RENISHAW METROLOGY LIMITED

PRELIMINARY USER GUIDE

FANUC OTA

TOOL SETTING SOFTWARE

H/2000/6016

INDUCTIVE COMPATIBLE

This document covers:-
Kit A/4012/0475) Type 1
Tape A/4012/0476) Retrofit package
see appendix for details

This document covers:-
Inductive kit A/4012/0464

19.01.88

Part of N/4012/0463
Tape No. A/4012/0463

CONTENTS

Requirements

1. This software is to be installed on the Fanuc OTA Control.

2.1 Information signals are required.
UI0 only for the FI5 interface.

2.2 U014 and U015 when inspection software is to be installed with Renishaw Tool Setting Software. They are used for interface inhibit signals.

3. The software cycles described in this document are intended for the inductive (FI5).

4. Memory Capacity Utilised

Inductive System 7.5 metres approximately.

5. User macro A.

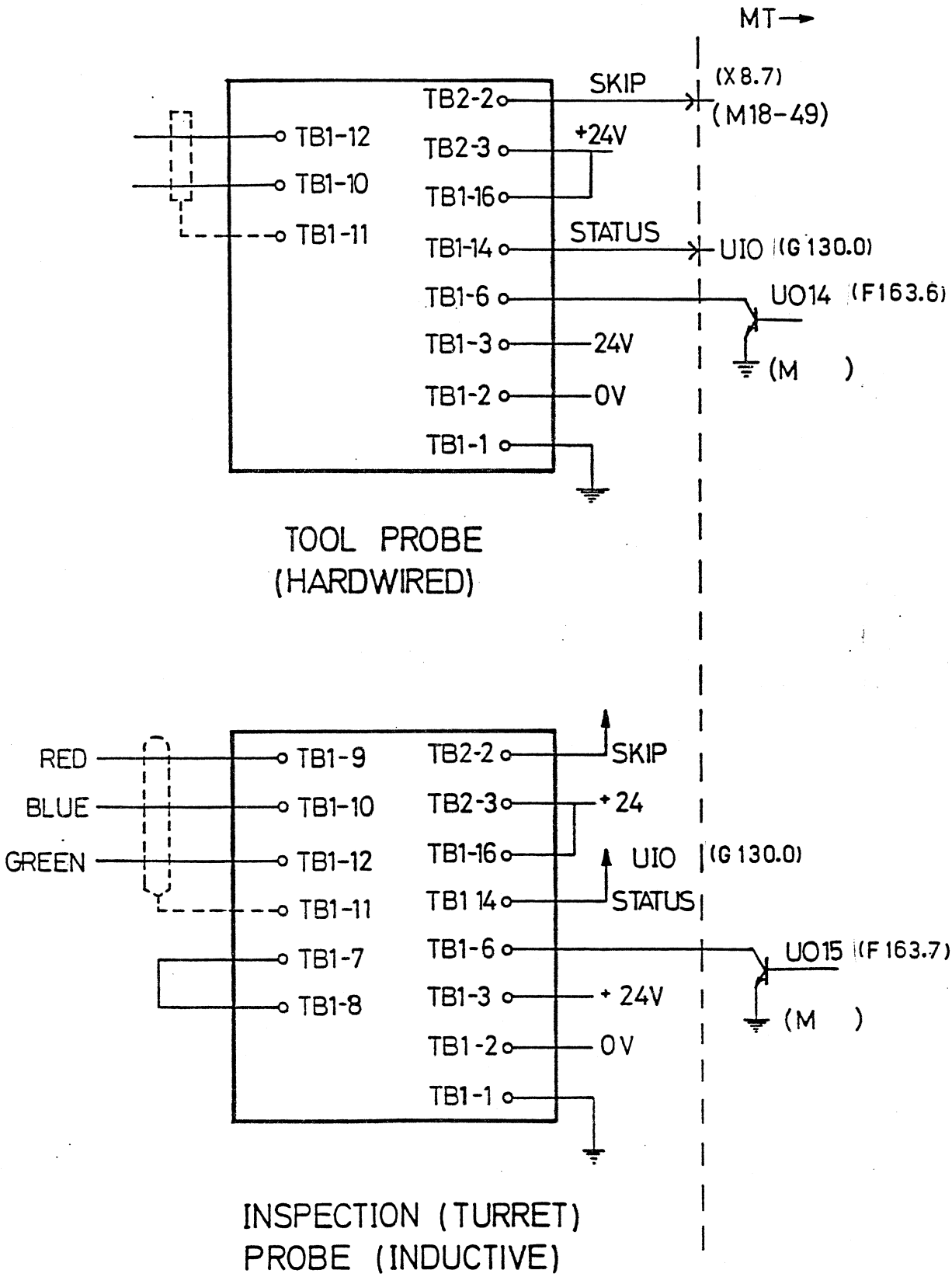
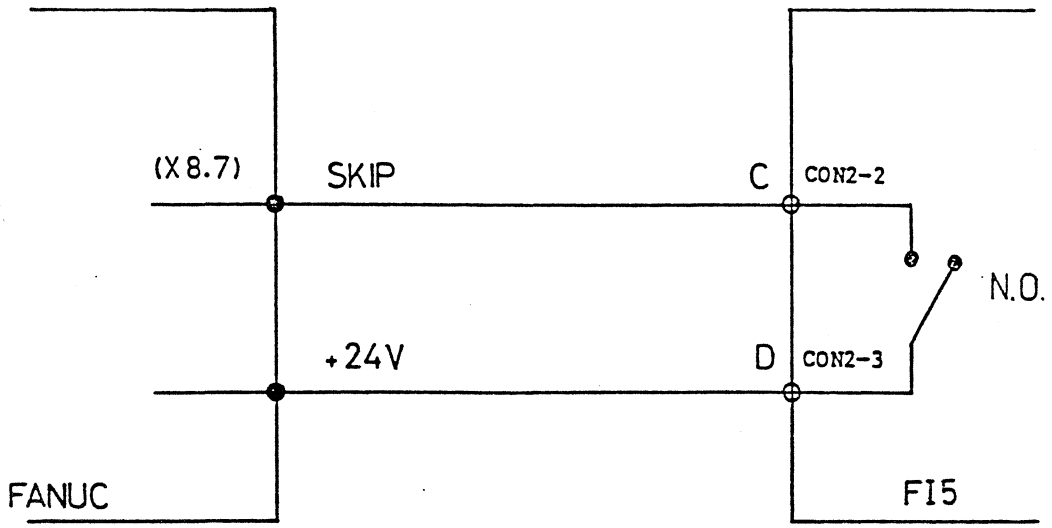
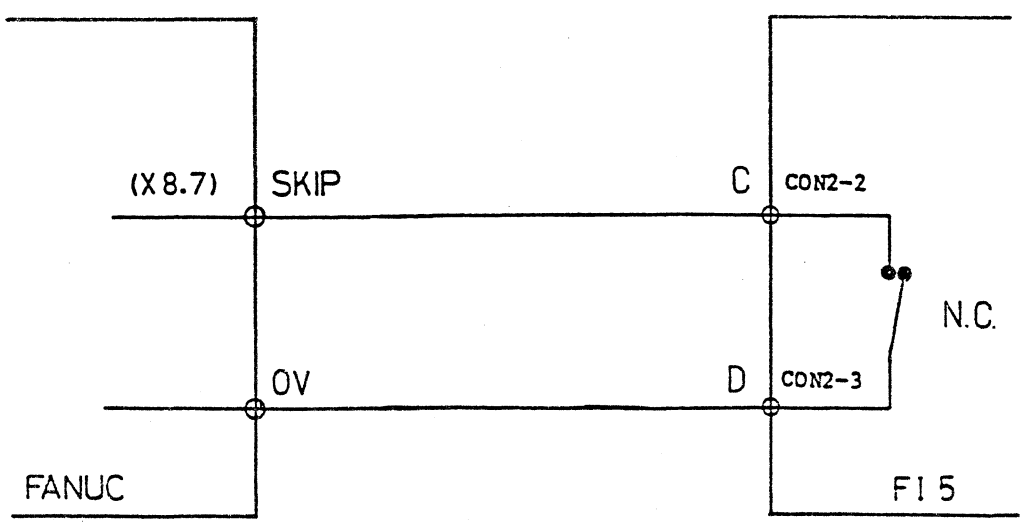

MT
TB1-12
TB1-10
TB1-11
TB2-2
TB2-3
TB1-16
TB1-14
TB1-6
TB1-3
TB1-2
TB1-1
SKIP
+24V
STATUS
24V
0V
(X8.7)
(M18-49)
UIO (G130.0)
UO14 (F163.6)
(M)
TOOL PROBE
(HARDWIRED)
RED
BLUE
GREEN
TB1-9
TB1-10
TB1-12
TB1-11
TB1-7
TB1-8
TB2-2
TB2-3
TB1-16
TB1 14
TB1-6
TB1-3
TB1-2
TB1-1
SKIP
+24
UIO
STATUS
+24V
0V
(G130.0)
UO15 (F163.7)
(M)
INSPECTION (TURRET)
PROBE (INDUCTIVE)

FIG 7



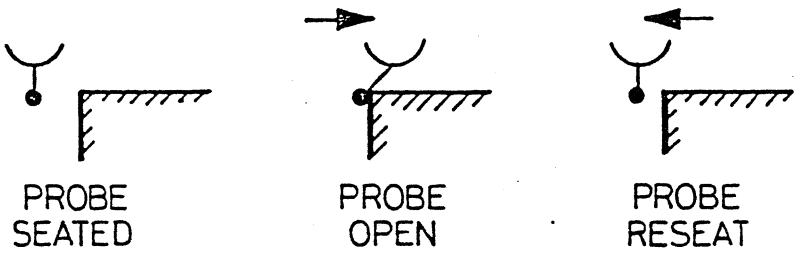
24 VOLT COMMON



0 VOLT COMMON

FIG 2

PROBE - DIAGNOSTIC RELATIONSHIP



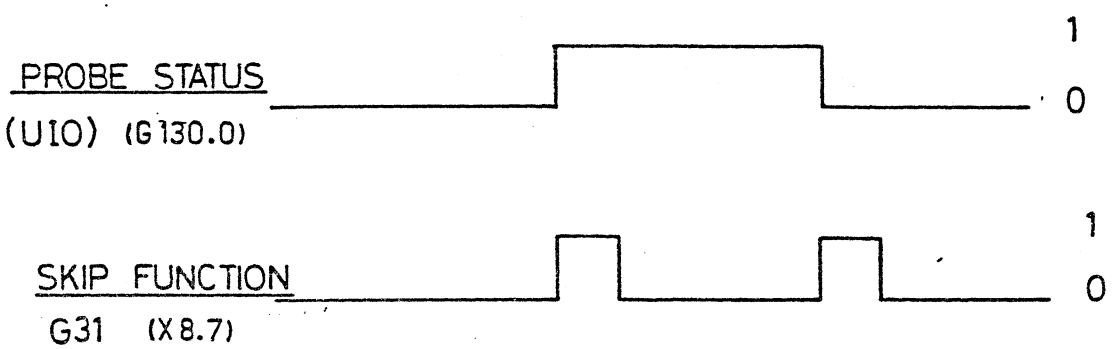


FIG 5

THE GAUGING CYCLE

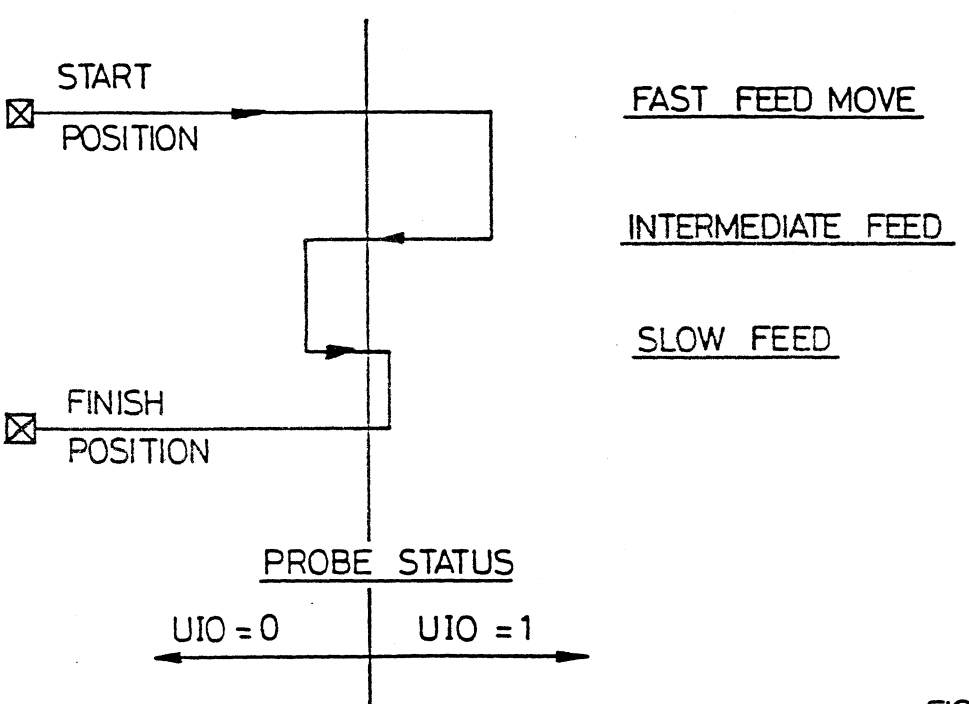


FIG 6

Software

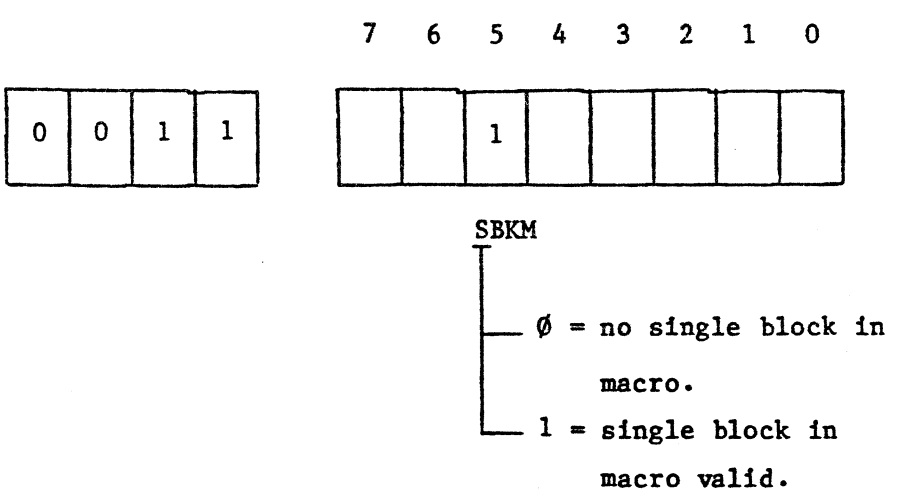
The Gauging Macro Programs form the software for the probe system. The programs are provided on Mylar Tape and must be registered within the main program memory store. The following instructions form the recommended installation procedure.

1. Examine the Program Directory and ensure that the following program numbers are available for use:

   :9001
   :9002
   :9010
   :9011
   :9014
   :9016
   :9019
   :9020
   :9021

2. Set parameters for the loading of the macro programs.

   Parameter 11



Parameter 10

0	0	1	0

7	6	5	4	3	2	1	0
			0				

PRG9

The setting of the parameter will permit loading of the macro programs into the protected area of the memory.

3. Loading of the Tape.

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

a) Load Tape to Tape Reader

b) Select EDIT Mode

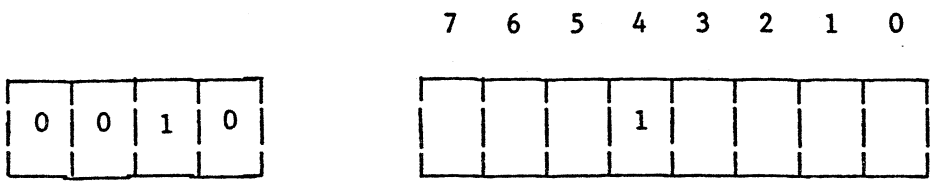
c) Press [PRGM] Button

d) Press [INPUT] Button

When loading is finished remove the tape and store in a safe place.

4. The following parameters may be reset

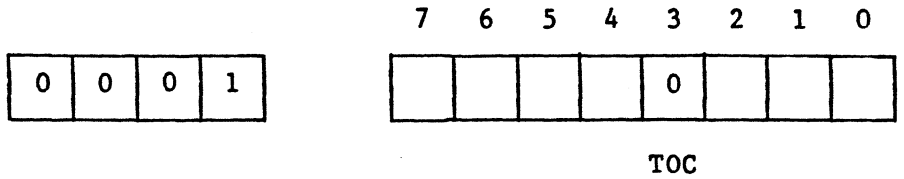
Parameter 10



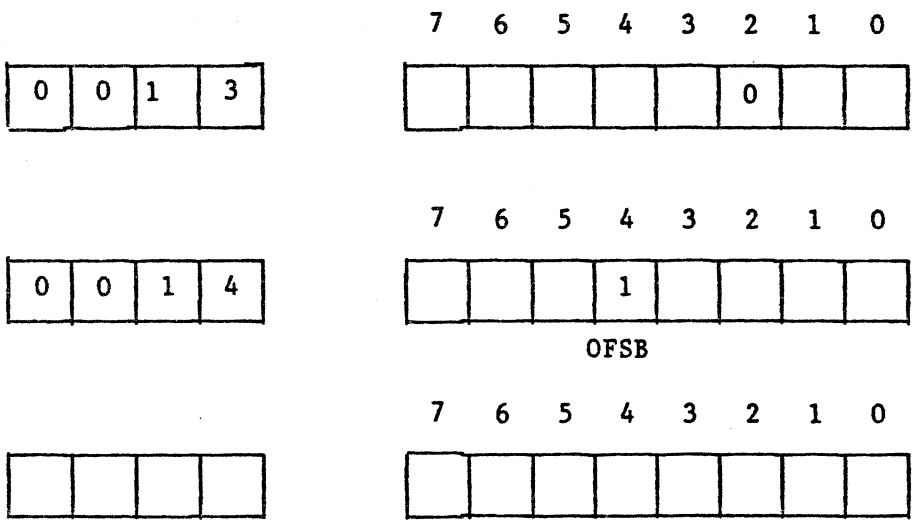
PRG9

This will prevent accidental editing of the macro programs and leave the macro call line only displayed during main program execution.

5. The following parameters must be checked.



The setting of parameter will retain the tool offset vector when the | RESET | function is used in cycle. Failure to do so will result in the machine moving out of position either towards or away from the work, depending on the sign of the tool offset amount. Correctly set the probe will remain at the programmed depth.



Note

The explanations and methods of setting of the parameters is clearly laid out in the Fanuc Operators and Maintenance manuals. Please refer to those manuals in case of difficulty.

NOTES ON FANUC OT

1. The macro variable input is by integer value.
Trailing zeros must be used.

eg.

#126 = 4 (G65 H01 P#126 Q6)
is regarded as 0.006 mm
or 0.0006 inch

whereas

#126 = 4000 (G65 H01 P#126 Q6000)
is regarded as 6.000 mm
or 0.6000 inch

The Programmer must check all inputs.

2. The default must be entered before the probe is used. :9020 enters default values to the axis target registers and tool store numbers. Failure to do so will eliminate the format checking of the first probe macro.

3. Inch-Metric

G65 P#100 Q -[20 / 21]

Must be stated before the first probe cycle. This value is lost on power off, but will otherwise remain modal provided it is not used for other purposes.

4. The variables used are as follows:-

* Reserved for inspection cycles.

Variable Name	Alphabet Position	Referred To
D	7	#107 *
R	18	#118 *
S	19	#119 *
X	24	#124
Z	26	#126
M	13	#113 *
T	20	#120
Inch/Metric	—	#100
H	11	#111 *
K	6	#106 *
P	16	#116 *

Input statements #124 or #126 are necessary everytime;

Input statements #100, #120 are compulsory.

4.1 Renishaw cycles will use common variables #100-#131. They can be used for other purposes if required with the exception of #100. If this is used it must be restated before the next Renishaw cycle. See common variable list.

4.2 Renishaw cycles use retained variables #505-#508 for the Tool setting package. #500-#510 should be reserved for inspection packages etc.

5. Renishaw cycles for the Tool setting package use program numbers :9001,:9002,:9010,:9011,:9014,:9016,:9019,:9020, :9021.:9000-:9030 should be reserved for other possible packages.

#509 Tool Offset Type Indicator.

This must be set when the software is installed according to the type of tool offset being used on the machine.

Setting of this variable will ensure that the correct tool offset variable numbers will be addressed by the software.

Set #509 = 0 or 1

Integer 0 will indicate Tool offset only.
1 will indicate Tool geometry and wear.

OPERATORS AND PROGRAMMERS NOTE

In guaging routines the CNC system will inhibit the override of feed rates. The Feed Hold button is still active.

Note:

1. If #100 is not set to 20 or 21 then a Format error will result. (591)

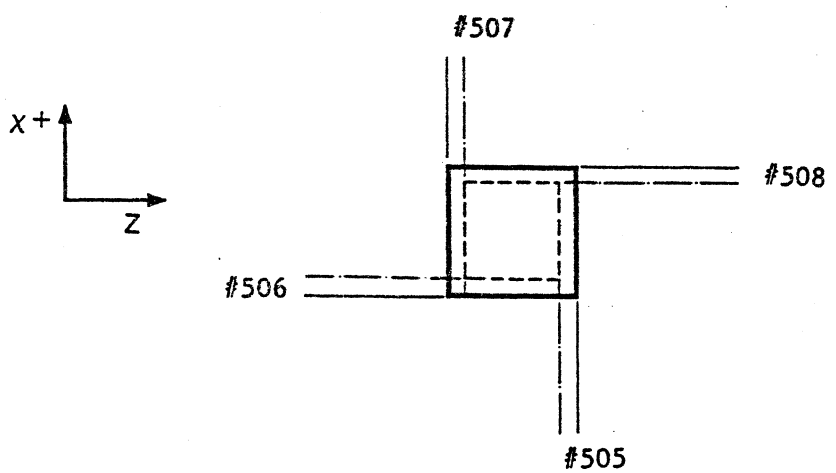
2. The macro to set #100 must be run at the beginning of any program containing a probe sequence.

3. The macro does not convert programs from inch to metric, and vice-versa. It converts a feed rate depending on the input data.

Correction Factors

Each face of the cube stylus has its own correction factor. The correction factor is the error between the nominal position of the face and its true position established by datuming.

Macro variable locations for the cube stylus correction factors



If the Inch code is input when metric values are required then the feed rates will be at inch units at metric speed.

e.g.

60mm/min
6mm/min
1mm/min

If the metric code is input when the inch values are required then the feed rates will be at metric units at inch speeds.

e.g.

1500in/min
150in/min
25in/min

In the last case damage may result to the probe at the high feed if the machine is unable to stop quickly. Also the accuracy will have been lost.

The programmer must enter the values required correctly.

:9020 DEFAULT MACRO

Function

This macro should be stated immediately before the first Renishaw cycle to set default values. If multi Renishaw cycles are called following each other, then it is not necessary to restate this macro, since it is called automatically at the end of each Renishaw cycle, to reset all input variables used with the exception of #100 which is left modal. The inch/metric variable (#100) should either not be used for other purposes, or it should be restated at the next probe cycle.

Example:

```
%
: 0001
. )
. )  move to position etc.
M98 P 9020                          Set defaults
G65 P #100 Q21                      Inch/metric
. )
. )                                 Other inputs
M98 P ....                          Probe cycle call
.
.
.
```

This macro will set default values of 9999999 to all input variables, except #100.

:9021 INCH METRIC

(User Transparent Utility)

Format

```
                  ┌
G 65 H1 P #100 Q  │20 inch
                  │21 metric
                  └
```

M98 P 9021 called inside Renishaw cycles.

General

This program is embedded within the probe cycle programs. It's purpose is to calculate the required feed rate units used within the cycles to inch or metric units depending on the input variable #100, and to set a default value.

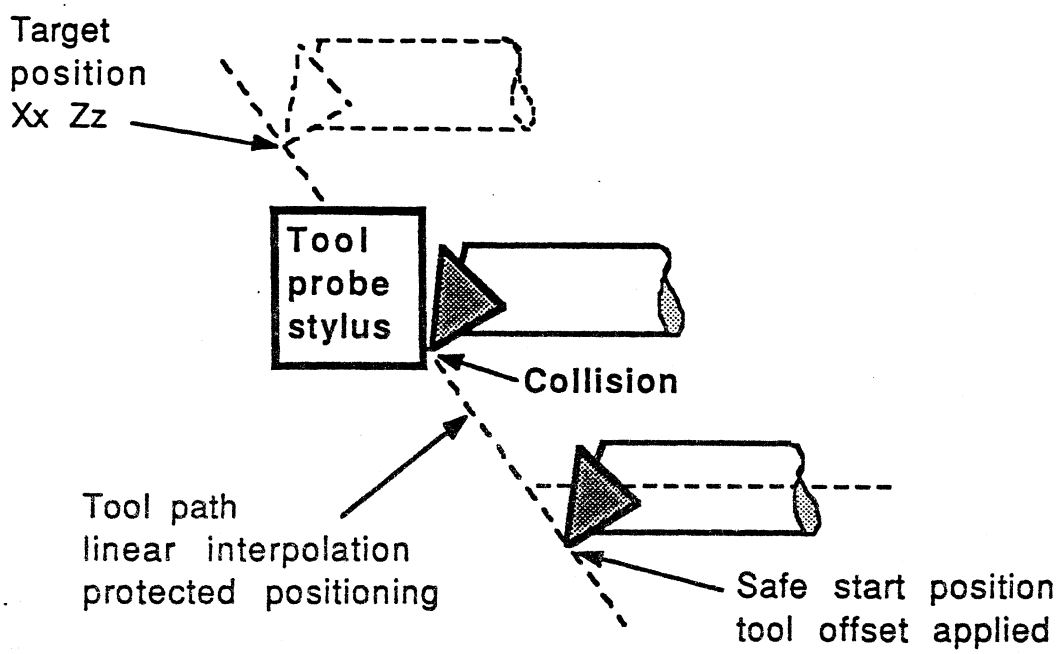
#128 = 1	gauging feed	inch
#125 = 1 x 6 = 6	intermediate feed	
#123 = 1 x 60 = 60	rapid feed	
#117 = 1600	overtravel (Q) also default for #118 (R)	

#128 = 25	gauging feed	metric
#125 = 25 x 6 = 150	intermediate feed	
#123 = 25 x 60 = 1500	rapid feed	
#117 = 4000	overtravel (Q) also default for #118 (R)	

Note:

The inch/metric variable (#100) should either not be used for other purposes, or it should be restated at the next probe cycle.

:9014 PROTECTED POSITIONING



Format

```
                 ┌
                 |21
G65 H1 P#100 Q   |20
                 └
G65 H1 P#124 Qx
G65 H1 P#126 Qz
G65 H1 P#1115 Q1
M98 P 9014
G65 H1 P#1115 Qo
```

Note* This cycle can only be used prior to setting tools, if the inspection probe interface is inhibited. This may be achieved by programming G65 H1 P#1115 Q1 before and G65 H1 P#1115 Qo after the cycle is called. Alternatively suitable 'm' codes provided by the OEM may be used.

General

The Protected Positioning will move the probe to the target positions for the gauging cycle to take place. The probe should previously have been positioned to a safe place with the tool offset applied. The program will monitor the stylus for any type of trigger.

Should a trigger occur the macro will decide whether the trigger was a False Trigger, caused by vibration, or a collision.

Application

The probe is programmed to move to the start co-ordinates of a gauging cycle.

The resulting move is similar to using linear interpolation, except that no feed rate will be required, the actual value used will be taken from program :9021 (#123).

Inputs

G65 H1 P#100 Q	21 20	State 20 or 21 (G20/G21 inch/metric)
G65 H1 P#124 Qx		Target position in x
G65 H1 P#126 Qz		Target position in z

#100 compulsory
#124, #126, are optional
Note: #100 is modal - it should not be used for other purposes.

Errors

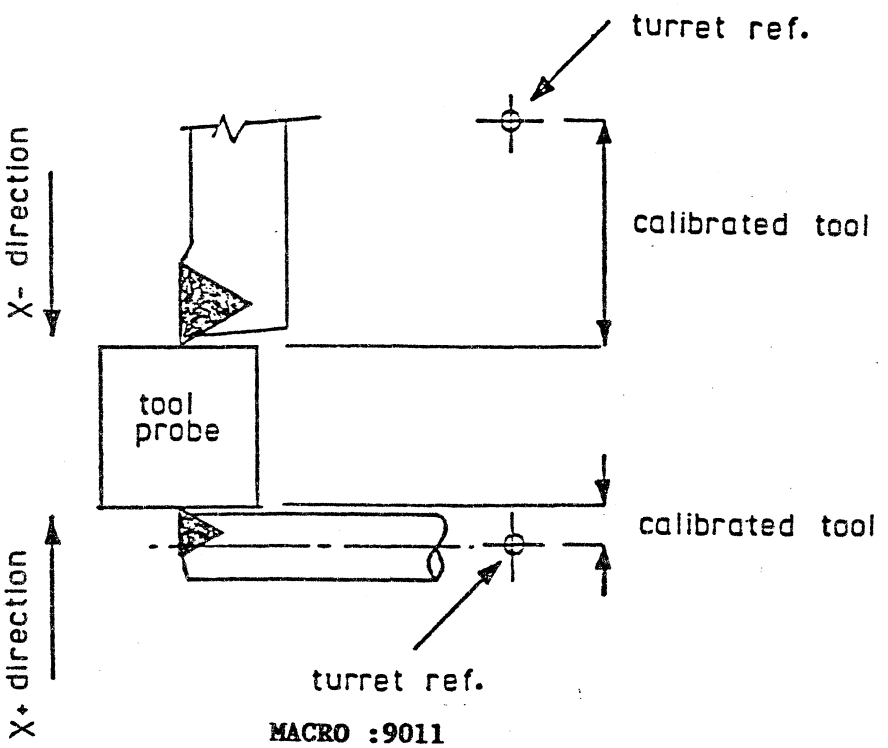
Errors occurring during the cycle will stop the machine and display an alarm number. See macro alarm list for guidance.

MACRO ALARM LIST

ERROR	MESSAGE	REASON	ACTION
586	Path Obstruction	The stylus hit an obstruction. The infra red beam was cut.	Edit the program or remove the obstruction.
587	False Trigger	Four false triggers were detected prior to this error message. The probe is out of position.	Check the probe stylus pressure. Check for vibration sources.

FUNCTION

TO DATUM THE TOOL PROBE WITH A CALIBRATED TURRET TOOL



MACRO :9011

INPUT DATA	Variable Name
Inch/metric	#100
Target Face Position	#124

OUTPUT DATA

X Axis Directional	#506 (X+)
Probe Compensation - Cube Stylus	#508 (X-)

OPERATION

The calibrated tool is positioned with its geometry compensation active to a position above or in front of the cube stylus reference surface. The referencing move takes place from which the trigger point of the cube stylus is calculated in the X+, X- direction.

When subsequently used for datuming an unused tool the trigger Point will provide the position of the tool edge in the unloaded condition of the machine.

eg. G65 H1 P#100 Q21
G65 H1 P#124 Q101560
M98 P9011

Data found from the use of this macro will be used in the datuming of any tool in the X+, X- direction.

ERROR

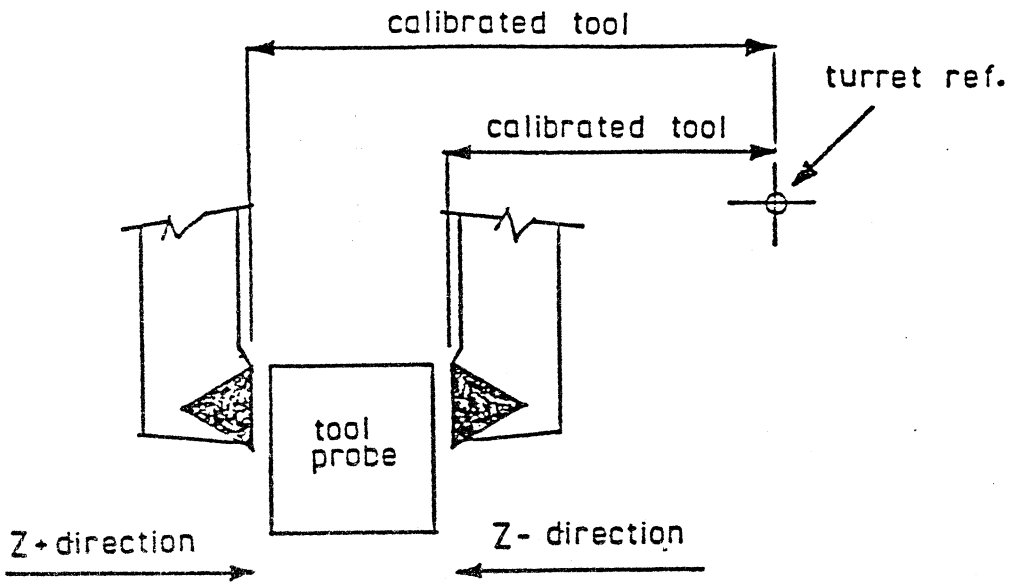
591 Format Error
A Value was not found in #124
(Default Occured).

592 Probe Open
The stylus is in contact with the workpiece before the reference move occurs.
The stylus is deflected by contamination in the probe eyelid (remove and clean) or by probe malfunction (check probe by diagnostics).

593 Probe Fail
The target face was not found within 4 mm of its expected position.
Check target value.
Check probe position prior to the macro cycle starts.

FUNCTION

TO DATUM THE TOOL PROBE WITH A CALIBRATED TURRET TOOL



MACRO :9010

INPUT DATA	Variable Name
Inch/metric	#100
Target Face Position	#126
Probe to Probe Indicator	#118 (G65 H1 P#118 QI)

OUTPUT DATA

Z Axis Directional	#507 (Z+)
Probe Compensation - Cube Stylus	#505 (Z-)

OPERATION

The calibrated tool is positioned with its offset (geom./wear) compensation active to a position behind or in front of the cube stylus reference surface. The referencing move takes place from which the trigger point of the cube stylus is calculated in the Z+, Z- direction.

When subsequently used for datuming an unused tool the trigger point will provide the position of the tool edge in the unloaded condition of the machine.

eg. G65 H1 P#100 Q21
G65 H1 P#126 Q50123
M98 P9011

Data found from the use of this macro will be used in the datuming of any tool in the Z+, Z- direction.

ERROR

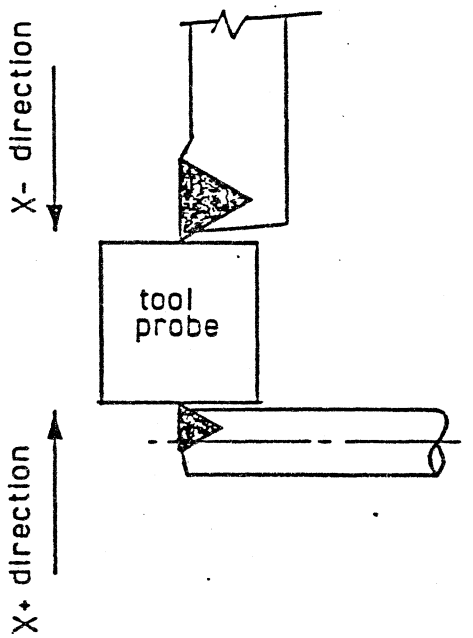
591 Format Error
A value was not found in #126
(Default Occured)

592 Probe Open
The stylus is in contact with the workpiece before the reference move occurs.
The stylus is deflected by contamination in the probe eyelid (remove and clean) or by probe malfunction (check probe by diagnostics).

593 Probe Fail
The target face was not found within 4 mm of its expected position.
Check target value.
Check probe position prior to the macro cycle starts.

FUNCTION

TO SET A TOOL IN THE X DIRECTION. TO ZERO THE WEAR OFFSET AND ESTABLISH A NEW GEOMETRY OFFSET.



MACRO :9016

INPUT DATA	Variable Name
Inch/metric	#100
Traget Face Position	#124
Tool No	#120

OUTPUT DATA

The tool wear store is zeroed and the geometry store is updated.

OPERATION

The tool is programmed to a position adjacent to the Z face of the cube stylus. Use only the geometry offset and not the wear offset.

A setting move takes place which will calculate the error of the tool tip position.

eg. G65 H1 P#100 Q21
G65 H1 P#124 Q50600
G65 H1 P#120 Q9
M98 P9016

ERROR

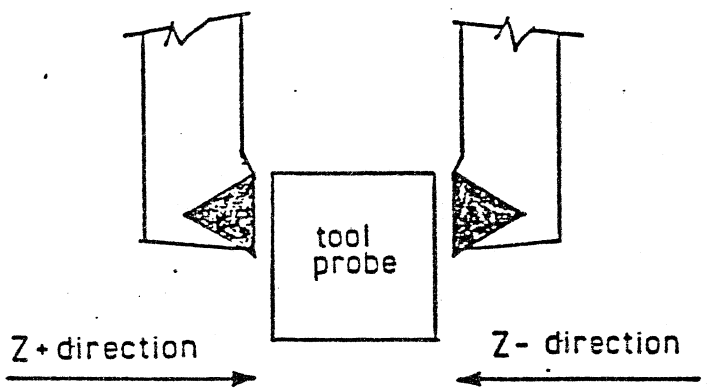
591 Format Error
A value was not found in #124
(Default Occured)

592 Probe Open
The stylus is in contact with the workpiece before the reference move occurs.
The stylus is deflected by contamination in the probe eyelid (remove and clean) or by probe malfunction (check probe by diagnostics).

593 Probe Fail
The target face was not found within 4 mm of its expected position.
Check target value.
Check probe position prior to the macro cycle starts.

FUNCTION

TO SET A TOOL IN THE Z DIRECTION. TO ZERO THE WEAR OFFSET AND ESTABLISH A NEW GEOMETRY OFFSET.



MACRO :9019

INPUT DATA	Variable Name
Inch/metric	#100
Traget Face Position	#126
Tool No	#120

OUTPUT DATA

The tool wear store is zeroed and the geometry store is updated.

OPERATION

The tool is programmed to a position adjacent to the Z face of the cube stylus. Use only the geometry offset and not the wear offset.

A setting move takes place which will calculate the error of the tool tip position.

eg. G65 H1 P#100 Q21
G65 H1 P#126 Q50600
G65 H1 P#120 Q9
M98 P9016

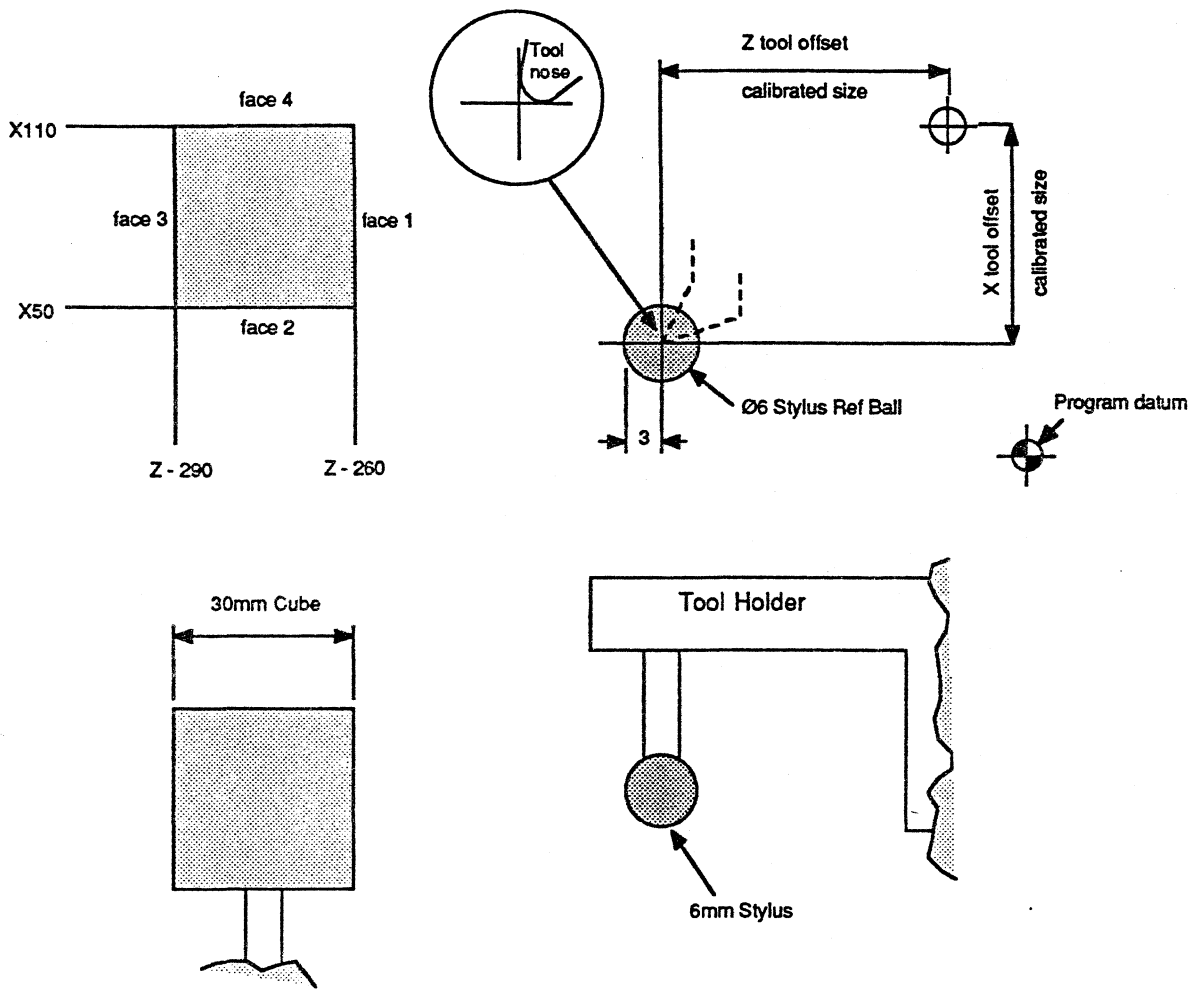
ERROR

591 Format Error
A value was not found in #126
(Default Occured)

592 Probe Open
The stylus is in contact with the workpiece before the reference move occurs.
The stylus is deflected by contamination in the probe eyelid (remove and clean) or by probe malfunction (check probe by diagnostics).

593 Probe Fail
The target face was not found within 4 mm of its expected position.
Check target value.
Check probe position prior to the macro cycle starts.

FIG 1



SEE EXAMPLES 1 and 2

Example 1

```
    % (datum 4 faces of the cube)
    G28 U0 W0
    T0303
*   G0 X80.  Z-247.
    G65 H1 P#100 Q21
    M98 P9020
    G98
    G65 H1 P#126 Q-257000
    M98 P9010                          Face 1
*   G0 X24.
*      Z-275.
    G65 H1 P#124 Q44000
    M98 P9011                          Face 2
*   G0 Z-303.
*      X80.
    G65 H1 P#126 Q-293000
    M98 P9010                          Face 3
*   G0 X136.
*      Z-275.
    G65 H1 P#124 Q116000
    M98 P9011                          Face 4
*   G0 Z-247
*      X80
    G28 U0 W0
    T0000
    M30
    %
```

* Alternatively protected positioning can be used.
  See macro :9014.

Cont/d.

Example 2

```
    % (set a Turning Tool Face)
    G28 U0 W0
    T0404
*   G0 X80.  Z-250.
    G65 H1 P#100 Q21
    M98 P9020
    G98
    G65 H1 P#126 Q-260000
    G65 H1 P#120 Q4
    M98 P9019                              Face 1
*   G0 X130.
*      Z-275.
    G65 H1 P#124 Q110000
    G65 H1 P#120 Q4
    M98 P9016                              Face 4
    G28 U0 W0
    T0000
    M30
    %
```

* Alternatively protected positioning can be used. See macro :9014.

DOCUMENT NO. N/4012/0476

APPENDIX

TYPE 1 TOOL SETTING INSTALLATION REQUIREMENTS

KIT NO. A/4012/0475
TAPE NO. A/4012/0476

This package is intended for installation where no user input/outputs are provided, and particularly for the installation of the 'TS20' probe which outputs a level signal for skip.

REQUIREMENTS

1. This software is to be installed on the Fanuc OTA Control.

2. User Macro A.

3. G31 skip option.

4. No user inputs/outputs required.

5. Memory Capacity 7 metres approx.

6. Basic Move Control Factor

   Must set variable #510 to optimise the basic move cycle. Typical value is between 250 and 500. It is a multiplication factor which modifies the distance that the probe retracts off the surface before the final gauging move takes place. The software uses a maximum retract factor of 500 as a default value if #510 is zero.

INSTALLATION DETAILS

Refer to the TS20 Data Sheet H/2000/2110 for connection details.

In the case of an FI5 inductive interface see connection diagram as shown.

SOFTWARE

1. All inputs etc. as described in user guide H/2000/6016 are applicable, except for the following:-

a. Protected positioning :9014. It is not necessary to use input G65 H1 P#1115Q1. There is no false trigger alarm 587.

b. Datum the tool probe :9010 and :9011. It is not necessary to use input G65 H1 P#118 Q1 for probe to probe calibration.

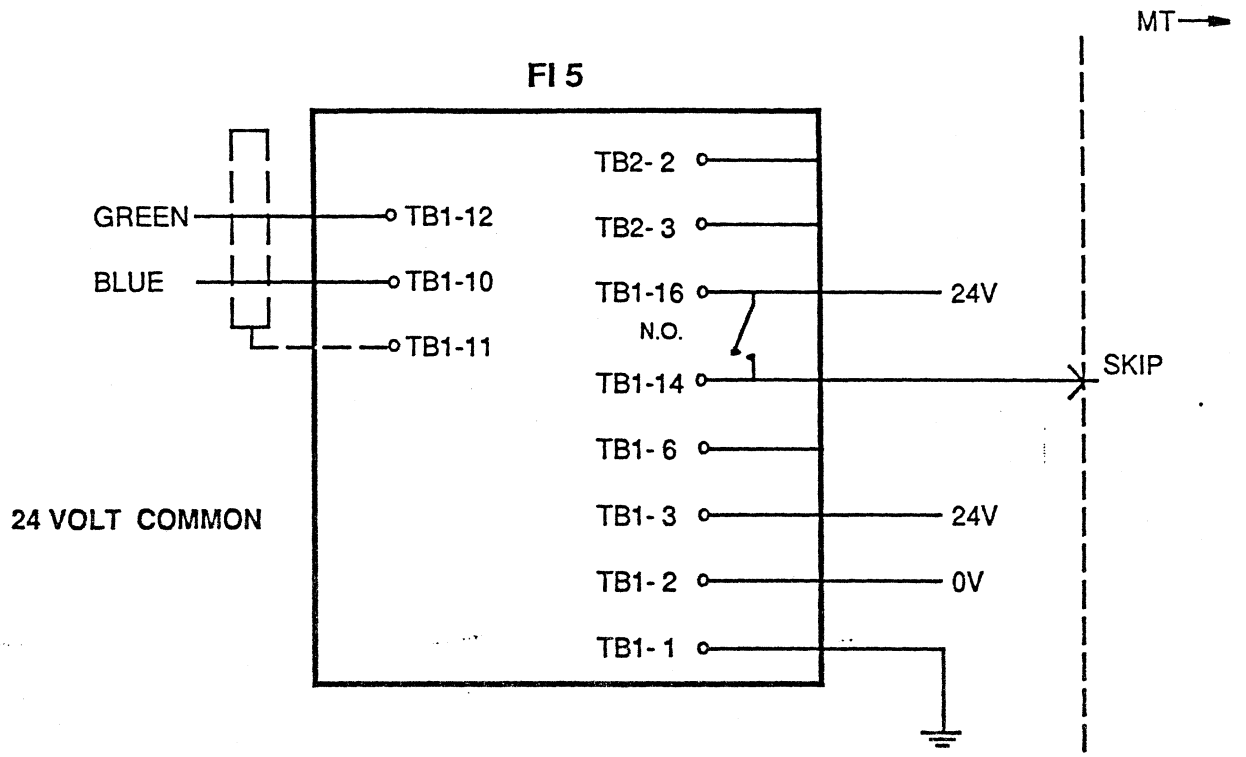
c. User outputs U014 and U015 will not be addressed in the software.

2. Examine the Program Directory and ensure that the following program numbers are available for use:

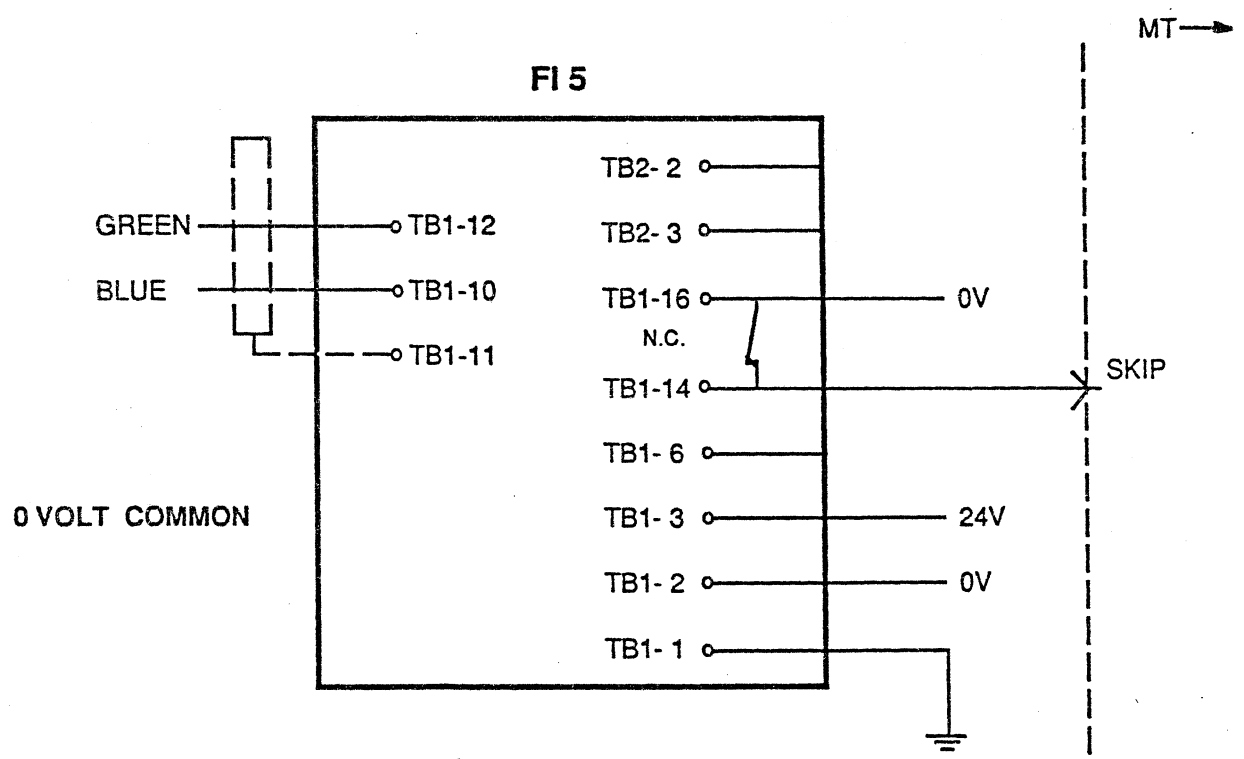
09025
09026
09010
09011
09014
09016
09019
09020
09021

Note. When this package is installed with the inspection software tape A/4012/0463, the protected positioning macro 09014 provided with this software must be used.

CONNECTION DIAGRAM



TOOL PROBE (HARD WIRED)



TOOL PROBE (HARD WIRED)

Note:
The internal SSR relay across pins TB1-16 and TB1-14 is reversable in its socket to select either N.O. or N.C.