Macros user manual for
TTC200 / OPS-30 / Syntec 22MA

Contents

Macro global stored variables

The default base is 950, so variable 0 goes to @950, variable 1 goes to @951, etc.

You can change the base by editing the macros by setting internal variables #30 (remember to change it in EVERY macro otherwise it won't work and may lead to catastrophic behavior).

For the tool setter TTC200

- 0: Z calibration value for non-rotating tools
- 1: Z calibration value for rotating tools
- 2: stylus measured X diameter
- 3: stylus measured Y diameter
- 4: stylus center position X in machine coordinates
- 5: stylus center position Y in machine coordinates
- 6: maximum tool length allowed in mm
- 7: maximum size in mm for non-rotating tools
- 8: maximum tool diameter in mm
- 9: minimum allowed tool length in mm
- 10: probe orientation in degrees from X+ axis in counter-clockwise direction from above
- 11: NOT USED (may be used in future revisions)
- 12: back off distance in mm
- 13: maximum spindle speed during measurements in rpm for rotating tools
- 14: desired surface speed during measurements in m/min
- 15: maximum feed rate during measurements in mm/min
- 16: feed rate used for the precise measurement in mm/min

For the wireless workpiece probe OPS-30

- 30: probe tool number
- 31: back off distance in mm
- 32: overtravel in mm
- 33: first touch (fast) feed rate in mm/min
- 34: second touch (slow) feed rate in mm/min
- 35: probe length
- 36: probe radius in +X direction
- 37: probe radius 30° from +X direction
- 38: probe radius 60° from +X direction
- 39: probe radius in +Y direction
- …
- 47: probe radius 30° counter clockwise from +X direction

Initial setup

For the tool setter TTC200 on Syil X7

- 6: 200.0 for max tool length 200mm
- 7: 0.0 so that all diameters with S defined are rotating
- 8: 50.8 for max tool diameter 2 inches
- 9: 0.0 use it if your tool setter is too low
- 10: correspond to your probe position on the table
- 12: 0.5 seems to work good with TTC200 and defined speeds
- 13: 800.0 for maximum 800rpm during measurement
- 14: 60.0 for surface speed of 60m/min during measurement
- 15: 800.0 for 800mm/min max federate during measurement
- 16: 4.0 for 4mm/min precise feed rate

With these values, for diameter measurement, second touch is 4mm/min at 800rpm, hence 5µm travel distance for a rotation. With a 2 teeth tool that's a 2.5µm travel between 2 teeth, so worst case 2µm error on radius calculation. You can increase the rpm or lower the precise feed rate to reduce this error.

First touch will always use 0.12 times the spindle speed for length and 0.16 times the spindle speed for diameter, this results in 0.12mm per rotation for length, and 0.16mm per rotation for diameter.

All other stored global variables are set during calibration.

For the workpiece probe OPS-30 on Syil X7

- 30: whatever you use as probe tool number (set to 0 if you don't use a probe)
- 31: 0.5 for 0.5mm back off, seems to work good on X7 with these feed rates
- 32: 4.0 for 4.0mm overtravel
- 33: 800.0 for 800mm/min first touch feed rate
- 34: 4.0 for 4mm/min second touch feed rate

All other stored global variables are set during calibration.

Macro output global volatile variables

For the tool setter TTC200

Variable	Manual Length	Manual Diameter	Automatic
	O9851	O9851	O9853
135		X position	X position
136		Y position	Y position
137	Z position		Z position
138	Length	Diameter	Length
139			Diameter
143	Length error	Diameter error	Length error
144			Diameter error
145	Absolute error	Absolute error	Absolute error

For the wireless workpiece probe OPS-30

Variable	Single Surface	Web Pocket	Bore Boss	Internal Corner	External Corner	4th Axis	Multi Bore Boss	Angle
	O9811	O9812	O9814	O9815	O9816	O9817	O9823	O9843
135	X position	X position	X position	X position	X position		X position	
136	Y position	Y position	Y position	Y position	Y position		Y position	
137	Z position							
138	Position	Size	Diameter				Diameter	
139				X surface angle	X surface angle	4th angle		Angle
140	X error	X error	X error	X error	X error		X error	
141	Y error	Y error	Y error	Y error	Y error		Y error	
142	Z error			Y surface angle	Y surface angle			
143	Position error	Size error	Diameter error	Y angle error	Y angle error	Height error	Diameter error	Height error
144				X angle error	X angle error	Angle error		Angle error
145	Absolute error	Absolute error	Absolute error	Error distance	Error distance		Error distance	

Macro descriptions

For the tool setter TTC200

- O9851: manual tool length and probe Z calibration
- O9852: manual tool diameter and probe center and dimension calibration
- O9853: automatic tool length and diameter

For the wireless workpiece probe OPS-30

- O9832: enable probe
- O9833: disable probe
- O9801: probe length calibration
- O9804: probe vector radius calibration
- O9810: protected move
- O9811: single surface measurement
- O9812: web or pocket measurement
- O9814: bore or boss measurement
- O9815: find an internal corner
- O9816: find an external corner
- O9817: 4^{th} axis measurement
- O9823: multi point bore or boss measurement
- O9843: angle measurement in the X or Y plane

Macro O9851: manual tool length and probe Z calibration

This macro is used for manual measurement of rotating and non-rotating tools length.

Parameters

S if set, the absolute value should be the nominal tool diameter in mm. Use positive values for right-handed cutting tools (cutting in clockwise rotation) and negative values for left-handed cutting tools (cutting in counter clockwise rotation). For non-rotating operation, do not set this value at all (not even to zero).

T if set, the macro will set the tool length to this tool number (or use the tool stored length for comparison if H is set)

Q overtravel distance, if set, overrides the one in global variables

Z must be negative, sets the nominal travel to reach the stylus (if omitted, a default value of -10mm is used).

H tool length tolerance, if set, the macro will compare the measured length and the length stored for this tool, if the difference is above H in absolute value, the macro will trigger an alarm.

K used for calibration only, set it to the master tool length.

How to use

Manually place the tool about 10mm above the tool setter stylus (e.g., using jog).

When running the macro, the spindle will go down on Z axis until the stylus triggers or the overtravel is reached. If the stylus triggers, it will back off, then do a second touch at much slower feed rate for better precision.

Whatever the result, the spindle will always go back at initial Z position (before the macro started).

The macro will then compute the tool length and depending on the parameters, set some variables.

Stylus Height Calibration

For calibration, first set the stylus mechanically level with the spindle using a comparator (sweep stylus top surface in X and Y). Then make sure the initial values for global variables are set correctly.

Place the master tool about 10mm above the stylus, then call G65P9851Kxxx.xxx where xxx.xxx is the master tool length.

The macro will find the stylus top surface and set adequate global variables.

Macro O9852: manual tool diameter and probe center and dimension calibration

This macro is used for manual measurement of rotating tools diameter.

Parameters

S must be set, the absolute value is the nominal tool diameter. Use positive values for right-handed cutting tools (cutting in clockwise rotation) and negative values for left-handed cutting tools (cutting in counter clockwise rotation). For calibration, S is the master tool precise diameter.

D if set, the macro will set the tool radius to this tool number (or use the tool stored radius for comparison if H is set)

Z must be negative, sets the nominal down travel before measurement (if omitted, a default value of -15mm is used).

R overtravel distance, if set, overrides the one in global variables.

H tool radius tolerance, if set, the macro will compare the measured radius and the radius stored for this tool, if the difference is above H in absolute value, the macro will trigger an alarm.

I adjustment value, a positive value will set the tool radius lower by the specified amount, a negative value will increase the stored tool radius.

K used for calibration only, set it to the nominal stylus diameter.

How to use

Place the tool about 10mm above the tool setter stylus (e.g., using jog).

When running the macro, the table will first move to stylus center, then offset some distance (depending on tool nominal diameter and radial clearance), and approach stylus. If the stylus triggers, then the tool will back off and make a second touch at slower speed for better precision.

Then the tool will come back up at initial height, and move back to stylus center.

Stylus Center and Diameter Calibration

For calibration, first calibrate the tool setter height using macro O9851.

Place the master tool about 10mm above the stylus and approximately centered on the stylus, then call G65P9852Sxxx.xxxKyyy.yyy where xxx.xxx is the master tool exact diameter, and yyy.yyy is the nominal stylus diameter (e.g., 12.7mm for TTC200 standard stylus).

The macro will first do 4 quick touches on the sides of the stylus to get a first measure of the stylus center.

It will then do 2 times 4 touches, rotating the spindle half a turn between the 2 measures.

Based on these measures, il will set the adequate variables to the correct values.

Macro O9853: automatic tool length and diameter

This macro is used for automatic tool length and/or diameter measurement.

It can also be used for workpiece probe calibration.

Parameters

B measure type, use 1 for length only, 2 for diameter only, 3 for both length and diameter. If used for diameter only a tool length must first be set.

S nominal tool diameter, you can omit this value for non-rotating tools (for length only). Use positive values for right-handed cutting tools (cutting in clockwise rotation) and negative values for left-handed cutting tools (cutting in counter clockwise rotation).

D tool number destination for radius.

T tool number to measure, and destination for length. You can use 3 decimals to set the destination for measured length (e.g., T6.020 will measure tool 6 and set length for tool 20).

Q overtravel distance for length, if set, overrides the one in global variables.

R overtravel distance and clearance for radius, if set, overrides the one in global variables.

Z height from stylus top for radius measurement, if omitted, a default value of -5mm is used. This value must be negative.

H measurement tolerance, if set, compare measured values with stored values and trigger an alarm is the absolute difference is above this value.

I adjustment value, a positive value will set the tool radius lower by the specified amount, a negative value will increase the stored tool radius.

K workpiece stylus nominal diameter for workpiece probe calibration only.

How to use

No preparation needed, the macro will call the specified tool and safely make the required measurements.

Workpiece probe automatic calibration

If using both TTC200 tool setter and OPS-30 wireless workpiece probe, this macro can also be used to calibrate the workpiece probe length and/or radius.

Before using the macro for calibration, mechanically set the workpiece probe runout (refer to OPS-30 manual).

The macro will automatically detect if the used tool is the workpiece probe (based on global variable).

If B is set to 1, only the probe length is measured.

If B is set to 2 (probe length must be set before), then the macro will measure the probe radius, both K and S parameters must be set, K holds the exact (not nominal) tool setter stylus diameter, S is the

nominal workpiece probe diameter. Do **NOT** use the measured value for tool setter stylus diameter, use the mechanical, measured (e.g., with a micrometer) value for K.

If B is set to 3, the macro will measure both the length and radius of the workpiece probe (K and S must be set correctly), ending in complete calibration of the workpiece probe stylus.

Macro O9832: enable probe

This macro is used to load the probe in the spindle (if not already) and enable the probe.

In case this macro is not used, each subsequent macro will check if the probe is in the spindle (if not they will trigger an alarm) and enable the probe for the duration of the macro, then disable it.

Parameters

None.

How to use

Simply call G65P9832.

You can call G65P9833 to explicitly disable the probe.

An M30 will also disable the probe.

Macro O9833: disable probe

This macro is used to disable the probe.

Parameters

None.

How to use

Simply call G65P9833.

An M30 will also disable the probe.

Macro O9801: probe length calibration

This macro is used to calibrate the workpiece probe length on a known height surface orthogonal to Z axis.

Parameters

K height of the reference surface in current WCS (Workpiece Coordinate System), If omitted, a default value of 0 will be used.

Z incremental travel for probing, this value must be negative, if omitted, a default value of -10mm will be used.

Q overtravel distance, if set, overrides the global variable.

How to use

Prepare a reference surface orthogonal to Z axis of known height, typically by using a tool with a known (or measured) length to mill a surface.

Place the probe about 10mm above the surface reference, then use macro to measure surface and set probe length global variable.

By default (no parameter set), the macro will look 10mm down to find a reference surface set at 0 in current WCS.

Macro O9804: probe vector radius calibration

This macro is used to calibrate the workpiece probe radius on an inner or outer circular feature.

Parameters

K probe nominal diameter (e.g., 6mm).

S feature diameter (internal of external).

Q overtravel distance, if set, overrides the global variable.

Z incremental vertical position for external feature measurement, if set this value must be negative, do not set for internal feature.

How to use

Prepare a reference inner or outer feature. Typically, a calibrated ring gauge clamped on the machine table is used for internal feature, or the tool setter stylus can be used as an external feature (using TTC200 and OPS-30).

Place the probe inside the internal feature, or above the external feature, approximately in the center (e.g., using jog).

Call the macro, it will first find the center of the feature, then measure the workpiece probe stylus radius in 30° increment (for a total of 12 measures), and set the global variables accordingly.

Macro O9810: protected move

This macro is used to move the probe. If the stylus touches something during movement, it stops and triggers an alarm.

Parameters

S specify the WCS to use (S1 for G54 up to S6 for G59), if omitted, the current WCS will be used.

X/Y/Z target position in specified WCS (Workpiece Coordinate System).

F feed rate. The feed rate is modal, so if not specified, it will reuse the last used feed rate. This cannot exceed the fast feed rate defined in global variables.

For X, Y and Z coordinates, at least one must be set, omit other values if no movement is needed on the axis.

How to use

Set the Workpiece Coordinate System first.

Then simply use the macro to move to a location, protecting the probe stylus during movement.

Warning: only the probe stylus is protected, not the probe main body.

Macro O9811: single surface measurement

Parameters

How to use