs are registered.

Setting of NEP and RAL is optional.

PARAMETER No.
5 0 0 3

DATA TABLE

	7	6	5	4	3	2	1	0	
		1							**T Series**
		1							**M Series**
		LVC - T **LVK - M**							

LVC - T
Tool compensation vector.

LVK - M
Tool length compensation vector.

LVC - T
LVK - M
1: NOT cleared, but held by reset.

0: Cleared by reset.

Setting of LVC or LVK is recommended, but is not compulsory.

PARAMETER No.	
6	0 0 1

DATA TABLE

	7	6	5	4	3	2	1	0	
	0	1					0		T Series
	0	1					0		M Series
	CLV	CCV					PRT		

CLV
Custom macro local variables #1-33.

CLV
1: NOT cleared by reset.

0: Cleared by reset.

CCV
Custom macro common variables #100–149.

CCV
1: NOT cleared by reset.

0: Cleared by reset.

PRT
Leading zero when data output using a DPRNT command.

PRT
1: Output no data.

0: Output a space.

Setting of CCV and PRT is compulsory when using the print macro.
Setting of CLV is optional.

PARAMETER No.	
6	2 0 0

DATA TABLE

	7	6	5	4	3	2	1	0	
	0								T Series
	0								M Series
	SKF								

SKF
Dry run, override and automatic acceleration and deceleration for G31 skip command.

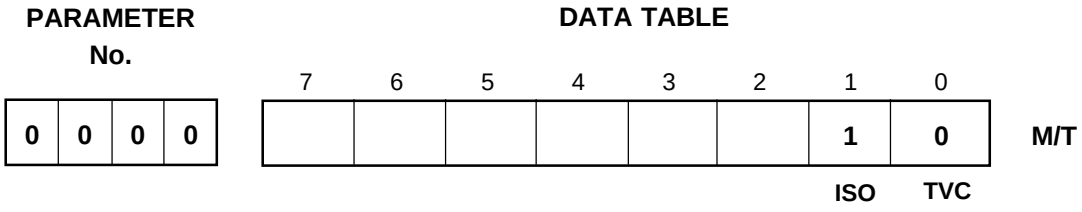
SKF
1: Enabled.

0: Disabled.

Setting of SKF is recommended but is not compulsory.

5.12 Appendix – Setting Parameters for RS232 Port (16-18 M/T)

These are usually set by the machine tool builder, but it is often necessary to change the Baud Rate to suit different equipment used to load software. Full descriptions are to be found in the Fanuc operators manual. The following data is offered as a quick reference.



ISO
Code used for data output.

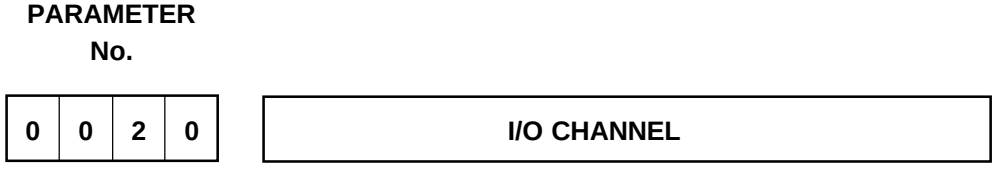
ISO
1: ISO code.

0: EIA code.

TVC
TV check

TVC
1: Performed.

0: NOT performed (normally 0 for Renishaw).



= 0 Channel 1
= 1 Channel 1
= 2 Channel 2
= 3 Channel 3

BAUD RATE SETTING No.

SETTING VALUE	BAUD RATE
1	50
2	100
3	110
4	150
5	200
6	300
7	600
8	1200
9	2400
10	4800
11	9600
12	19200

Set to suit equipment

I/O CHANNEL = 0 (Channel 1).

101	Stop bit and data
102	Number specified for the input/output device
103	Baud rate

I/O CHANNEL = 1 (Channel 1).

111
112
113

I/O CHANNEL = 2 (Channel 2).

121
122
123

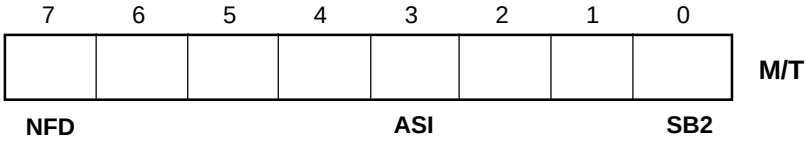
I/O CHANNEL = 3 (Channel 3).

131
132
133

PARAMETER Nos.

0	**1**	**0**	**1**
0	**1**	**1**	**1**
0	**1**	**2**	**1**
0	**1**	**3**	**1**

DATA TABLE



NFD
Feed before and after data at data output.

NFD
1: NOT output.

0: Output.

ASI
Code used at data output

ASI
1: ASCII code.

0: EIA or ISO code (automatically distinguished).

SB2
The number of stop bits.

SB2
1: 2 stop bits.

0: 1 stop bit.

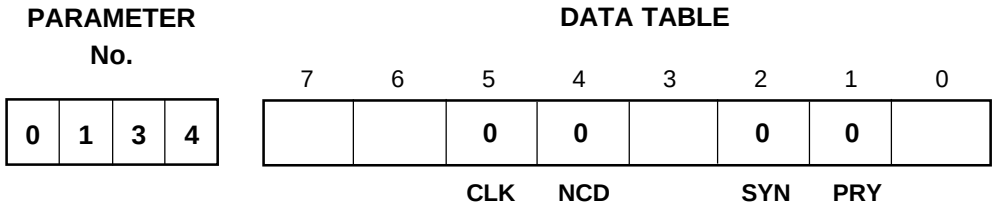
PARAMETER Nos.

0	**1**	**0**	**2**
0	**1**	**1**	**2**
0	**1**	**2**	**2**
0	**1**	**3**	**2**

Setting parameter when parameter 20 = 0
Setting parameter when parameter 20 = 1
Setting parameter when parameter 20 = 2
Setting parameter when parameter 20 = 3

Set value and specified number of Input/Output device

Set Value	Number specified for Input/Output device
0	RS-232C (for other than the following,set 0.)
1	FANUC CASSETTE ADAPTOR 1 (FANUC CASSETTE B1/B2)
2	FANUC CASSETTE ADAPTOR 3 (FANUC CASSETTE F1)
3	FANUC PROGRAM FILE Mate, FANUC FA Card Adaptor FANUC FLOPPY CASSETTE ADAPTOR FANUC SYSTEM P-MODEL H
4	Not used
5	Portable tape reader
6	FANUC PPR FANUC SYSTEM P-MODEL G, FANUC SYSTEM P-MODEL H



CLK
Baud rate clock when the RS-422 interface is used.

CLK
0: Internal clock.

1: External clock.

NCD
CD (signal quality detection) of the RS-232C interface.

NCD
0: Checked.

1: NOT checked.

SYN
NC reset/alarm in protocol B

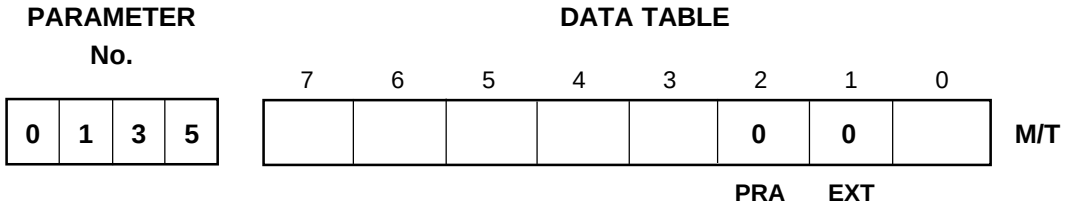
SYN
0: NOT used.

1: Reported to the host with SYN and NAK codes.

PRY
Parity bit.

PRY
0: NOT used.

1: Used.



EXT
End code for protocol A or extented protocol A.

EXT
1: EXT code in ASCII/ISO.

0: CR code in ASCII/ISO.

PRA
Communition protocol.

SYN
1: Protocol A.

0: Protocol B.

Chapter 6

Fanuc Software Installation

This chapter describes how to install retrofitted Inspection Packages on Fanuc Controllers for the:

- Optical Transmission System, and
- Inductive Transmission System.

Contained in this Chapter

6.1 Software Installation

The installation and use of software require the setting of machine parameters. Refer to your Fanuc operating manuals for procedures related to parameters (see Machine Parameter Section).

Check the Fanuc control program directory to ensure all macro numbers on the tape are available for use (see the Macro Number lists in the Programming Manual).

Where a conflict in numbers exists, then either the resident macro numbers can be changed, or deleted if not required, otherwise the Renishaw macro numbers can be modified.

Top level macro numbers can be changed, but if they are moved outside the range of G and M code selectable numbers, then they must be called in part programs using the G65P - - - method.

Renumbering user transparent macros will involve changing the nested macro call statements within the Renishaw macros. Refer to Renishaw if in doubt.

Refer to *Chapter 5 – Fanuc Machine Parameters* and follow the instructions for setting parameters for safe software operation.

Full descriptions and methods of changing parameters are to be found in the Fanuc Manuals.

Depending on the control system in use, certain parameters require resetting after completing probe system and software checks.

6.2 Loading the Software 0 M/T

Check that all parameters related to tape loading have been set as required.

1. Select EDIT or AUTO mode.
2. Set the NC tape on the tape recorder.
3. Press the PRGRM button.
4. Press the INPUT button.

When loading is complete the software should be kept in a safe place. The following parameters may be reset to the user's choice.

PARAMETER No.

0	**0**	**1**	**0**

DATA TABLE

7	6	5	4	3	2	1	0	
			1					**0T**
			1					**0M**

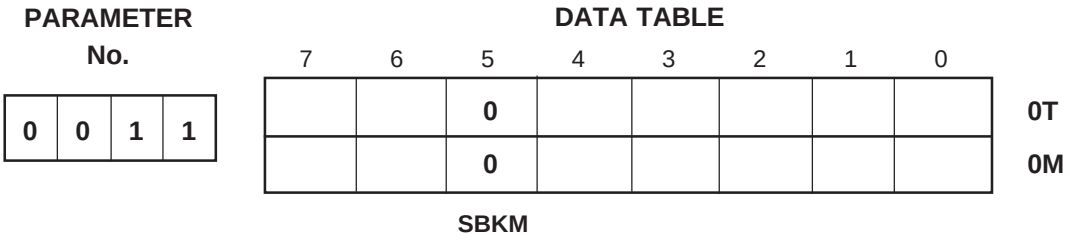
PRG9

PRG9

0: Editing programs O9000-O9999 is possible.

1: Editing programs O9000-O9999 is NOT possible.
Programs are safeguarded against accidental editing when PRG9 = 1

Setting is recommended



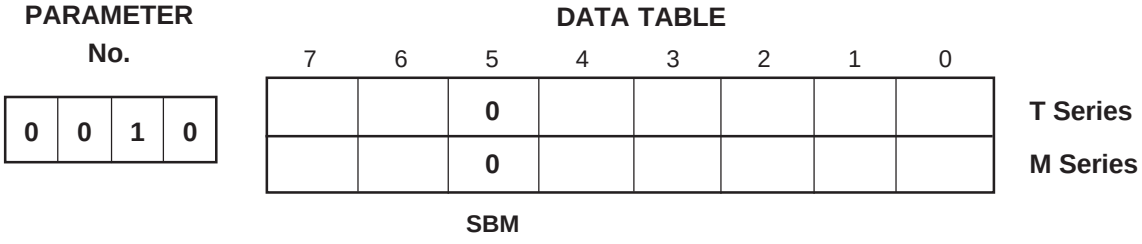
SBKM

0: Single block can NOT be performed during execution of macro programs O9000-O9999.

1: Single block can be performed during execution of macro programs O9000-O9999.

Refer to your Fanuc manuals for further descriptions regarding parameters.

Set as desired.



SBM

0: Do NOT perform single block stop in custom macro statement.

1: Perform single block stop in custom macro statement.

When loading has been completed the tape should be stored in a safe place.

Full descriptions regarding parameters are described in Fanuc manuals.

Set as desired.

6.3 Loading Software 16–18 M/T

Check that all parameters related to tape loading have been set as required.

1. Select EDIT mode.
2. Switch on the data protection key.
3. Set the NC tape on the tape reader.
4. Press <PROG> to display the program screen
5. Press the [READ] key.
6. Press the [EXEC] key.

When the tape holds multiple programs, reading is continued until ER (%) code is reached.

PARAMETER No.

3	2	0	2

DATA TABLE

	7	6	5	4	3	2	1	0
T Series				**0**				
M Series				**0**				

NE9

NE9

0: Programs 9000–9999 can be edited.
Programs 9000–9999 can be displayed.
Programs 9000–9999 can be registered.

1: Programs 9000–9999 can NOT be edited.
Programs 9000–9999 can NOT be displayed.
Programs 9000–9999 can NOT be registered.

6.4 Notes Prior to Use

Please check the following.
The probe installation should be tested for safe operation prior to using the macros.

1. Testing Skip Function

2. Write a small program

```
e.g.  O0001
      G91  G40   G80
      G31  Z-50. F100    (Metric values shown)
      G90
      M30
```

The probe should never be turned on and active.

The spindle should be in safe position where the Z axis is free to travel 50mm (1.97in).
When the machine is in cycle and the G31 command is read, the Z axis should move.
Verify this on the position page of the screen.
If the probe is triggered manually the slides should stop, and the program end.
If this does not happen the installation should be checked.

6.4.1 Retrofit Packages using the Status Relay

NOTE: This section is not applicable to Yasnac controllers.

If the Z axis does not move when the above test program is run, **then check the skip diagnostic.**
If the diagnostic signal is high, the machine is inhibited.
Check, if the output relay is configured normally open or normally closed correctly (see Hardware Installation).

Software packages fitted with user input/output signals.
Test that these signals are being read by the control.
Check relevant diagnostics for change of state (see *Chapter 4 – Fanuc Diagnostic and Location Chart and High Speed Skip).*

6.5 Fanuc Diagnostics for Skip – (Retrofit Packages)

NOTE: The following table covers MI 5, MI 8, MI 12, and MI 14 interfaces.

Fanuc Skip	**Fanuc Diagnostics** (see the diagnostic location chart in *Chapter 4 – Fanuc Diagnostic and Location Chart and High Speed Skip)*	
	Logic 0 (0)	Logic 0 (0)
Status Relay	**LED ON** 1. Probe seated. 2. Transmission good. 3. Power on.	**LED OFF** 1. Probe deflected. or 2. A forced condition for transmission failure. or 3. IMM/IMP not aligned. or 4. Power off.

6.6 Checking Fast Feed Rates

Check that macro variables used do not coincide with the Renishaw list of common and retained variables.

If software edits are required, consult Renishaw or your Renishaw Distributor.

6.6.1 Checking the Fast Feed Rate in the Z Direction

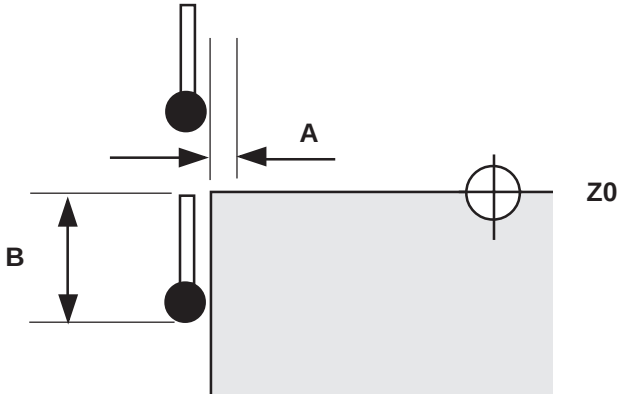


Figure 6.1 Checking Fast Feed Rate in Z Direction

Position the stylus a small distance (0.5mm [0.197in]) inside the surface (A) and approximately 10mm (0.4in) above.

Write a small program using G31 skip to take the probe stylus through the surface. Being only a small distance inside the surface allows the stylus to deflect without breaking.

When the machine slides have come to a halt, measure distance B. Distance B must not exceed the actual travel provided for the stylus in the Z axis.

Information regarding travel for the Z axis is to be found in the Renishaw Users Guide supplied with the system.

Sample Program

```
G91   G80  G40
G31   Z-10.0    F3000
      (For retrofit installations make F1000, values shown in mm)
G90
M30
```

Measure distance B and manually return the probe to a safe position.

NOTE: Make sure the skip function (G31) is working correctly before executing the above example.

As a rule of thumb, when distance B is within the Z axis travel of the probe, X and Y will be within their respective limits.

Should it be necessary to make alterations to the fast feed rates consult Renishaw or your Renishaw Distributor for advice.

The cycles should be tested at reduced feeds initially to establish that the machine slides stop within the overtravel of the probe. The probe overtravel in Z axis is usually the limiting condition.

It is only large machines or special circumstances which will require adjustment to the feed rates in the macros.

Consult Renishaw or your Renishaw Distributor for advice if this is necessary.

A Check that all machine parameters have been set (see *Chapter 5 – Fanuc Machine Parameters*), particularly the parameters related to retaining tool length offsets.
Test if the tool offset Vector is lost after pressing 'Reset Button'. (see *Chapter 5 – Fanuc Machine Parameters*).

NOTE: There is a Software Deviation Record Sheet provided at the front of this manual to record all authorised changes to software.

B Set Tool offset type indicator #508

Set as follows :

10/11/12/15M	#508 = 1	Tool offset type A
10/11/12/15M	#508 = 2	Tool offset type B
10/11/12/15M	#508 = 3	Tool offset type C
6M	#508 = 1	
0M	#508 = 1	(not fitted to inspection package)

C Set Basic Move Factor #506 (Retrofit packages only).

The axis move programs all refer to #506 for the control factor. Once the initial contact is made the recovery off the surface is made in proportion to the factor #506.

6.7 Basic Move Factor – Retrofit Cycle

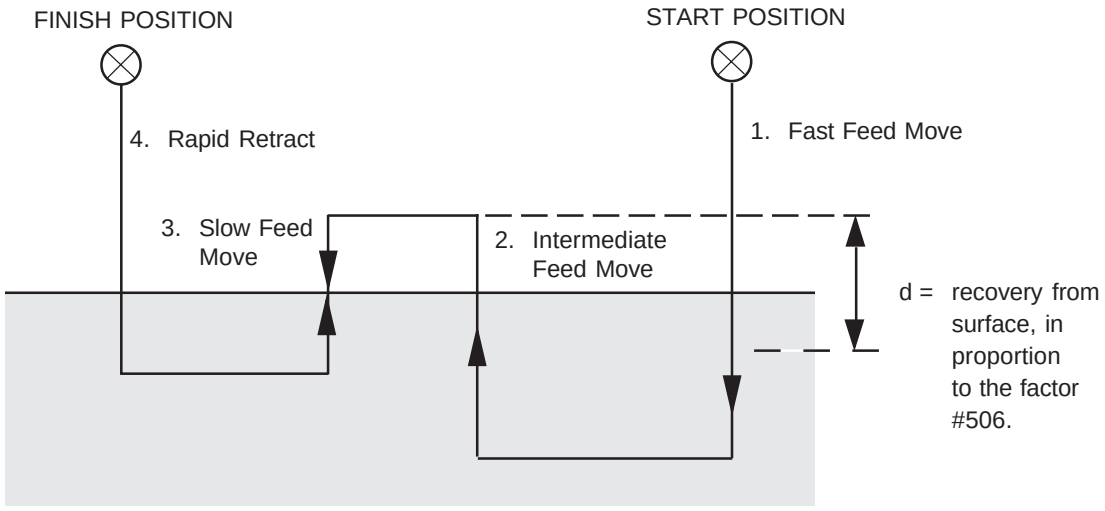


Figure 6.2 Basic Move Factor

1. Fast feed move to the surface, the skip position is captured (*) to gain an approximate surface position, then this is used with #506 in order to get a recovery position for move 2.

2. Intermediate position (d) to remove stylus from the surface.

3. Slow feed move to the surface, this is the final gauging move to capture the true surface position.

4. Rapid retract move off the surface back to the initial start position.

   By testing, the value of #506 should be adjusted so that the probe moves clear of the target surface by the smallest amount.

   Values will be in the range of 0.25mm to 0.5mm (0.010in to 0.0197in) typically.

   The higher the value the further away from the target surface the probe moves to.

High inertia machines will have high values of #506 to compensate for longer accelerations and decelerations.

A default value (0.5mm [0.0197in]) is automatically installed in some packages.

NOTE: References to #506 are applicable to machining centre software.

Before the probe is used for measurement and setting, it must be calibrated to the machine. This is achieved by running the calibration cycles.

Machining Centres

a. Calibrate in a bored hole.
b. Calibrate in a ring gauge.
c. Calibrate in Z axis.

Lathes

a. Calibrate on a known diameter.
b. Calibrate in Z axis.

The characteristics of both machine and probe will be established and stored as correction values.

NOTE: Subsequent recalibration will be required periodically dependent on usage and application.

Always calibrate after changing the stylus.

Chapter 7

Yasnac Installation

Renishaw provide software packages for machines fitted with the following Yasnac controller types.

- MX1, MX2, MX3, M80 (I80)

This chapter describes how to connect the Renishaw interface to these controllers in readiness for installing the software and then covers installing the software.

Contained in this Chapter

7.1 General

Yasnac programming format and wiring requirements are similar to Fanuc. However specific diagnostic and wiring connection locations are different.

Software is supplied in either Retrofit or OEM type. Each requires different wiring instructions.

Reference to the Software Kit No. purchased and the programming manual will establish which type of installation to use.

7.2 Hardware Installation

Refer to *Chapter 3 – Fanuc Connection Diagrams* for general guidance.

Any reference to	UI 0	will be	XUI 10 for Yasnac – Matsuura.
Any reference to	UI 1	will be	XUI 11 for Yasnac – Matsuura.
Any reference to	UI 2	will be	XUI 12 for Yasnac – Matsuura.

7.2.1 Connection Diagrams

Connection diagrams in *Chapter 3 – Fanuc Connection Diagrams* cover Fanuc installation only.

The following differences apply to Yasnac controllers.

OPTICAL OEM — **Kit A-4014-0006** **Tape A-4014-0007**

Yasnac MX3 - Matsuura Inspection Software (MC-450H).

Please note the following differences in *Chapters 3* and *4*.

Skip signal will be configured for 24V common.

Use connection diagram 7.3 in this section

	Fanuc ref.		**Matsuura ref.**	**Connector Blk (TB2)**
User Inputs	UI 0	**change to**	XUI 10	25D
	UI 1		XUI 11	24D
	UI 2		XUI 12	10D
Supply	+24VNC	**change to**	+24V	130
	0V		0V	101
(G31)	SKIP	**change to**	XSKIP	
The MI 12 interface dip switch SW3 should be set to option 5				127

Diagnostic Information

			M/C-P/C	**M/C-P/C**
	XUI 10	-	#10382	#13242
	XUI 11	-	#10383	#13243
	XUI 12	-	#10384	#13244
(G31)	XSKIP	-	#10190	#12804

OPTICAL RETROFIT — **Kit A-4014-0002** / **Tape A-4014-0001**

Yasnac MX2 - Matsuura Inspection Software (MC-40011-30).

Please note the following differences in *Chapters 3* and *4*

Use connection diagram 7.5 in this section

	Fanuc ref.		Matsuura ref.	
Supply	+24V	**change to**	+24V	(133)
	0V		0V	(101)
	+24VNC		+OUT1(PCB0065B)	(727) TB27

(G31)	SKIP	**change to**	B.SKIP.M	(322) via CR37 (1)

NOTE:

Existing wire (727) must be disconnected from CR37. Re-connect to +24VNC (MI 12).

The MI 12 interface dip switch SW3 should be set to option 1.

Diagnostic Information

(G31) B.SKIP.M - #10290 (MX1 - #10130)

Matsuura M81/M82 option required

i.e. M81 measurement signal (skip) 'OFF' check

M82 measurement signal (skip) 'ON' check

Matsuura dip switch settings on PCB 0065B

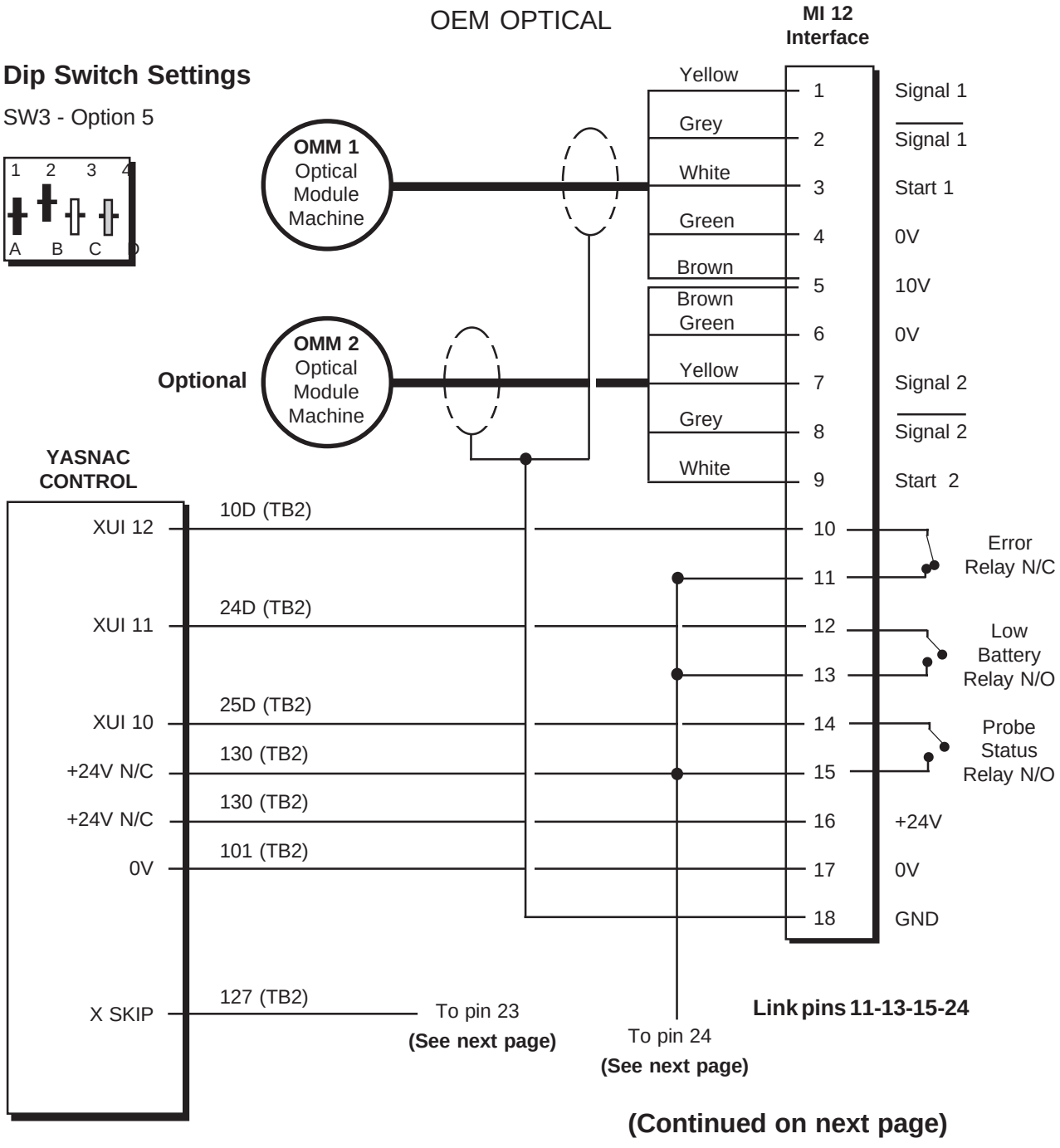
DSW - 1

1	2	3	4	5	6	7	8
			ON	**ON**			

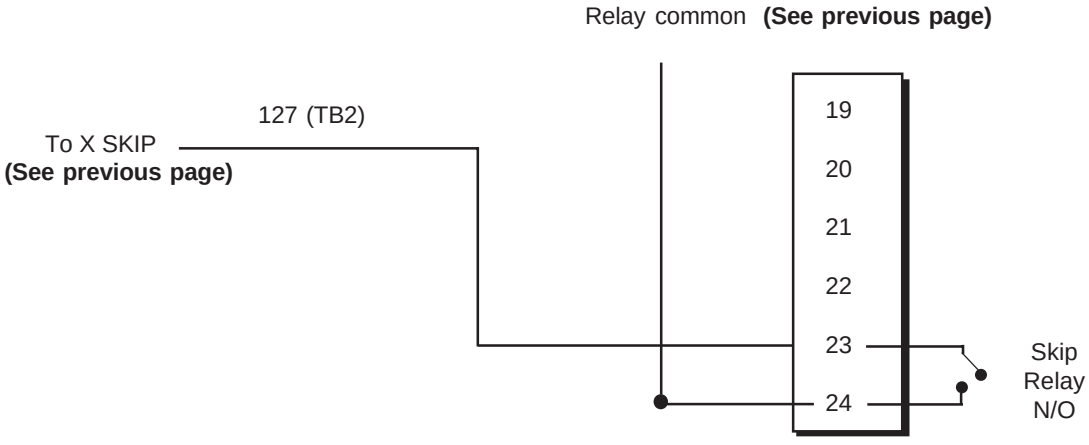
DSW - 2

ON		**ON**					
1	2	3	4	5	6	7	8

7.3 MI 12 Interface to Yasnac MX3 Control – Skip Signal 24V Common



(Continued from previous page)



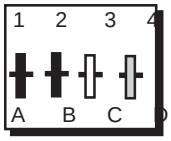
Link pins 11-13-15-24

7.4 MI 12 Interface to Yasnac MX3 Control – Skip Signal 24V Common

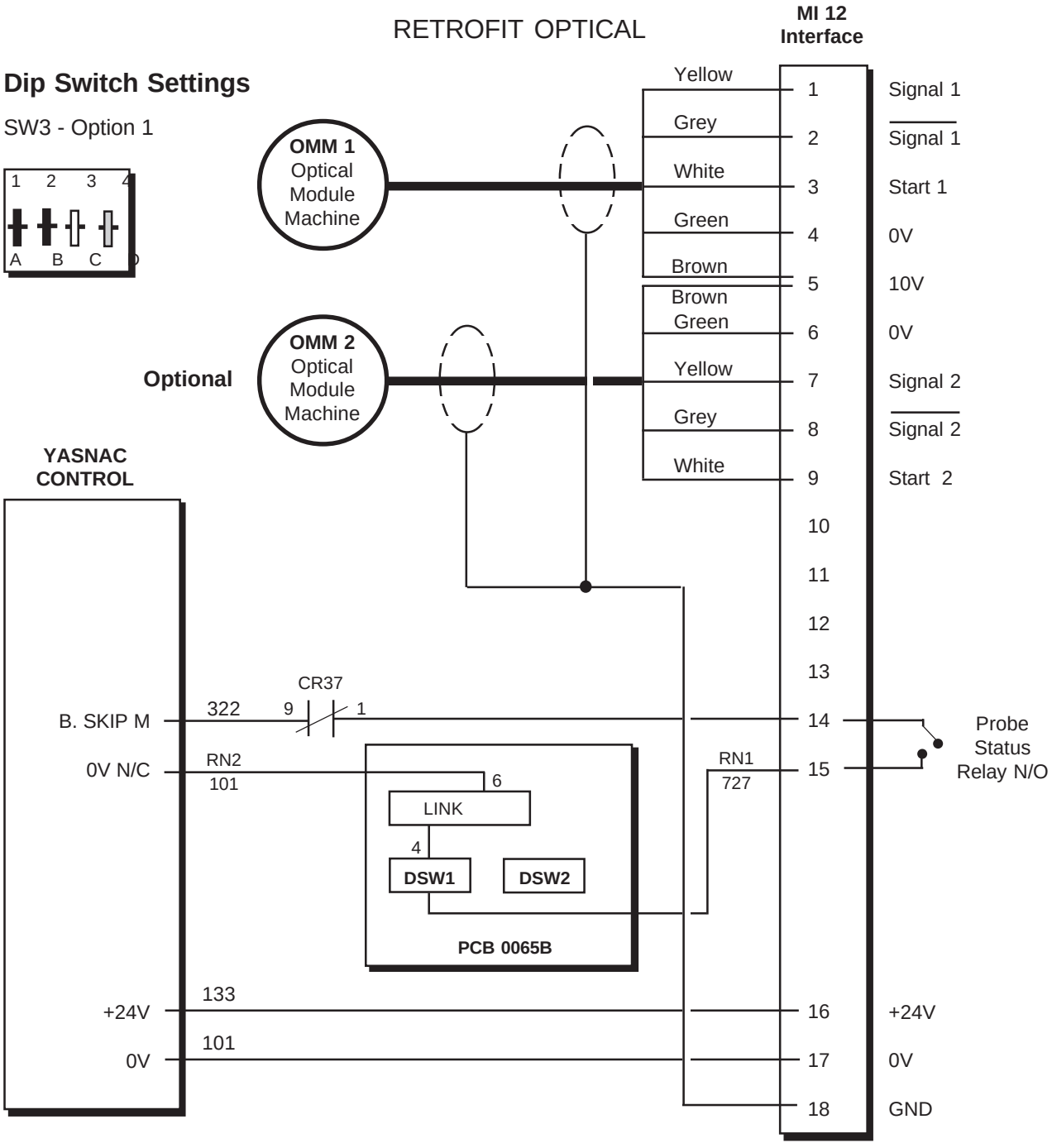
RETROFIT OPTICAL

Dip Switch Settings

SW3 – Option 1



7.5 MI 12 Interface to Yasnac MX2 Control –Skip Signal 0V Common

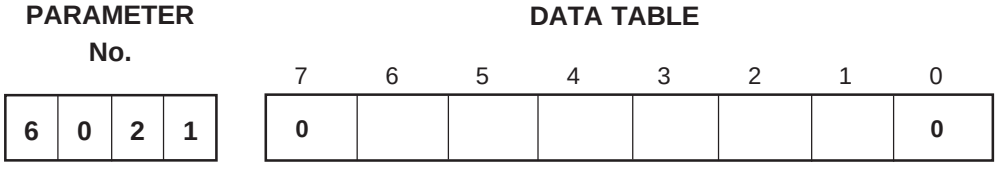


7.6 Parameters

Examine the program directory and ensure that the program numbers on the tape are available for use.

A list of the macro numbers is contained in the programming manual.

Set parameters for the loading in the macro programs (Interlock on reader must be set to 1. MX1–MX2).

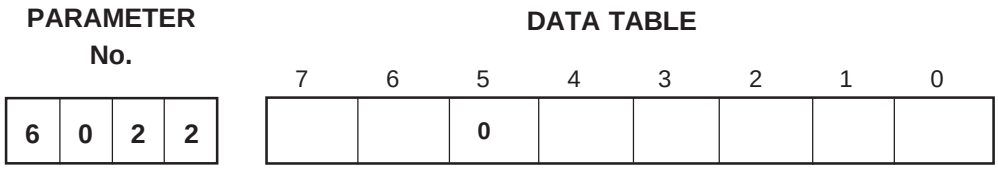


DO = 0
As shown will permit the loading of programs, sub programs and macro programs that contain M02, M30 and M99 without that code being recognised as the program terminator.

Some macro programs use multiple M99 codes and setting this bit enables correct program registration under these circumstances.

D7 = 0
As shown enables editing of macro O9000 – O9999

Once loaded the parameter may be reset if required to the users choice.



D5 = 0
Makes editing display of O9000 through O9999 interlock ineffective.

7.6.1 Loading the Tape

The tape has been prepared to allow for a continuous load of all the macro programs.

a. Load Tape to Tape Reader.

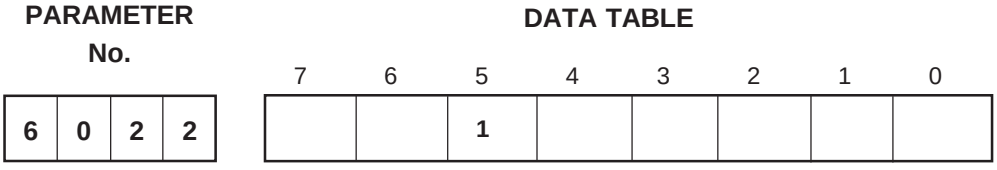
b. Select EDIT mode.

c. Press PROG button.

d. Press RESET button.

e. Press "O" "–" "9" "9" "9" "9"

f. Press IN button.



D5 = 1
Makes editing display of O9000 through O9999 interlock effective.

Check the Following Parameters

PARAMETER No.	DATA TABLE							
	7	6	5	4	3	2	1	0
6004								1

D0 = 1
The next block is excuted if there is no skip signal output.

D0 = 0
Causes alarm '087**'**

PARAMETER No.	DATA TABLE							
	7	6	5	4	3	2	1	0
6008							1	

D51 = 1
Does NOT clear common variables (advise only).

PARAMETER No.	DATA TABLE							
	7	6	5	4	3	2	1	0
6019				0				

D4 = 0
Employs the F code command as the feed rate for skip (G31).

PARAMETER No.	DATA TABLE							
	7	6	5	4	3	2	1	0
6 0 6 2				**1**				

D4 = 0
Set the skip signal to respond to a falling edge signal 24V – 0V (MX1 –MX2 only).

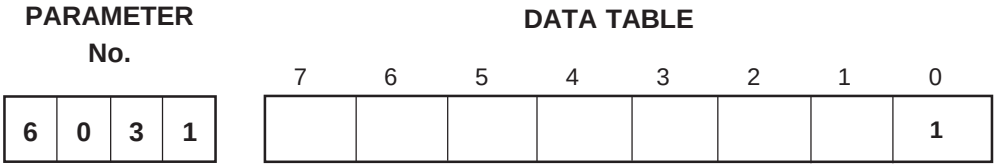
D4 = 1
Set the skip signal to respond to a rising edge signal 0V – 24V (MX3).

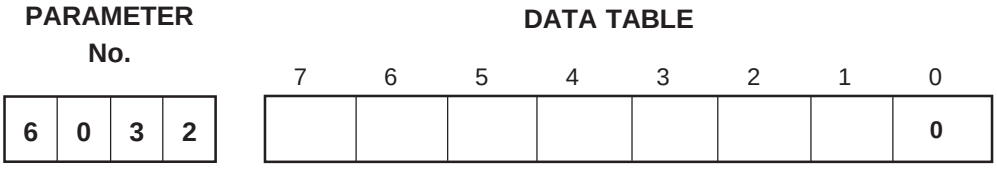
PARAMETER No.	DATA TABLE							
	7	6	5	4	3	2	1	0
6 0 6 3							**1**	

D1 = 1
Enable the control circuit of 'skip' input for skip function.

NOTE: Setting parameters #6019, #6062, and #6063 is essential

NOTE: Yasnac MX1 and MX2 controllers.
The following parameters can be checked if difficulty is experienced (see the Yasnac manual for parameter descriptions).
Set interlock on reader to 4 in order to display parameters.





D0 = 0
Must be displayed.

7.7 Parameters for G and M Code Call

G codes may be set for the simplified calling of macro programs. The following parameters can be set.

The G codes are optional. Three-figure codes have been chosen to avoid clashes with the standard G codes.

The G code calls given in the charts below are only recommended codes, and are subject to the availability of free G codes.

Should there be any doubt as to the availability of free G codes, the programmes can be called by using G65 instead of the simplified macro call.

Example: **G65 P9010 (web/pkt) Xx Mm Ss Tt etc.**

G Code Parameters	Program Number	Recommended G Code MX1 - MX2 - MX3 - M80
6120	9010	150
6121	9011	151
6122	9012	152
6123	9013	153
6124	9014	154
6125	9015	155
6126	9016	156
6127	9017	157
6128	9018	158
6129	9019	159

M Code Parameters	Program Number	Recommended M Code	
		MX3 - MX80	MX1 - M2
6131	9001	119	219
6132	9003	105	205

7.8 Setting Data for RS232C

7.8.1 Setting Data Input/Output Interface

To use data input/output interface, it is necessary to set which interface is to be used.

Make this setting as follows.

1. Setting the Data Input Interface

INVCE1 (#6003,D1)	INVCE0 (#6003,D0)	Data Input Interface
0	1	RS232C Interface No.1
1	0	RS232C Interface No.2

NOTE: PTR interface is for the standard tape reader. Usually this interface is set.

2. Setting the Data Output Interface

INVCE1 (#6003,D5)	INVCE0 (#6003,D4)	Name of Interface
0	1	RS232C Interface No.1
1	0	RS232C Interface No.2

7.8.2 Setting the Baud Rate and Others for the Serial Interface

To use serial interface (RS232C), it is necessary to set the following parameters.

a. The baud rate.
b. Stop bit length.
c. Control code transmission specification.

1. Current loop or RS232C, interface.

   The data shown below is set for input and output combined or separately.

   #6028D6

   0 Data is set for input and output combined.
   1 Data is set for input and output separately.

SETTING DATA INPUT/OUTPUT INTERFACE

A. Setting Baud Rate Device 1 (Paper tape input only)

INPUT OUTPUT	#6026D3 #6028D3	#6026D2 #6028D2	#6026D1 #6028D1	#6026D0 #6028D0
50	0	0	0	0
100	0	0	0	1
110	0	0	1	0
150	0	0	1	1
200	0	1	0	0
300	0	1	0	1
600	0	1	1	0
1200	0	1	1	1
2400	1	0	0	0
* 4800	1	0	0	1
* 9600	1	0	1	0

* must be set for D1 (device 1)

B. Setting Stop Bit Length

INPUT	**#6026D4**	= 1 : Stop bit as 2 bits
OUTPUT	**#6028D4**	= 0 : Stop bit as 1 bit

C. Setting Control Code Transmission Designation

INPUT	**#6026D5**	= 1 : Does NOT send control code
OUTPUT	**#6028D5**	= 0 : Sends out control code.

D. Setting Baud Rate Device 2 (Computer connection)

INPUT **OUTPUT**	**#6027D3** **#6029D3**	**#6027D2** **#6029D2**	**#6027D1** **#6029D1**	**#6027D0** **#6029D0**
50	0	0	0	0
100	0	0	0	1
110	0	0	1	0
150	0	0	1	1
200	0	1	0	0
300	0	1	0	1
600	0	1	1	0
1200	0	1	1	1
2400	1	0	0	0
4800	1	0	0	1
9600	1	0	1	0

E. Setting Stop Bit

INPUT	**#6027D4**	= 1 : Stop bit as 2 bits
OUTPUT	**#6029D4**	= 0 : Stop bit as 1 bit

F. Setting Control Code Sending

INPUT	**#6027D5**	= 1 : Does NOT send control code
OUTPUT	**#6029D5**	= 0 : Sends control code.

NOTES:

1. Set the baud rate and stop bit length according to the specifications of the input/output equipment to be used.

2. The start and stop signals to be sent from the NC to the input/output equipment after pressing IN, VER, or OUT key are called 'control codes'

If the specifications of the input/output equipment do not allow the acceptance of the control codes, set the parameter for the control code transmission designation to 1 (not send).

In this case, it is necessary to press IN, VER or OUT key on the NC side then start/stop the input/output equipment manually.

Refer to *Chapter 6 – Fanuc Software Installation.*
Sections 6.4 onwards are applicable

OPTICAL RETROFIT	**Kit A-4014-0013** **Disk A-4014-0014**
Yasnac I80M80 Matsuura Inspection Software (FX5 FXH45).	
NOTES G codes assigned to macros are shown in the Yasnac G code table (6.6) of the Installation Manual. Refer to the M80 parameter listing. Full descriptions will be found in the Yasnac Manual.	
Skip diagnostic #1443 bit 1 0 probe seated - when fitted 1 probe deflected - when fitted Skip connections will be found on connector CN26 board, FC230 and FC260 pin numbers are shown in connection diagram 7.5	

7.8.3 Loading the Tape

The tape has been prepared to allow for a continuous load of all the macro programs.

a. Connect peripheral device to RS232 port

b. Select PROGFUNCTION.

c. Press the [IN/OUT] SOFTKEY.

d. Move cursor down to [ALL]

e. Press [WR] KEY.

f. Press [Y] KEY.

7.9 M80 Parameter List

PARAMETER No.	DATA TABLE							
	7	6	5	4	3	2	1	0
3005				0				

Permit multiple macro registration into memory (M02, M30, M99 codes)

	7	6	5	4	3	2	1	0
0022								0

Permit editing of programs 9000–9999

	7	6	5	4	3	2	1	0
0022								1

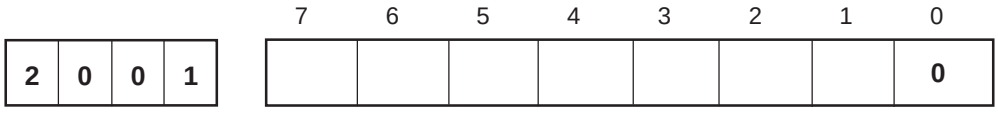
Protect programs 9000–9999

	7	6	5	4	3	2	1	0
0007						1		

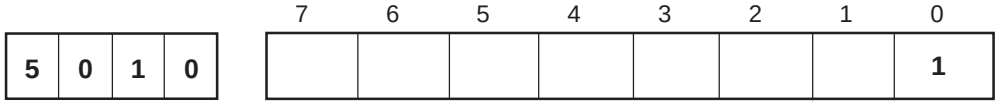
The next block is executed if there is no skip signal input (Set 0 causes 087 alarm)

	7	6	5	4	3	2	1	0
4009							1	

Does not clear common variables (advise only)

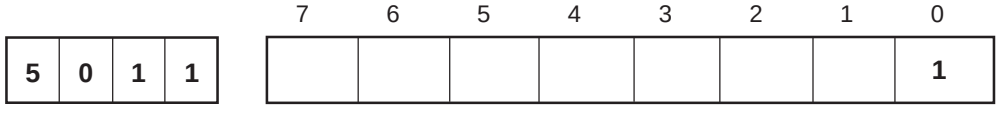


F code command for skip (G31)

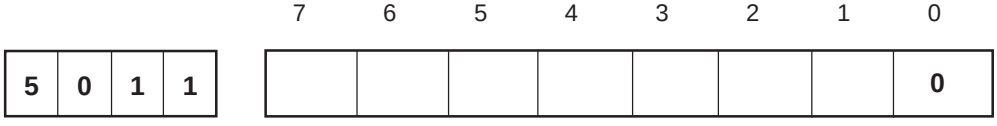


Enable the control circuit of skip input for skip function

NOTE: Parameters #2001, #5010 – setting is essential.

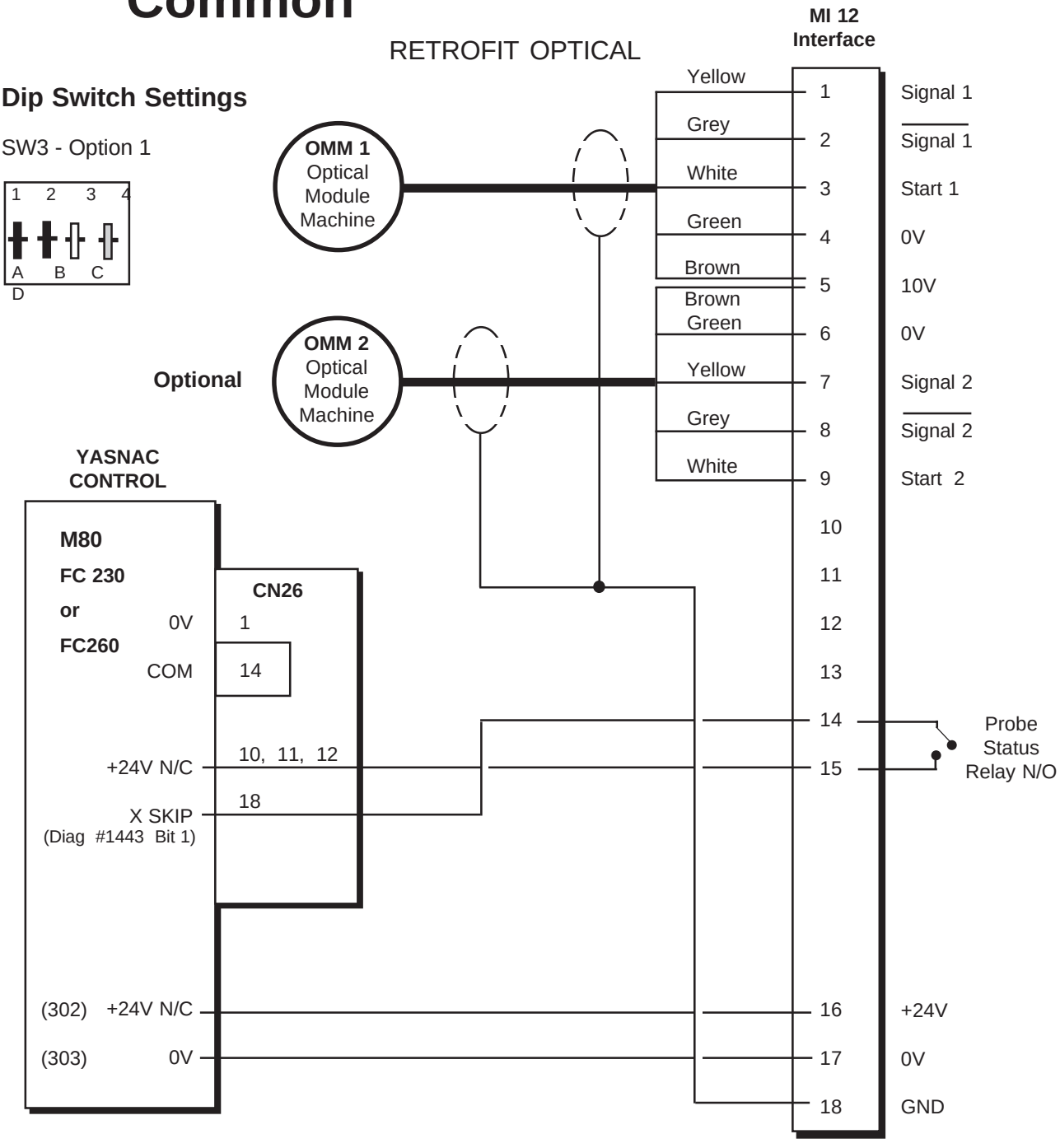


1st skip on rising edge signal



1st skip on falling edge signal

7.10 MI 12 Interface to Yasnac/Matsuura M80 Control – Skip Signal 24V Common



Chapter 8

Mazak Installation

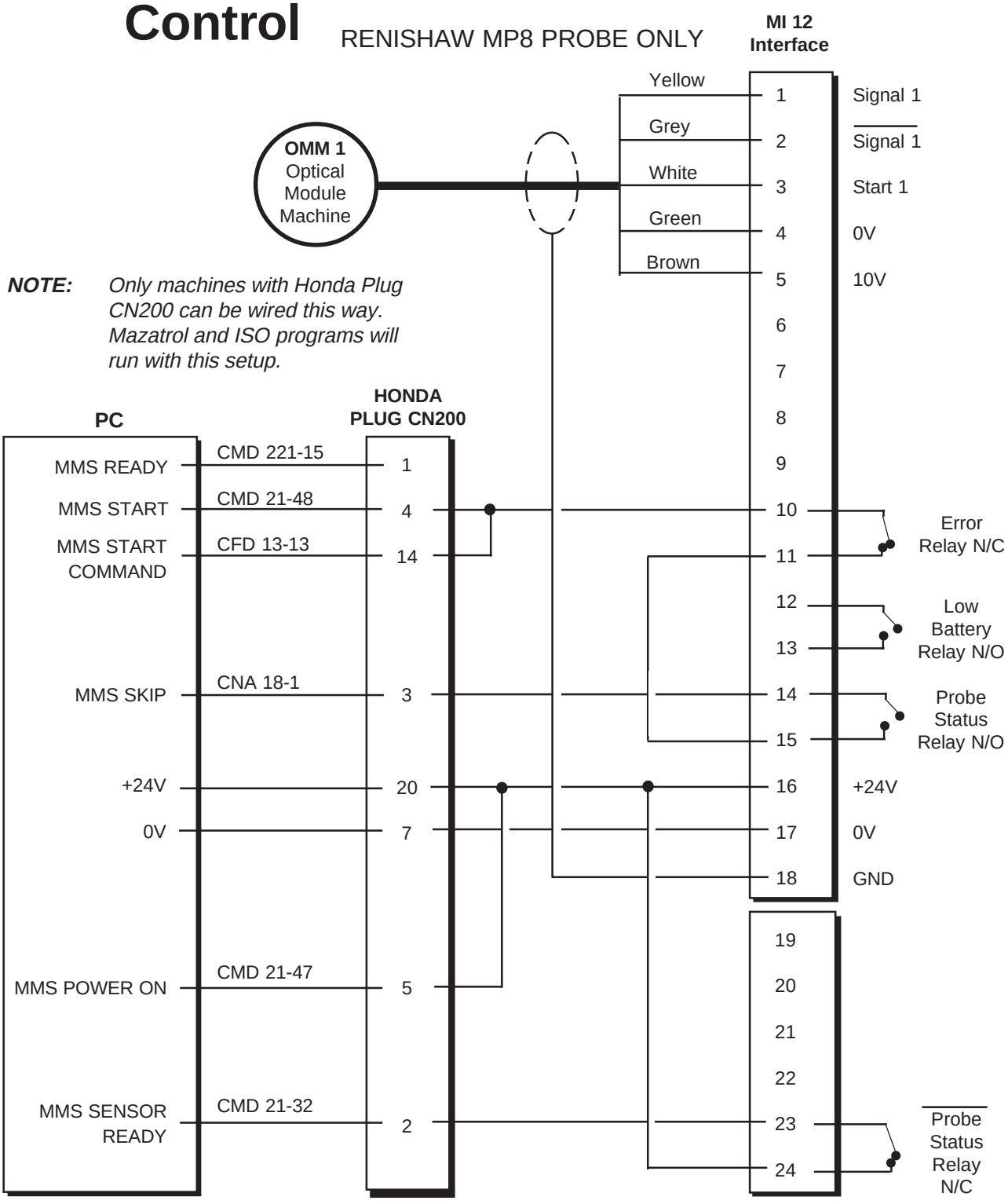
Renishaw provide software packages for machines fitted with a Mazak controller type M32.

This chapter describes how to connect the Renishaw interface to these controllers in readiness for installing the software and then covers installing the software.

Contained in this Chapter

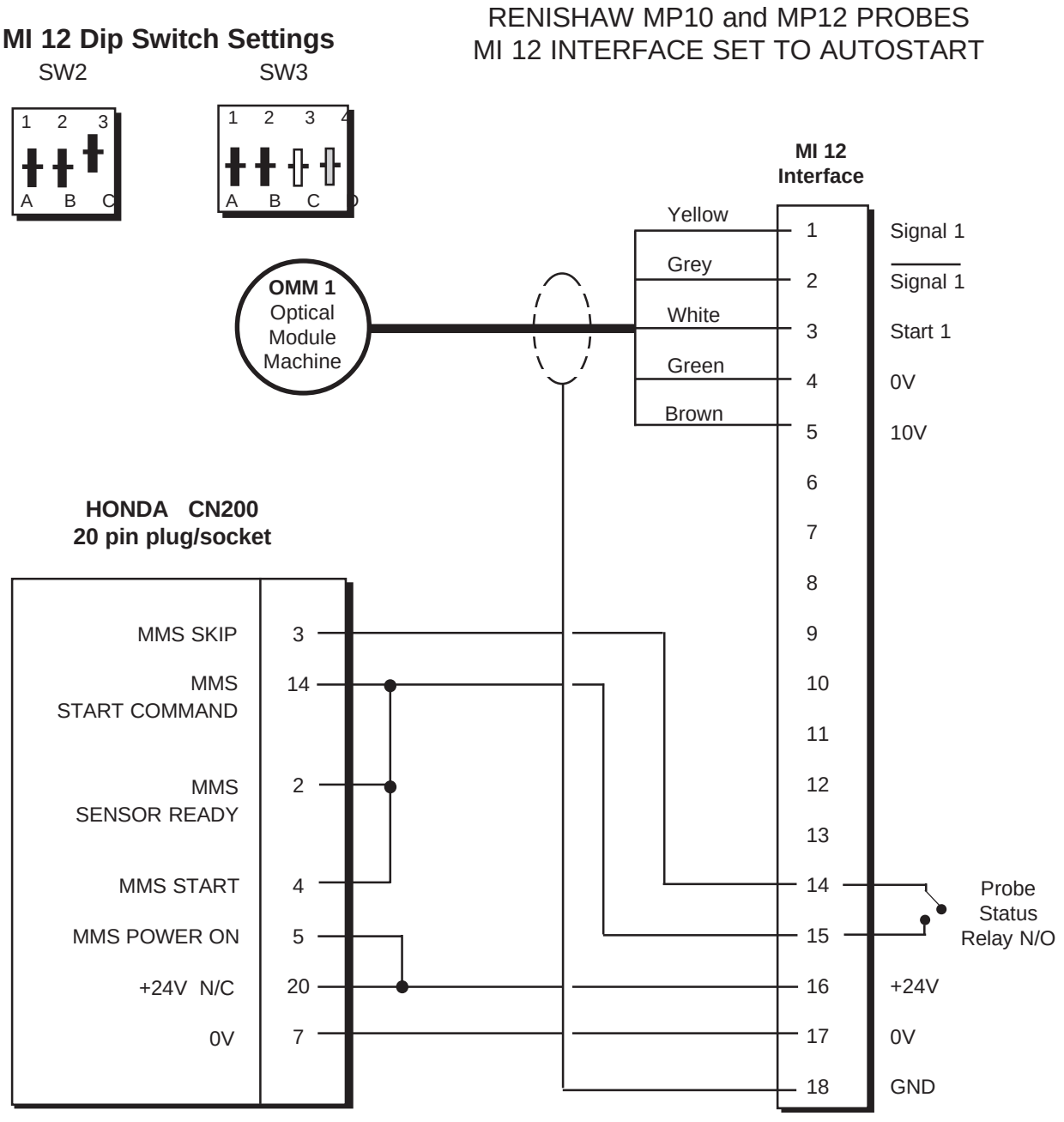
8.1 MI 12 Interface to Mazatrol CAM M2 Control

RENISHAW MP8 PROBE ONLY



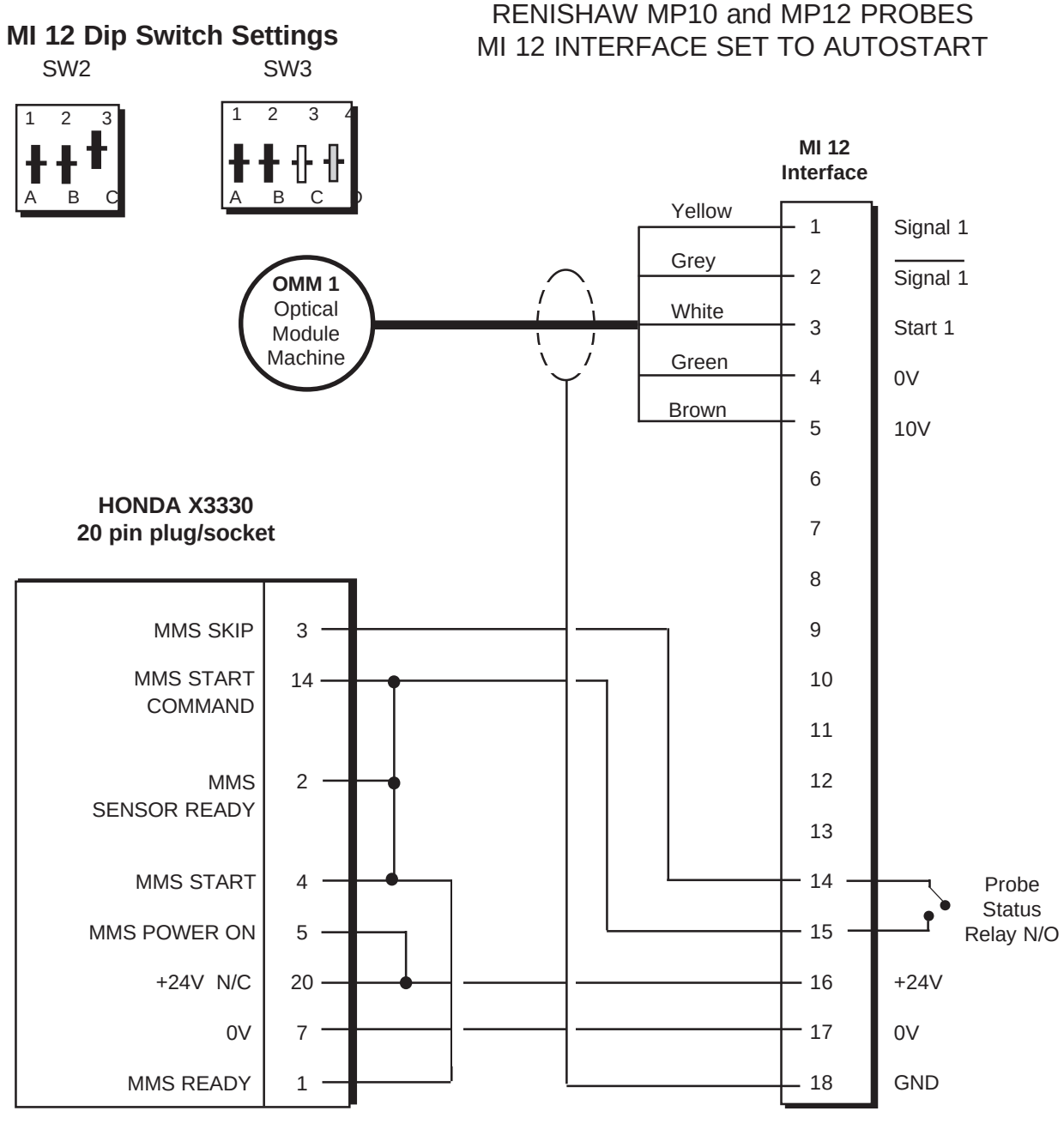
NOTE: *Only machines with Honda Plug CN200 can be wired this way. Mazatrol and ISO programs will run with this setup.*

8.2 MI 12 Interface on Mazatrol M32 - Connector CN200



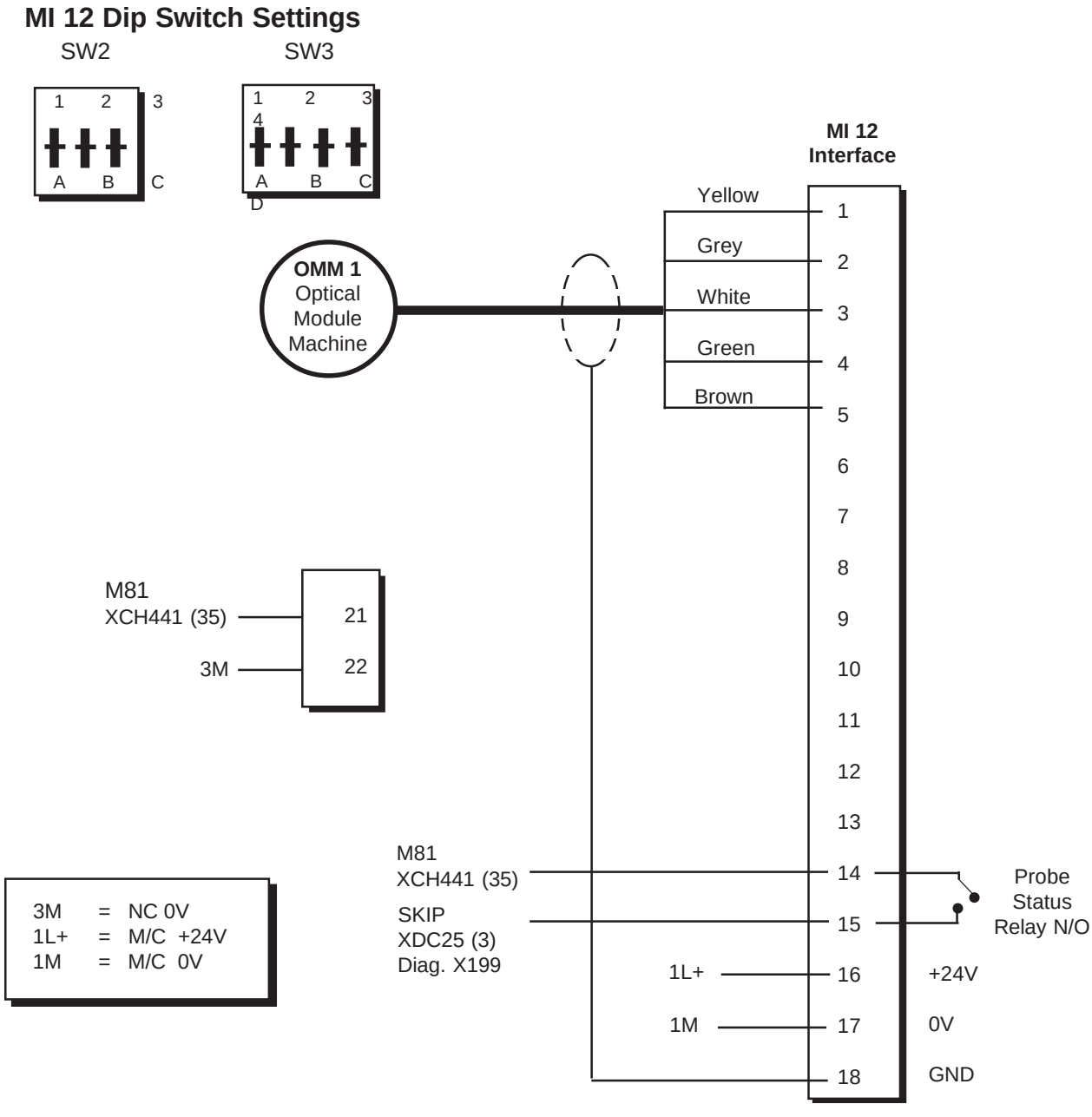
NOTE: *These connections for use with standard Mazatrol MMS Menu Cycles and ISO programming option using Renishaw software* ***(G31 Skip).***

8.3 MI 12 Interface on Mazatrol M32 - Connector X3330



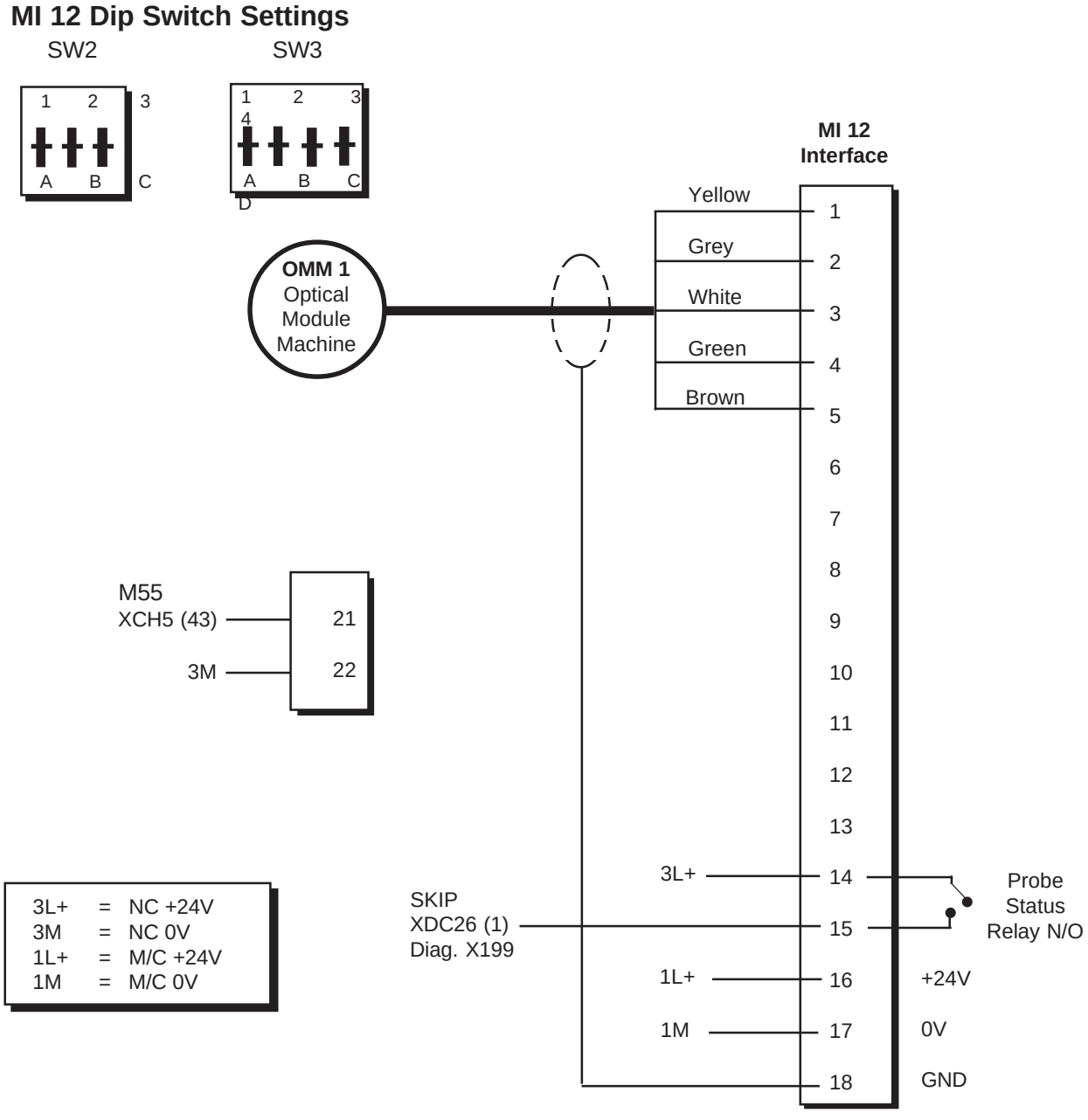
NOTE: *These connections for use with standard Mazatrol MMS Menu Cycles and ISO programming option using Renishaw software* ***(G31 Skip).***

8.4 MI 12 Interface on Mazatrol T-Plus Control (Y-Axis Machines Only)



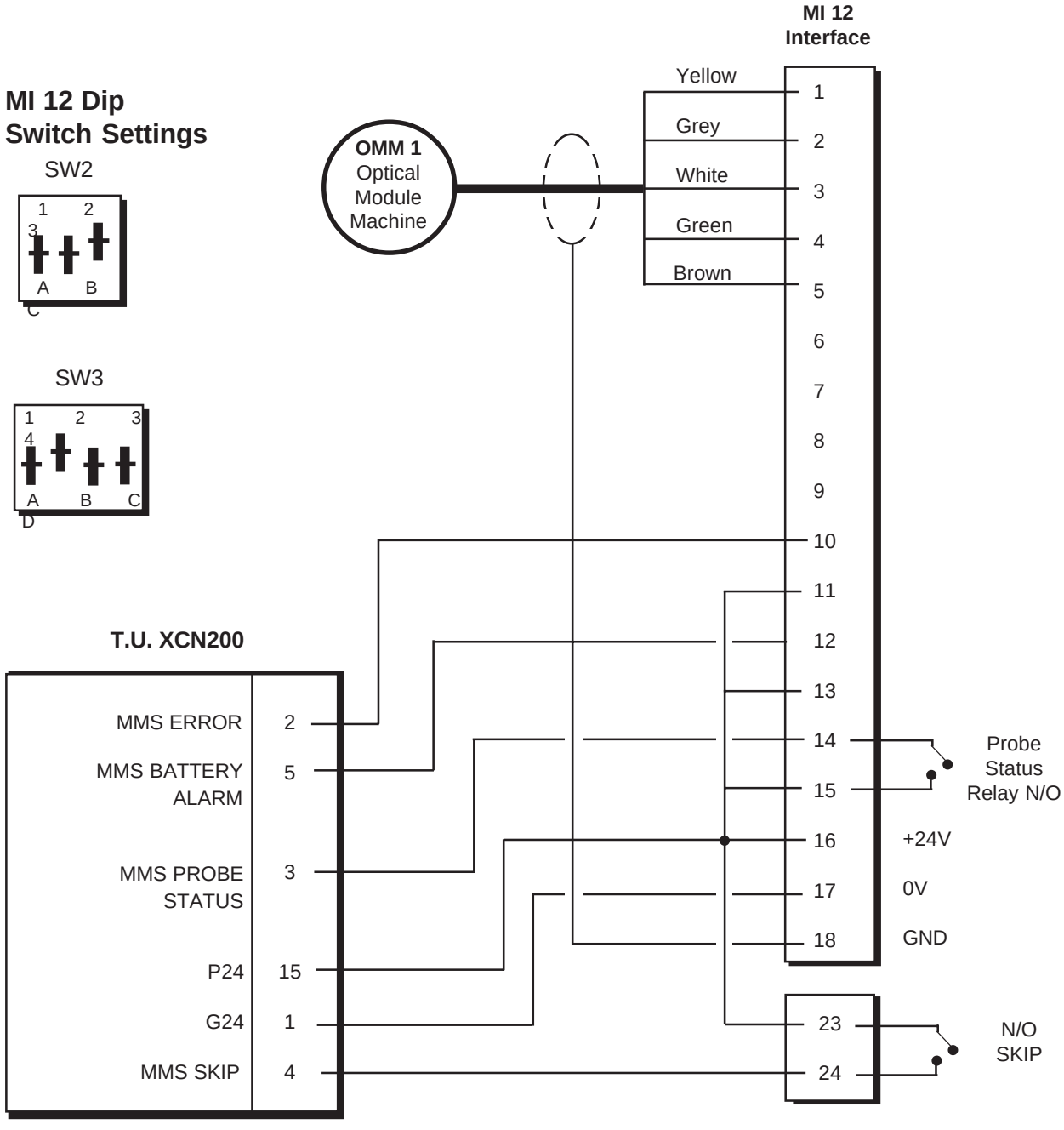
NOTE: *M81 is output by the Mazatrol measuring software. After 'SENSOR EDGE' is called into the working station, M82 cancels M81 after probing or a reset.*

8.5 MI 12 Interface on Mazatrol T-Plus Control and T32 without Y-Axis



NOTE: *To switch system on, a manual tool change followed by an M55 is required.*

8.6 MI 12 Interface on Mazatrol M32B Amber Control (Mazak Connection for MI12)



NOTE: *Only late versions of the amber screen have this wiring. Check Mazak wiring book. If not as above, use standard M32 wiring.*

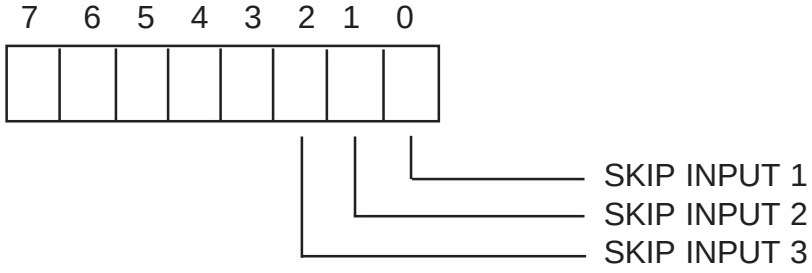
8.7 Control Settings – Mazatrol

	M32 Control Variable Locations	M32 Control Initial Settings	M2 Control Variable Locations	M2 Control Initial Settings
X Axis error in Centre-line Offset	L1	0	TS1	0
Y Axis error in Centre-line Offset	L2	0	TS2	0
X Axis Ball Radius	L3	0	TS3	0
Y Axis Ball Radius	L4	0	TS4	0
Maximum amount of Skip Move	L8	300000	TS5	30000
Skip Feedrate	K41	120	TS6	40
	Diagnostic Location		**Diagnostic Location**	
Diagnostic MMS Ready	X61		HOC-1	
Diagnostic MMS Start	X63		HOC-3	
Diagnostic MMS Start Command	Y2B		H46-6	
Diagnostic MMS Skip	X178		HO7-7	
Diagnostic MMS Sensor Ready	X62		HOC-2	
Diagnostic Power on	X60		HOC-0	

NOTE: L8, K41, TS5 and TS6 are shown in mm.
CAM-M2 works to three decimal places in mm.
M32 works to four decimal places in mm.

8.7.1 Control Setting Mazatrol M32

K73 G4 SKIP CONDITION



Set as shown above.

If a ‘1’ is input into K73.0 and Skip input 1 is high (probe triggered), G4 dwell will not work. It will be skipped.

G Code Parameters

Call Type
0 = M98
1 = G65
2 = G66
3 = G66.1

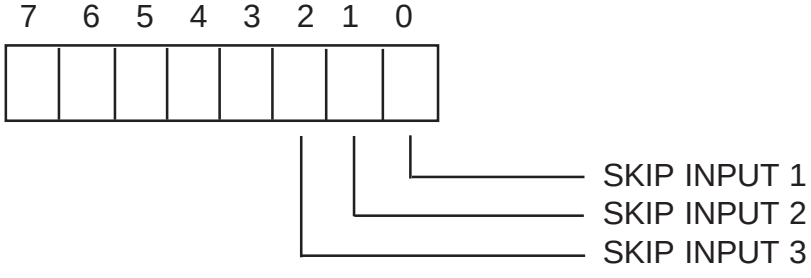
Program No.	G Code No.	Type of Call	Invalid
J1	J2	J3	J4
J5	J6	J7	J8
J9	J10	J11	J12
J13	J14	J15	J16
J17	J18	J19	J20
J21	J22	J23	J24
J25	J26	J27	J28
J29	J30	J31	J32
J33	J34	J35	J36
J37	J38	J39	J40

M Code Parameters

Call Type
0 = M98
1 = G65
2 = G66
3 = G66.1

Program No.	M Code No.	Type of Call	Invalid
J41	J42	J43	J44
J45	J46	J47	J48
J49	J50	J51	J52
J53	J54	J55	J56
J57	J58	J59	J60
J61	J62	J63	J64
J65	J66	J67	J68
J69	J70	J71	J72
J73	J74	J75	J76
J77	J78	J79	J80

K69 G31.1 SKIP CONDITIONS



Set as shown above.

If G31/G31.1 is moving the machine and input 1 goes high, the machine will stop.

K70 and K71 are for G31.2 and G31.3, which are used by the Mazak tool eye (tool length setter).

8.8 Parameters – Mazatrol (M32)

Promoter	Value	Description
G19	1	Baud rate (9600)
G20	3	Number of stop bits (9)
G21	0	Parity (even)
G22	0	Parity check (no check)
G23	3	Data bits (8: N.B. includes parity)
G27	1	Carriage return (LF only)
G29	3	Handshaking (software)
G30	1	Parity bit (assignment)
G31	76	Punch pattern (see User Manual)
G32	13	Punch pattern (see User Manual)
G33	109	Punch pattern (see User Manual)
G34	122	(see User Manual)
G35	91	(see User Manual)
G36	70	(see User Manual)
G37	26	(see User Manual)
G38	74	(see User Manual)
G39	30	Rewind code
G42	50	Wait limit
G43	0000000	ISO codes
G44	10	(see User Manual)
G45	30	(see User Manual)
G47	1	Program end code
G48	0	No rewind function
G49	0	No % at program end
G50	00000111	Program end code

8.9 Loading the Software

Load software using the following procedure:

1. On the Mazak
   Select DATA I/O from menu
   Select TAPE I/O
   Select LOAD ALL TAPE - NC
   Press START
   DATA I/O BUSY is displayed on the screen.

2. On the PC
   Send the software

Chapter 9

Tosnuc 600M/800M Installation

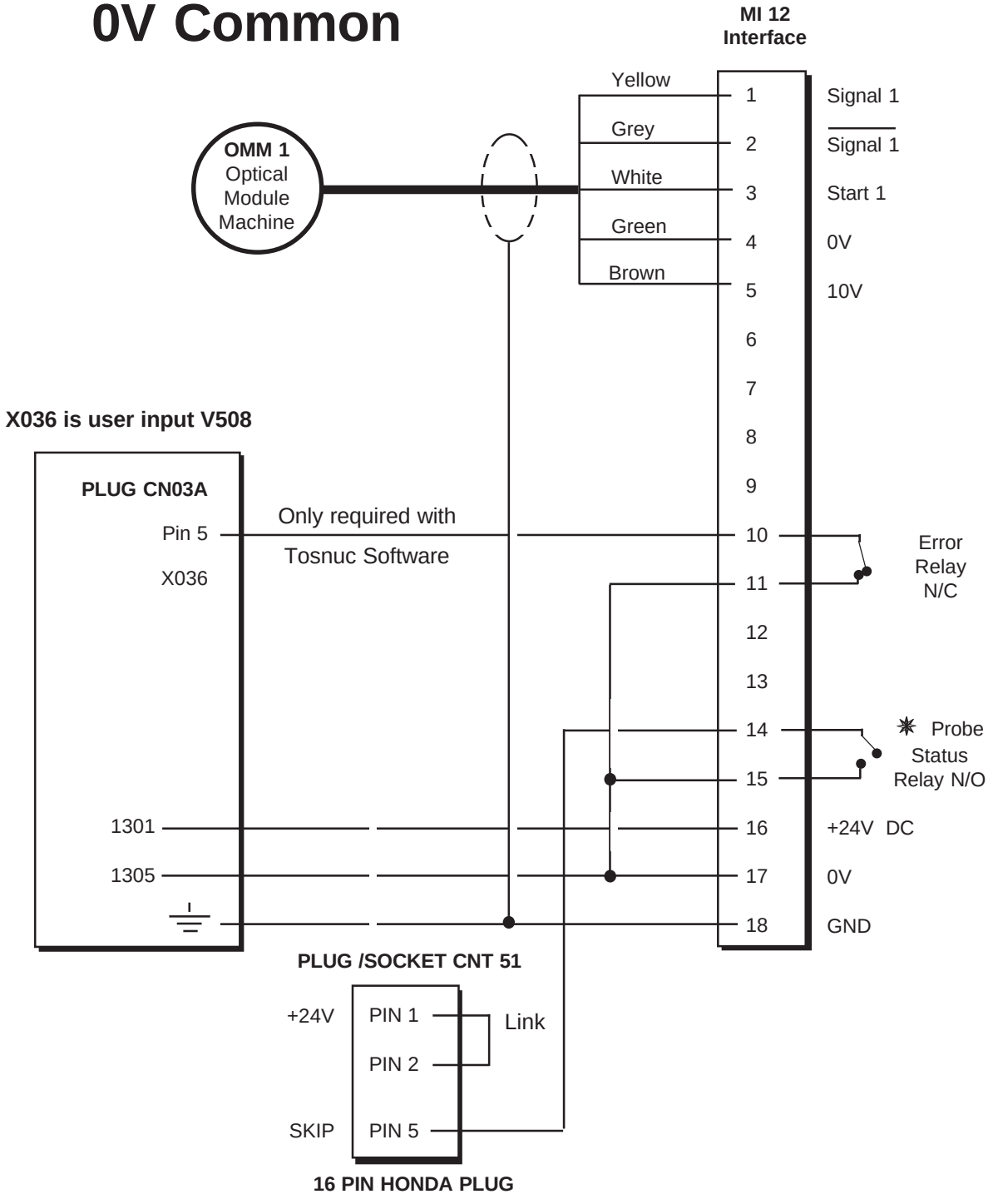
Renishaw provide software packages for machines fitted with following Tosnuc controller types.

- 600M, 800M

This chapter describes how to connect the Renishaw interface to these controllers in readiness for installing the software.

Contained in this Chapter

9.1 MI 12 Interface Connection to Tosnuc 800M Control – Skip Signal 0V Common



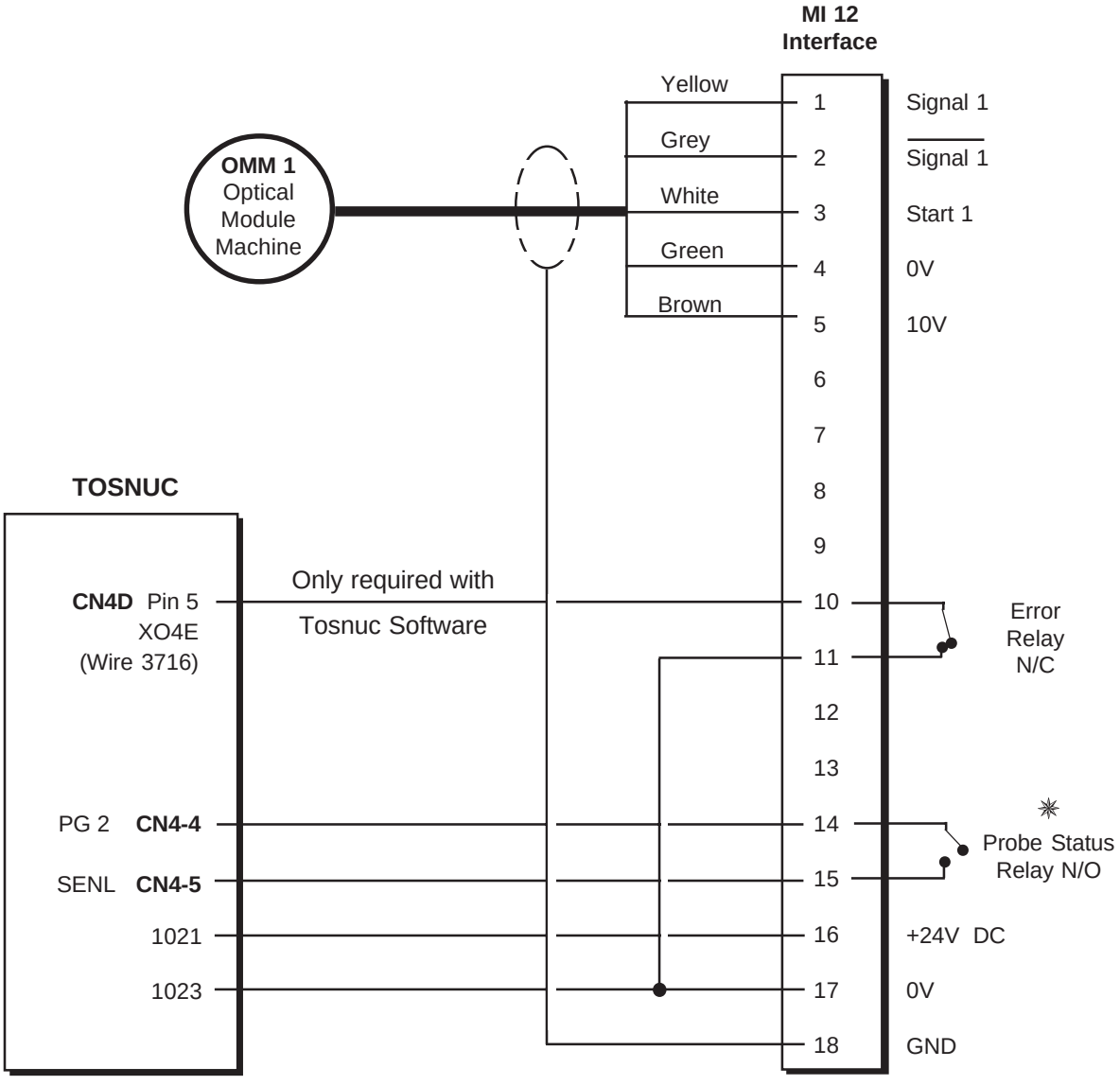
NOTES:

1. ***There is not a diagnostic for skip, however there is a 'Touch Sensor' light on the operator panel.***
   Light on – probe triggered
   Light off – probe seated.

2. ***For Tosnuc software a link is necessary from the Error Relay to Plug CN03A Pin 5.***

3. ✳ ***denotes that, alternatively terminals 23 and 24 can be used in conjunction with switch SW3 :***
   (see MP12 - MI 12 User Book)

9.2 MI 12 Interface Connection to Tosnuc 600M Control



X04E is user input V508

Tosnuc software looks at a user input, therefore connection is required to the Error Relay.

To access the Skip Diagnostic press the following:

1. M/C MODAL
2. Page 3
3. SKIP

✳
Alternatively terminals 23 and 24 can be used in conjunction with switch SW3 (see MP12 - MI 12 Users Guide).

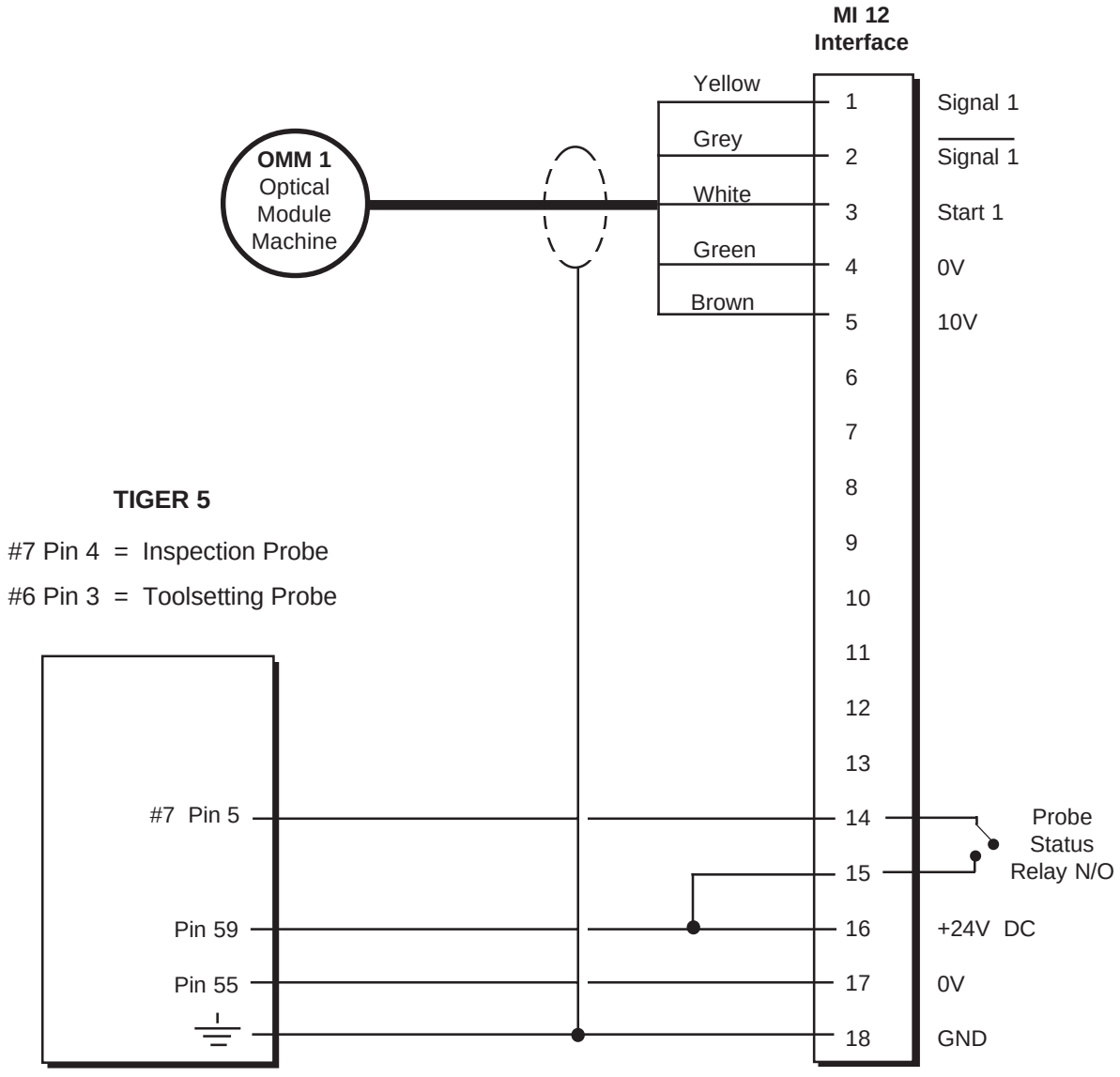
Chapter 10

Sharnoa Tiger 5 Installation

Renishaw provide software packages for machines fitted with Sharnoa Tiger 5 controllers. This chapter describes how to connect the Renishaw interface to this controller in readiness for installing the software.

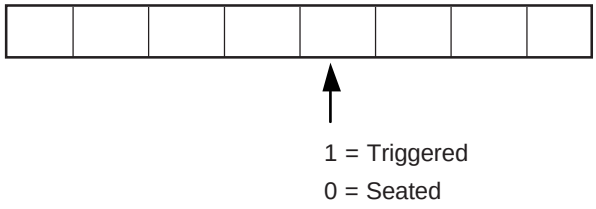
Contained in this Chapter

10.1 MI 12 Interface Connection – Skip Signal 24V Common

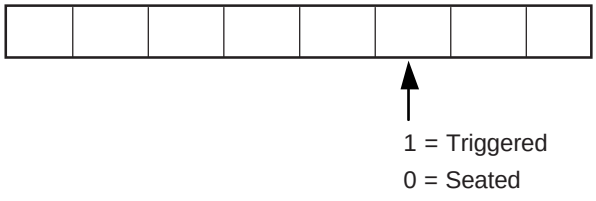


INPUT/OUT PORT DIAGNOSTIC

Inspection Probe #7



Toolsetting Probe#6



Chapter 11

Meldas Installation

Renishaw provide software packages for machines fitted with following Meldas controller types.

- M3, M310, M320, M330, M335, M520

This chapter provides useful information that will assist you in installing the software on these controllers.

Contained in this Chapter

11.1 Meldas Diagnostic and Location Chart

This reference chart is intended to show useful diagnostic and location details. Full details will be found in the relevant Meldas connection manual.

It is important to study the machine tool builders documentation and connection diagrams before any installation is made.

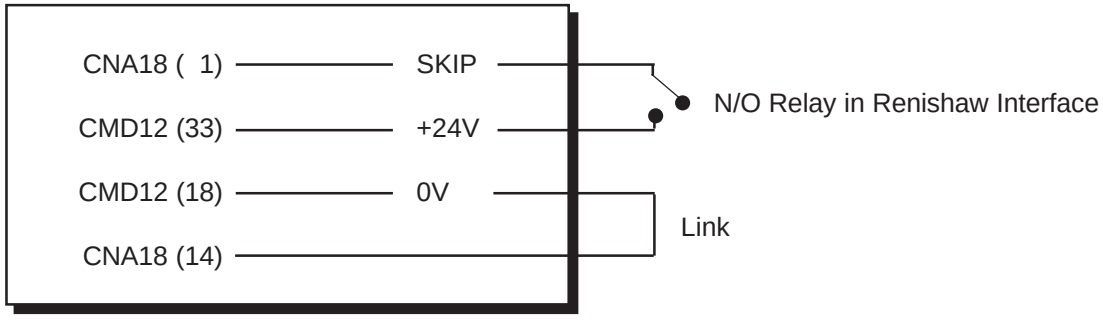
Control Type	G31	Diagnostic	G31.2	Diagnostic	G31.3	Diagnostic	G31.4	Diagnostic
M3	CNA 18 Pin 1	X178	CNA 18 Pin 2	X179	CNA 18 Pin 5	X17A	CNA 18 Pin 6	X17B
* **M310**	CMD 11 Pin 6							
M320	CNA 18 Pin 1	X178	CNA 18 Pin 2	X179	CNA 18 Pin 5	X17A	CNA 18 Pin 6	X17B
M330	CNA 18 Pin 1	X178	CNA 18 Pin 2	X179	CNA 18 Pin 5	X17A	CNA 18 Pin 6	X17B
M335	CNA 18 Pin 1	X178	CNA 18 Pin 2	X179	CNA 18 Pin 5	X17A	CNA 18 Pin 6	X17B
M520	CDP 51 Pin 2	X178	CDP 51 Pin 10	X179	CDP 51 Pin 3	X17A	CDP51 Pin 11	X17B

NOTES:

* ***1. The M310 control has no diagnostic for skip, the skip signal only works on an edge.***

2. OEM style software should be used. It requires both skip and user input connections.

3. M3, M320 and M335 controls may require a 0V supply – CNA18 (14) – to create a +24V common skip signal. See Chapter 4 – Fanuc Diagnostic and Location Chart and High Speed Skip, section 4.1.1



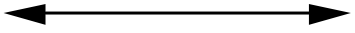
4. M520 controls require a +24V supply input to the Skip inputs. This +24V supply must be from the power supply that supplies 0V to pins 1 and 9 in CDP51.

11.2 Meldas Loading Software M3

MELDAS M3 I/O PARAMETER 8

PAGE 1/5		**Port**	**Device**	
#1	Data in	1	0	FD
#2	Data out	1	0	FD
#3	NC Running	1	0	FD
#4	Macro print	1	0	FD
#5	PLC in/out	1	0	FD
#6	Computer link	1	0	FD
#7	Robot I/F	1	0	FD

PAGE 2/5		**< 0 >**
#1	Device name	FD
#2	**Baud rate**	2
#3	Stop bits	3
#4	Parity effective	0
#5	Even parity	0
#6	CHR. length	3
#7	Terminator type	0
#8	Code 1	00
#9	Code 2	00
#10	Rewind code	00
#11	Handshake	3
#12	DC code parity	1



Baud Rate
1 = 9600
2 = 4800
3 = 2400
4 = 1200
5 = 600
6 = 300
7 = 110

PAGE 3/5 **< 0 >**

#1	DC2 / DC4 output	3
#2	CR output	1
#3	EIA output	0
#4	Title feed out	0
#5	Feed CHR.	200
#6	Parity V	0
#7	Time-out set	200
#8	Data ASCII	0

PAGE 4/5
All set to 0

PAGE 5/5
#1 Port No. 1

All other settings 0

To allow loading and editing of programs 9000–9999, edit lock B must be switched off in the 'Control' Parameters.

On the I/O page (not parameter page), set the following :

#11	Port	No. 1
#12	Device	No. 0

To output all programs type ‘ALL’ into the program number box.

The installation and use of software requires the setting of machine parameters. See section *11.3 – Meldas Control Parameters (M310, M3, M320, M330, M335, M520)* along with the Meldas operators manual.

11.3 Meldas Control Parameters (M3, M310, M320, M330, M335, M520)

To Unlock parameters

Press ‘DIAGN’ mode select.
Press ‘PLC-IF’ soft key.

Set ‘1001’ in DEVICE ( )
Leave DATA ( ) blank
Set "M" in MODE ( ), then ‘INPUT’

To Lock Parameters

Press ‘DIAGN’ mode select.
Press ‘PLC-IF’ soft key.

Set ‘1001’ in DEVICE ( )
Leave DATA ( ) blank
Set ‘U’ in MODE ( ), then ‘INPUT’

Base Specification Parameters 3/4

#7. edlk_c Edit lock C, 0 = off, 1 = on
9000 – 9999 programs are locked.

Base Specification Parameters 4/4

#1. dwlskp G04 Skip condition.
If a Skip input is 'HIGH' (triggered G04) dwell is not performed.

0 = G04 dwell as per normal
1 = If the first input is "HIGH" skip G04
2 = If the second input is "HIGH" skip G04
3 = If the third input is "HIGH" skip G04

#2. Skip 1 (G31.1)
#4. Skip 2 (G31.2)
#6. Skip 3 (G31.3)

These parameters select which input each G31 will look at for trigger. Set the table below:

Setting	PLC Interface Input Signal		
	Skip 3	Skip 2	Skip 1
0	x	x	x
1	x	x	0
2	x	0	x
3	x	0	0
4	0	x	x
5	0	x	0
6	0	0	x
7	0	0	0

Normal setting:
#2 = 1
#4 = 2
#6 = 4

Base Specification Parameters

#10 skip	G31 skip speed Selects G31 feedrate if not programmed.

Base Specification Parameters 4/4

#3 skip1	G31.1 skip speed
#5 skip2	G31.2 skip speed
#7 skip3	G31.3 skip speed
	Select multi-channel skip feedrate if not programmed.

Macro File Parameters 1/2

Selecting "M" codes to call programs.

#	<CODE>	<TYPE>	<PROGRAM-NO.>
1 M[01]	1234	0	123456768
10 M[10]			

CODE.	‘M’ code number required to call program (1–9999)
TYPE.	0 = M98, 1 = G65
PROGRAM NO.	Between 1 and 99999999

Macro File Parameters 2/2

Selecting ‘G’ codes to call programs.

#		<CODE>	<TYPE>	<PROGRAM-NO.>
1	G[01]	123	1	123456768
10	G[10]			

CODE.	‘G’ code number required to call program (1–255)
TYPE.	0 = M98, 1 = G65
PROGRAM-NO.	Between 1 and 99999999

Control Parameters

These do not require the unlocking of parameters to change them. Go to ‘CONTROL’ on the soft keys.

#3 MACRO SINGLE	ON	Control stops on every block in single block including macro statements.
	OFF	Does not stop on macro statements in single block.
#40 EDIT LOCK B	ON	Program numbers 8000 to 9999 cannot be edited.
	OFF	Program numbers 8000 to 9999 can be edited.
#47 COM-VAR RST CL	ON	When the control in RESET #100 – #149 are set to vacant.
	OFF	#100 – #149 are retained on RESET.
#48 COM-VAR PWR CL	ON	When power is removed from the control, #100 – #149 are set to vacant.
	OFF	When power is removed from the control, #100 – #149 are retained.

Chapter 12

Fadal CNC 88/32MP Installation

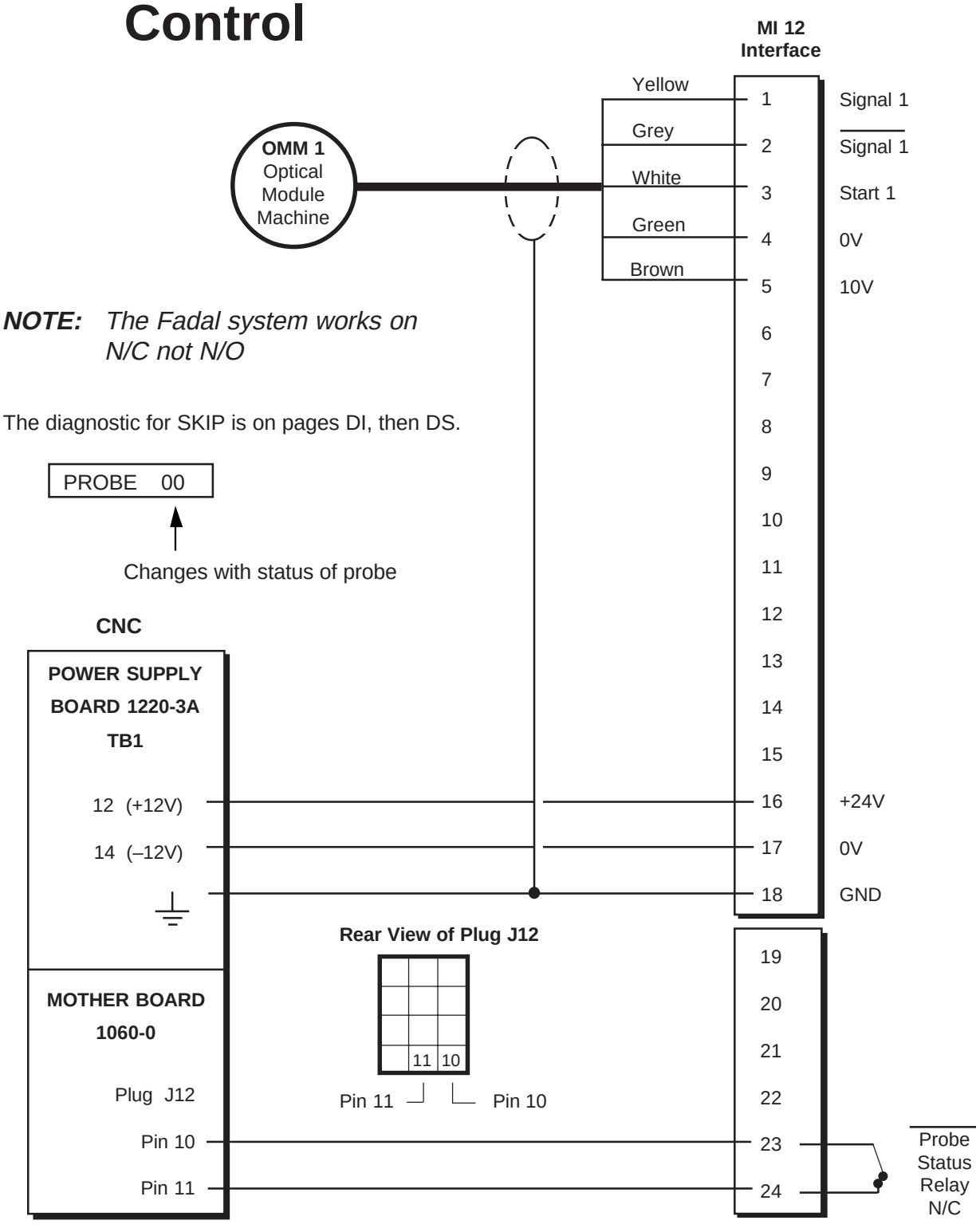
Renishaw provide software packages for machines fitted with following Fadal controller types.

- CNC88, MP32

This chapter describes how to connect the Renishaw interfaces to these controllers in readiness for installing the software.

Contained in this Chapter

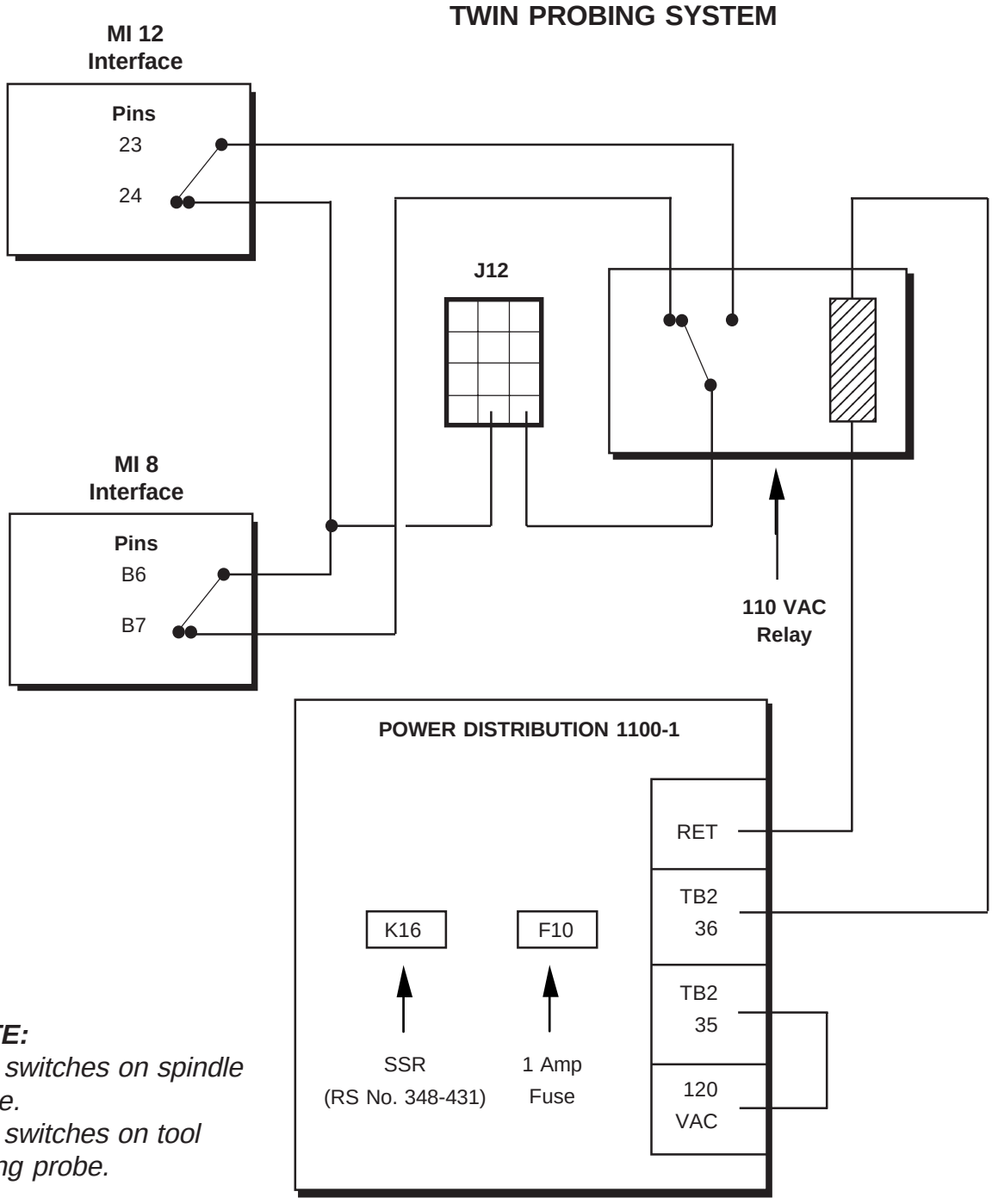
12.1 MI 12 Interface to Fadal CNC 88 Control



NOTE: *The Fadal system works on N/C not N/O*

The diagnostic for SKIP is on pages DI, then DS.

12.2 MI 12 Interface to Fadal CNC 88 Control



NOTE:
M64 switches on spindle probe.
M65 switches on tool setting probe.

Chapter 13

Okuma Machining Centres Installation

Renishaw provide software packages for machines fitted with following Okuma controller type.

- OSP5020

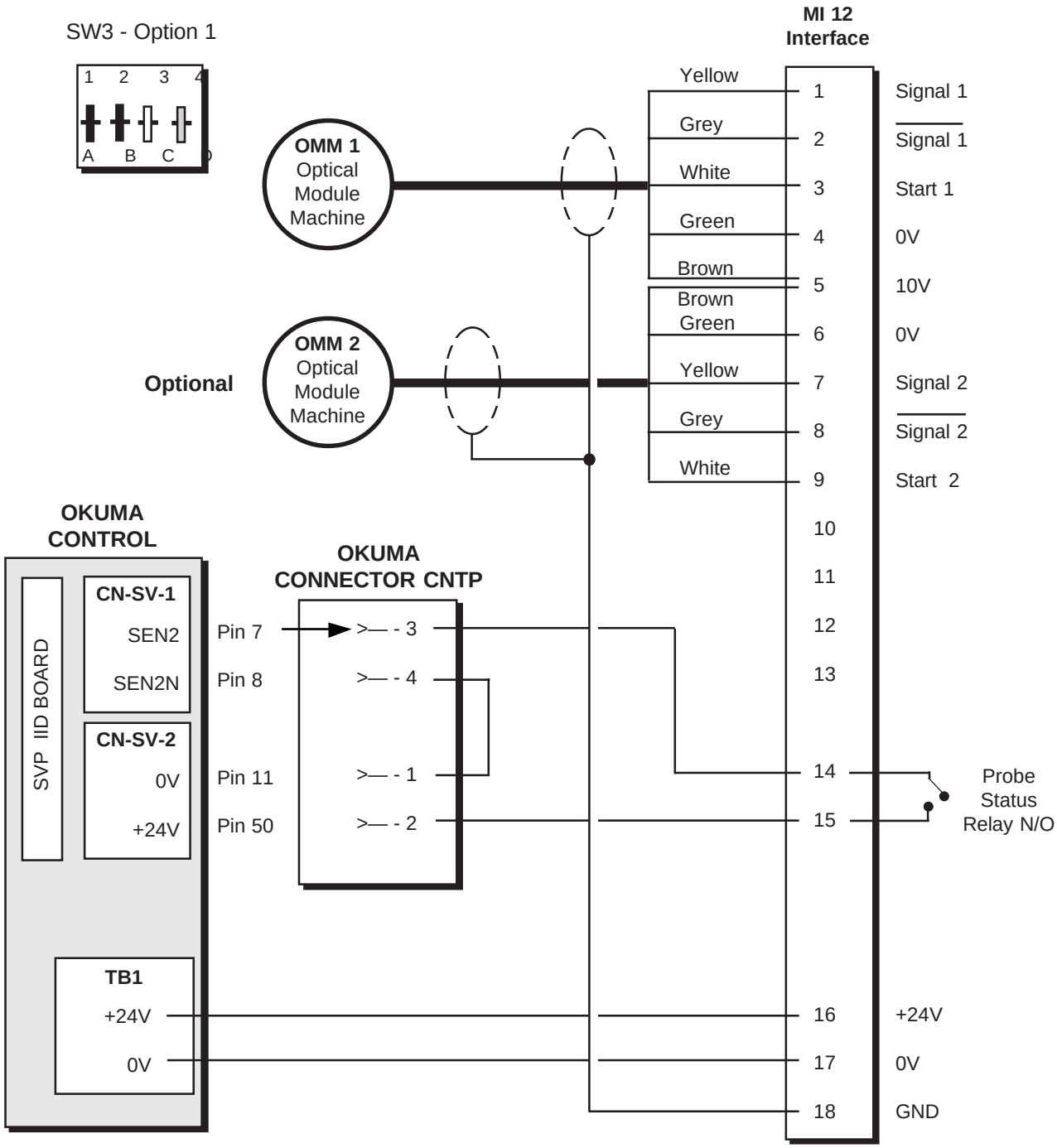
This chapter describes how to connect the Renishaw interfaces to this controller in readiness for installing the software.

Contained in this Chapter

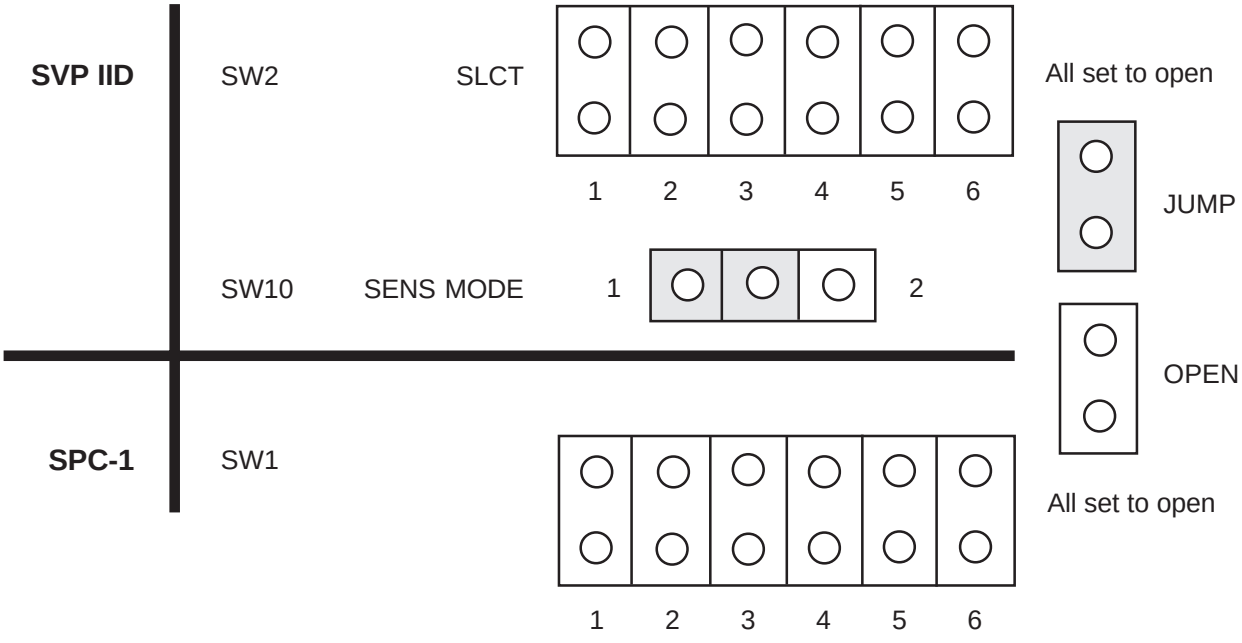
13.1 MI 12 Interface to Okuma Control

SPECIFIC DATA FOR OKUMA MC40H, CONTROL OSP 5020L

Dip Switch Settings



13.2 Okuma SVP IID Board DIP Switch Settings



Dip switch settings are all preset

Glossary of Terms – Abbreviations and Definitions

Definitions of many of the terms used are provided here to assist your understanding of Renishaw probe systems software. Definitions of terms associated with probing which may not have been used in this publication are also included here.

ATAN calculation
This describes a *User Transparent* macro written by Renishaw to handle the ATAN function in mathematical calculations.

User Transparent
Macros which are used by the software but which do not get called directly by the user, i.e. they are for internal use by the software only.

BRDO
Ball Radius Directional Offsets. This is a term that is used to describe the stored software compensations for the stylus ball radius. They are determined during calibration of the probe.

Bore/Boss Measure
This is a Renishaw measuring cycle type definition.
Bore – is an internal-width feature measurement on a circle. Feature types consist of holes or bores.
Boss – this is an external-width feature measurement on a circle. Feature types consist of shafts, bosses, and spigots.

Calibration
This is the method of establishing the probe trigger point compensations. They include the probe and machine effects which the software must use to correct the results.

C.W.
Clockwise

C.C.W.
Counter-clockwise.

Datum, Datuming
This is the method used to establish a part feature reference point which is subsequently used for other measurement or machining operations. A datum defines any co-ordinate value as a reference position.

DPRNT
This is a Fanuc control command. It outputs ASCII data to the RS-232 port of the controller. It is used to output a part inspection report that is based on probe results.

DTI
Dial Test Indicator. This instrument is traditionally used for aligning vices and fixtures with respect to the machine axis.

Gauging Move
This describes the movement of the probe onto the surface with data capture active, i.e. it is a measurement move.

IMM
Inductive Module Machine. Together with the *IMP*, it forms part of the inductive transmission system that is used to transmit signals back to the machine tool controller. The IMM is part of the inductive coupling and is mounted on the machine. See also *IMP*.

IMP
Inductive Module Probe. Together with the *IMM*, it forms part of the inductive transmission system that is used to transmit signals back to the machine tool controller. The IMP is part of the inductive coupling and is mounted on the probe. See also *IMM*.

INHIBIT
This is a Renishaw interface input signal. It is used to either stop or inhibit the transmission of the probe signal to the machine controller.

MDI
Manual Data Input. This is a commonly used term on Fanuc controllers (and controllers that emulate the Fanuc). It means that operation of the machine is determined by data that is entered through the keyboard.

MMS Menu Cycles
Mazatrol Monitoring System. This is a standard Mazak probe option unit that is normally fitted as original equipment.

MI5 Interface
This is the Renishaw probe interface that is used to condition and control the probe signal to the machine tool.

M19 Spindle Orientation
This is the machine manufacturer's M-code function that instructs the machine spindle to rotate and orientate to a fixed position.

Nominal Surface Position
This is the expected surface position, or theoretical position. When used in relation to tolerances, it refers to the mid-position of the upper and lower limit of the surface.

O-M-I
Optical Module Interface. This is a combined optical receiver and machine interface unit that forms part of the Renishaw optical probe transmission system. The unit is mounted either on the guarding or some other suitable position where it is within the transmission envelope and range of the probe.

OMM
Optical Module Machine. This is part of the Renishaw optical probe transmission system. The unit is mounted either on the guarding or some other suitable position where it is within the transmission envelope and range of the probe.

OMP
Optical Module Probe. This is part of the Renishaw optical probe transmission system. The unit is mounted on the probe unit.

Optimisation Macro
This is part of the Renishaw software package. It is used to establish the optimum fast feed rates for probing and the optimum back-off distance.

PCD
Pitch Circle Diameter. This is a commonly used British term to mean a set of features placed in a circular pattern.

Probe Trigger Flag
This is a variable or diagnostic register which is set to a value when the probe is triggered.

Protected Positioning
This is a means of moving the probe from place to place while the probe trigger signal is monitored. In the event of an unexpected triggering signal, the machine axis is halted to prevent damage to the probe stylus.

PTR
Paper Tape Reader. This is the machine's interface which is used to load the stored part programs. It is now largely superseded by the use of floppy disk drives, external PCs, and the RS-232 serial interface.

RMM
Receiver Module Machine. This is part of the Renishaw radio probe transmission system. The unit is mounted either on the guarding or some other suitable position where it is within the transmission envelope and range of the probe.

RMP
Radio Module Probe. This is part of the Renishaw radio probe transmission system. The unit is mounted on the probe.

SPC
Statistical Process Control. Some Renishaw software packages contain a macro which uses a simple form of SPC to control tool offset update corrections in closed loop machining.

Stylus
This is the probe tip assembly that is used to trigger the probe on the tool during measurement.

SSR
Solid State Relay. The SSR Converter Terminal Block is a Renishaw hardware unit which is used to convert the signal from a signal conditioning module into an SRR output signal.

Tolerance Limits
These are the extreme upper and lower metal condition values from the nominal surface position.

Vector Cycle, Vector Measure / Calibration
This is a probe move, which move one or more machine axes simultaneously to approach the surface from the normal direction.

Vector Stylus Ball Radius Calibration
This is an extra set of probe stylus ball radius calibration values which must be determined when using vector cycles. They are the probe software compensation values required for probing in different directions.

Web Pocket Measure
This describes a Renishaw measuring cycle type definition.
Pocket – is an internal-width feature measurement. Feature types consist of slots, pockets, and internal recesses.
Web – is an external-width feature measurement. Feature types consist of blocks, plate widths, and upstanding keys.

Work Zero Point
This is a similar concept to *Datum.* It defines where the work co-ordinate system is set to zero. A datum can define any co-ordinate value as a reference position.

Workpiece Datum
This can be any workpiece feature or co-ordinate, which is chosen as a reference position.