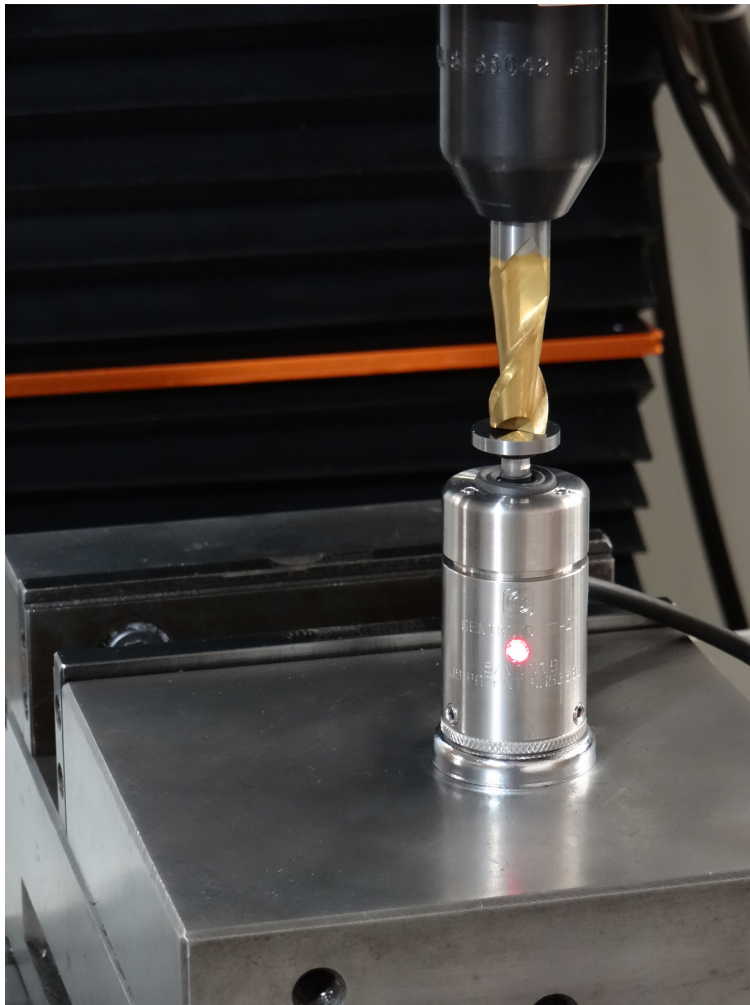


CENTROID

TT-2 Tool Touch Off



Operator's Manual

U.S Patent #6553682

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Howard, PA 16841**

TT-2 Quick Start Guide

1. Install MPU11 Probe cable assembly #11085 if necessary. Refer to TT-2 Kit Contents picture on page 10, connection diagram on page 11 and appropriate appendix data.
2. Connect coil cord to DP-4 and to bulkhead connector on probe cable assembly #11085. See probe features and general description page 1. LED indicating light should be green when connection is made then turn red when stylus mount boss is touched.
3. Set system control parameters. See “Table of Contents” to locate application specific appendix. See “Output Switch Logic Selection” page 5 if application requires a normally closed output connection.
4. Confirm machine is responding to the TT-2 input by running an automatic cycle without a tool in the spindle and manually touching the TT-2 stylus mount. Refer to control operator's manual for automatic probing cycles. See TT-2 setup procedures page 3.
5. Review stylus travel limits on page 2, install a tool in the spindle and perform an automatic probing cycle at reduced speed. See procedures on page 3.
6. Check adjustment of measurement surface. Install non stock mount option if applicable see page 6. See procedures on page 3 and adjustments on page 4.
7. Review “Performance Characteristics” page 7 to ensure good results.
8. Review Adjustments page 3 and 4 and Maintenance and Care page 9 to keep TT-2 in good operational condition.
9. TT-2 is now ready to use.

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TT-2 GENERAL DESCRIPTION AND SPECIFICATIONS



- Stylus
- Rubber seal
- End cap
- LED indicator light
Green = ready
Red = tripped
- Magnetic mount

TT-2 FRONT VIEW



- Stylus mount boss
- Angular alignment screws
- Core index screw
- Body
- Electrical connector
- Run-out adjustment screws

TT-2 REAR VIEW

GENERAL DESCRIPTION:

The TT-2 is a tool touch off device designed to implement automatic and manual tool height offset measurements for applications where the tooling or the spindle may be non conductive. It can also be used to determine tool breakage and wear.

The TT-2 is suitable for use with any CNC control or Digital Read Out (DRO). The output signal is an electronic switch and can be configured for normally open (stock) or normally closed logic. This choice may be specified when ordering or changed at a later time. A unique coil cord connector and connection detect circuit can be configured to avoid operator error and confusion with probing hardware when not permanently mounted. An LED indicating light signals the operator that the unit is powered and changes from green to red when the touch-off occurs.

Over-travel in XYZ directions allow for great flexibility in mounting location and orientation. Mounting options include the standard magnetic base, T- nut or shank. The Stylus (touch-off surface) can easily be customized or replaced as it is mounted with standard 4-48 threads. Adjustment screws are provided for run-out and parallelism. Three spring options are available: heavy, medium and light to match the requirements of the tooling. Stock TT-2s are assembled with the heavy spring. Medium and light spring options are special order.

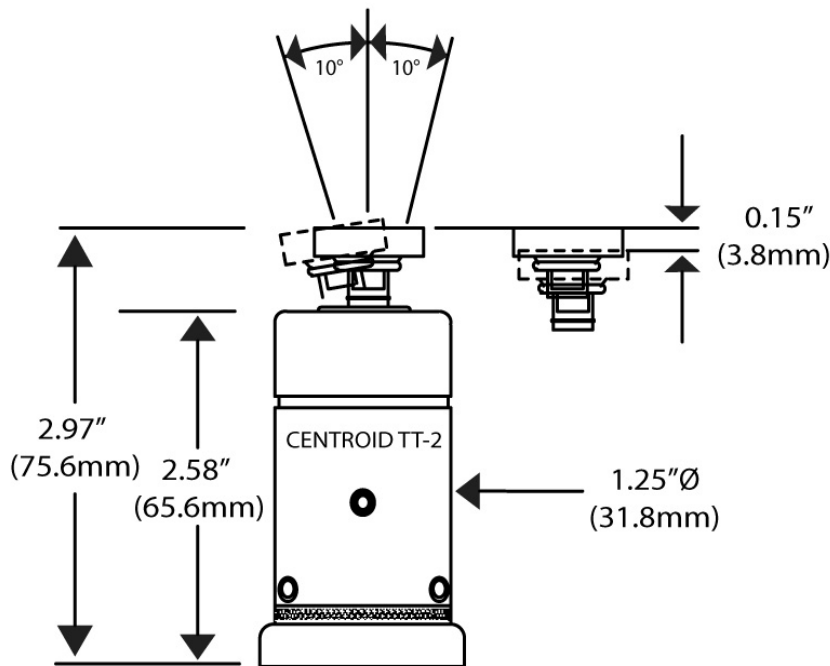
The user should first become familiar with the various parts and features of the TT-2 as shown above to facilitate assembly, installation and calibration. Read the Stylus installation and alignment procedures section before attempting adjustments. Review the over-travel limits shown in the specifications. Exceeding the limits will damage the TT-2. Go slow and verify everything is functioning properly before running automatic measuring cycles at full speed. A simple visual operational check can prevent very expensive repairs.

The TT-2 should only be serviced by Centroid. Contact Centroid Technical Support at 1-814-353-9290 for a description of the return policy and assistance in determining if return is necessary. See the "Maintenance and Care" section page 9 for precautions when shipping the TT-2.

SPECIFICATIONS:

Probing directions	X+/-, Y+/-, Z-
Unidirectional repeatability	.00004" (1 uM) 2 sigma at 1 ipm
Mounting orientation	Any
Height*	2.97" (75.6mm)*
Body diameter	1.25" (31.8mm)
Mounting Options	Magnetic (stock) or 1/2" Shank or Bolt
Mounting shank diameter and length	D= 0.5" (12.7mm) L= 1.47" (37.2mm)
Mounting bolt thread	1/2-13
Touch off surface mount thread	4-48
Over travel limit angle	10 degrees from vertical
Deflection travel limit -Z	0.15 inch (maximum)
Trigger force Z*	50 oz nominal center of disc*
Trigger force XY*	16-22oz nominal direction dependent*
LED status indicator	green = ready, red = tripped
Supply voltage	10-30VDC 50MA
Output	Switch (FET drain), 30VDC 50MA, NO or NC selectable
Pre-travel Z	< 0.0003" at center of disc
Pre-travel variation XY*	0.0015" nominal, direction dependent*
Parallelism adjustment range*	0.005"*
Measuring feedrate (nominal)	1 inch per minute
Weight*	0.45 lb (204g)*
Exposure to liquids	IP61

*Stock TT-2: heavy spring, magnetic mount and 0.75" diameter disc Stylus installed.



Dimensions and Over Travel Limits

TT-2 SETUP PROCEDURE

STEP 1: If probe cable P/N 11085 has already been installed for probe use and the TT-2 is to share the same input, this step may be skipped. If it is desired to not share inputs with the probe then connect probe cable P/N 11085 to the desired inputs. See drawing titled "TT-2 Connection Diagram" on page 14. Follow the wire colors to match-up the TT-2 outputs with the correct control inputs. Double check that supply power is not being applied to the TT-2 output.

STEP 2: Connect the TT-2 using the 6' retractile coil cord P/N 12605. Line-up the red dot on the connector plug with the red painted slot on the TT-2 receptacle, push the plug in until it clicks. At the opposite cord end confirm the white sleeve with "TT-2" printed on it is present at the connector. This identifies the unique cord for the TT-2 and enables connection detect feature operation. The cord end is keyed to prevent incorrect connection to probe cable P/N 120113. Rotate the connector until it drops into the mating receptacle then finger tighten the securing ring to seat the connector. The LED indicating light on the front of the TT-2 should be illuminated bright green. Touch the stylus (disc) and the LED should turn red.

STEP 3: Confirm that control parameters are setup correctly for your system. See the appropriate appendix of this manual for control specific default settings. Check the operation manual for your control for compatible parameter settings. For Centroid systems press <Alt+I> to open the Centroid PLC I/O diagnostic screen. Locate the inputs entered in parameters 11 and 18. Verify that they change correctly when the TT-2 is plugged in and triggered.

STEP 4: Do a slow dry run without a tool in the spindle operating the TT-2 manually. Confirm that the machine will respond correctly before attempting an actual automated touch off. Confirm the control is detecting the TT-2 connection by unplugging it and trying an automated touch off. No motion should occur and an error message should appear on the control screen.

STEP 5: Thoroughly clean the area where the TT-2 will be mounted. Mount the TT-2 in the desired location and confirm the magnetic mount is firmly attached to the mounting surface and no wobble, deflection or rocking is possible. If another mounting option is used, be sure it is solid and will not deflect when the tool is forced against the disc.

STEP 6: Review the TT-2 over travel limits in the specifications. Perform an automatic tool measurement cycle test with the feedrate override reduced to 20% to verify everything is functioning correctly. Be prepared to manually stop the machine to prevent over travel damage.

STEP 7: Perform a tool measurement cycle near the edge of the disc at each angle adjust set screw to confirm that the disc surface is parallel to the measurement plane. Each measurement should be within the operator's expected tolerance. See the "ADJUSTMENTS" section if necessary.

STEP 8: If the side of the disc is being used in the application then perform a measurement cycle on the side of the disc at each run-out adjust set screw to confirm that the disc center is located correctly. Each measurement should be within the operator's expected tolerance. See the "ADJUSTMENTS" section if necessary.

STEP 9: Measure tool then move tool to 0.010" inch from disc. Use feeler gauges to measure actual distance from disc. Pretravel equals 0.010" minus feeler gauge. See PERFORMANCE CHARACTERISTICS page 7. Repeat to confirm pretravel amount.

ADJUSTMENTS

RUN-OUT ADJUSTMENT

The run-out adjustment screws are provided to facilitate small translational adjustments when solid mount options such as the shank or bolt are selected. This adjustment is not necessary when the magnetic mount is used but the screws must still be kept tight. These screws shift the body and stylus disc similarly but opposite to the operation of a three jaw chuck. Turning the screw clockwise moves the disc toward the screw head. This provides an easy means to locate the center of the disc. Be sure all three screws are tight when adjustment is complete.

ANGULAR ADJUSTMENT

This feature provides a means to make fine adjustments to the stylus disc surface to make it parallel to the plane in which measurements are taken. In most cases the TT-2 is placed on the bed of a mill to measure tool heights. The disc surface must be perpendicular to the tool center axis to return accurate measurements at any point on the disc surface. The range of adjustment across the diameter of the disc is 0.005". The TT-2 is factory aligned with the stylus disc surface parallel to the mounting surface using the standard magnetic mount. An assessment of the alignment can be made by performing an automatic cycle on the top of the disc near the edge at each set screw in the end cap. All the measurements should be within the operators expected tolerance. If they are not, then begin adjustment with the set screw that returned the shortest tool length (disc edge highest above bed). Turning the set screw clockwise tilts the disc surface toward the set screw, lowering that portion of the disc height and tightening the sensing assembly, turning counter-clockwise has the reverse effect. Start with the screw that needs to be turned clockwise. Make a small adjustment and perform a measurement. Repeat this process until all the measurements are the same. If a screw becomes too tight loosen all three by a half turn and start over. Moderate tension must be maintained on these screws to maintain good repeatability.



WHEN TO CHECK ADJUSTMENTS

Any time the TT-2 is removed from its mounting location, the stylus disc is changed or the TT-2 is used in a different machine, the alignment procedure should be repeated to ensure accuracy. The user should also repeat the alignment procedure if the unit is dropped or receives any sudden external shock. It is good practice to periodically check alignment for quality control and to establish a base-line maintenance schedule.

OUTPUT LOGIC SELECT NO/NC

The default (stock) configuration of the output logic is normally open. To change the output logic loosen the run-out adjustment set screws in the TT-2 body enough to release the mounting device. Behind the LED indicator light is located a three pin header with a two pin jumper block installed. Move the jumper block to the opposite end of the header to change the output logic. Place the mounting device back in position and tighten the set screws evenly. A run-out adjustment may be necessary depending on the type of mounting device used and the application.

STYLUS INSTALLATION AND REMOVAL

To remove or install the stylus disc use the 3/16" wrench provided on the flats of the stylus mount boss to hold against the rotation force being applied to the disc. Use a shop cloth or wear gloves to grip the disc, the edges are sharp and this will prevent personal injury and improve leverage. The threads are right hand 4-48 so be careful not to over-tighten. Twisting the stylus mount without using the wrench can damage the TT-2 internal workings.



Hold wrench in fixed position while tightening stylus

MOUNTING OPTION INSTALLATION AND REMOVAL

To change the mount loosen the run-out adjustment set screws in the TT-2 body enough to release the mounting device presently installed from the body. The shank mount option directly replaces the stock magnetic mount. Insert the shank mount into the body and tighten the run-out adjustment set screws. Depending on the application a run-out adjustment may be necessary. To install the bolt mount option remove the magnetic mount by loosening the run-out adjustment set screws in the TT-2 body enough to release the mount. Remove the screw holding the magnet and thread in the bolt mount adapter. Place the mount device back in the body and tighten the set screws evenly.



TT2 Mounting Options

1. TT2 with Stock Magnetic Mount
2. Bolt Mount, T-nut adapter P/N: 12829
3. Shank Mount P/N: 10970

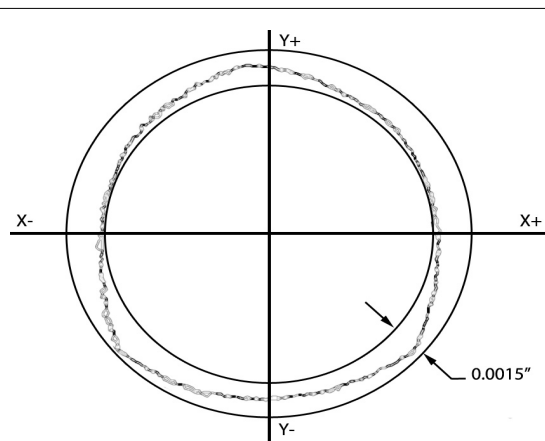
PERFORMANCE CHARACTERISTICS

The time it takes to measure a tool and the resultant accuracy are primarily affected by the feedrates. Typically a faster feedrate is used to approach or find the touch-off surface to save time. Care must be exercised selecting this speed, too slow wastes time and too fast increases error and may exceed over-travel limits and damage the TT-2. The axis must be capable of decelerating to a stop well within the over-travel limit. Any delay in processing the TT-2 signal will add error to the position recorded and will increase over-travel. Once the touch-off surface has been found the tool should be retracted a clearance amount allowing the TT-2 to return to the measuring position. A second approach to the surface at a slow speed provides very accurate position data in a small amount of time. This two step process is the basis of most probing and measurement cycles. Typical values are 30 inches per minute for the fast approach and 3 inches per minute for the slow.

Designating a reference tool for the sole purpose of calibrating the TT-2 can save a lot of set-up time and money in ruined parts. After the TT-2 is calibrated using the reference tool all other tool heights can be set up to the same standard quickly and easily using the TT-2.

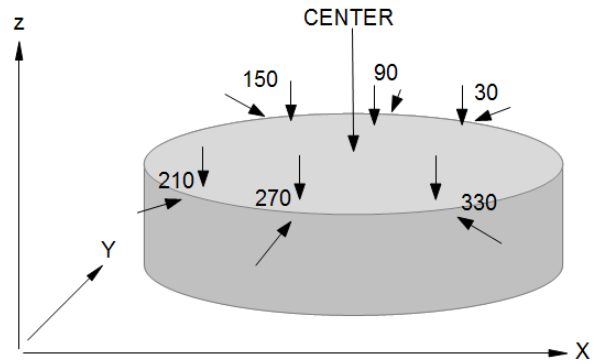
The stock TT-2 is equipped with a heavy spring to ensure that it doesn't deflect when a touch probe is used to locate its surface. The probe is used to set the height of the TT-2 as a reference so it is important that the TT-2 not deflect while being probed. Other spring options are available for the TT-2 for applications where lower trigger force is desired.

Pre-travel is the distance the detection surface moves before the signal output changes state. Pre-travel will vary depending on speed and direction. If only one location on the disc is used then pre-travel variation is not a concern as only one value of pre-travel will occur and repeatability will be of primary importance. If multiple locations on the disc are used then it will be necessary to determine the pre-travel amount of each and apply appropriately. In general the pre-travel amount should be added to the measured tool length. The minimum amount of pre-travel occurs at top dead center of the disc (see specifications page 2) and increases moving toward the edge. It is greatest when using the side of the disc. See the graph of pre-travel variation (PTV) in the XY plane below.

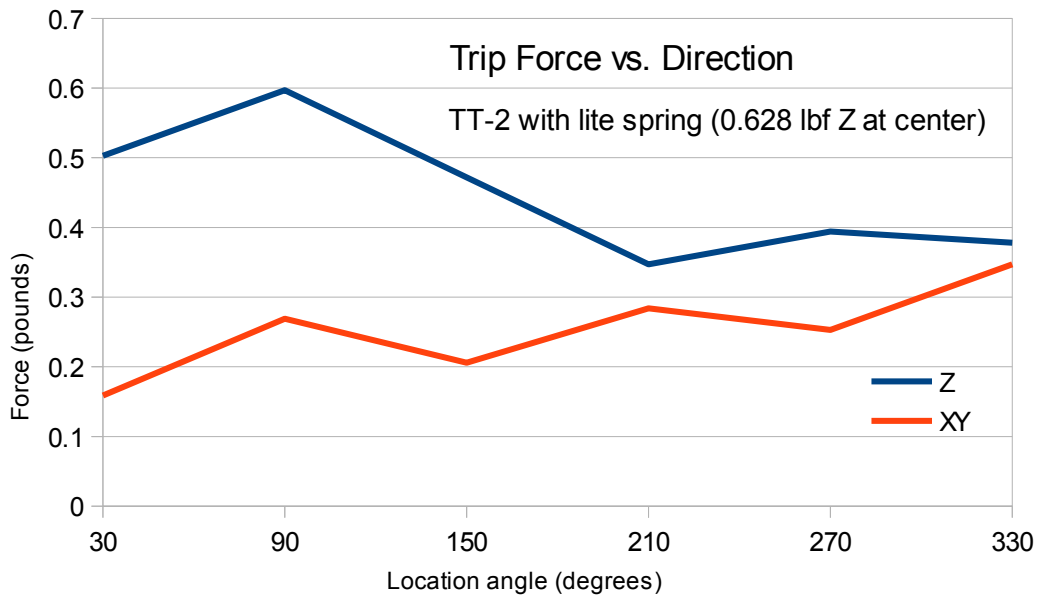
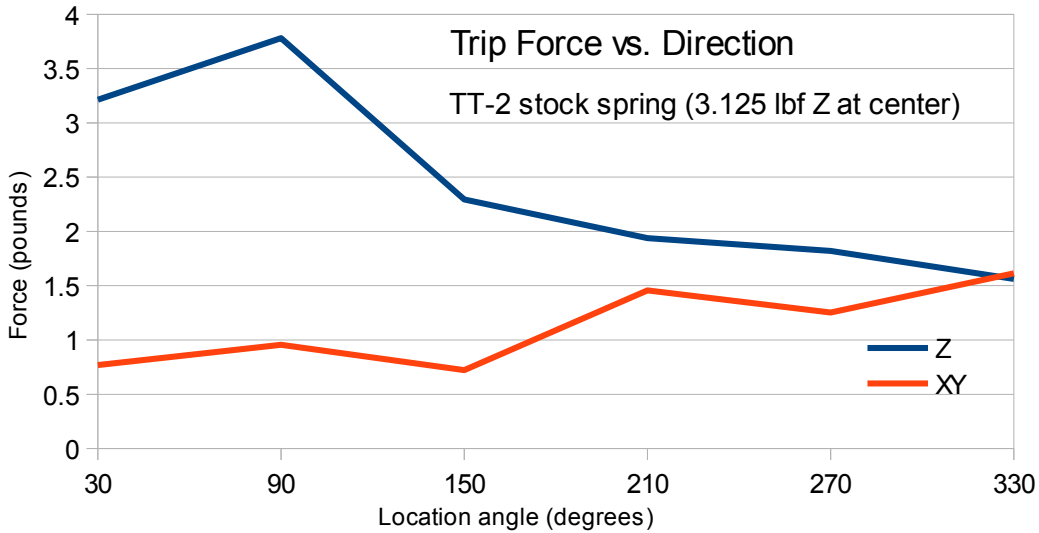


Pre-travel variation XY when touching-off the side of the disc for a TT-2 magnetically mounted on a bed mill table. Y- is aligned with the indicator light.

Direction of test trip force applied to disc is shown in the figure at right. The 270 degree area is aligned with the TT-2 indicator light. Test points are separated by 60 degrees in X-Y plane. See Trip force vs. Direction Charts below for nominal related force for selected spring option.



Forces applied to TT-2 disc



MAINTENANCE AND CARE

Do not submerge the TT-2. Avoid direct flow of coolant at the electrical connector. Wipe off excess liquids to prevent degradation of the rubber seal and indicator lens. Do not use compressed air to clean the TT-2 as this may force contaminants into the electrical connector and inside the body. The TT-2 body is stainless steel and should only be wiped clean with compatible cleaners.

Storage. Do not store or ship the TT-2 with the stylus mount boss pushed into the probe body as this will negatively affect internal lubrication.

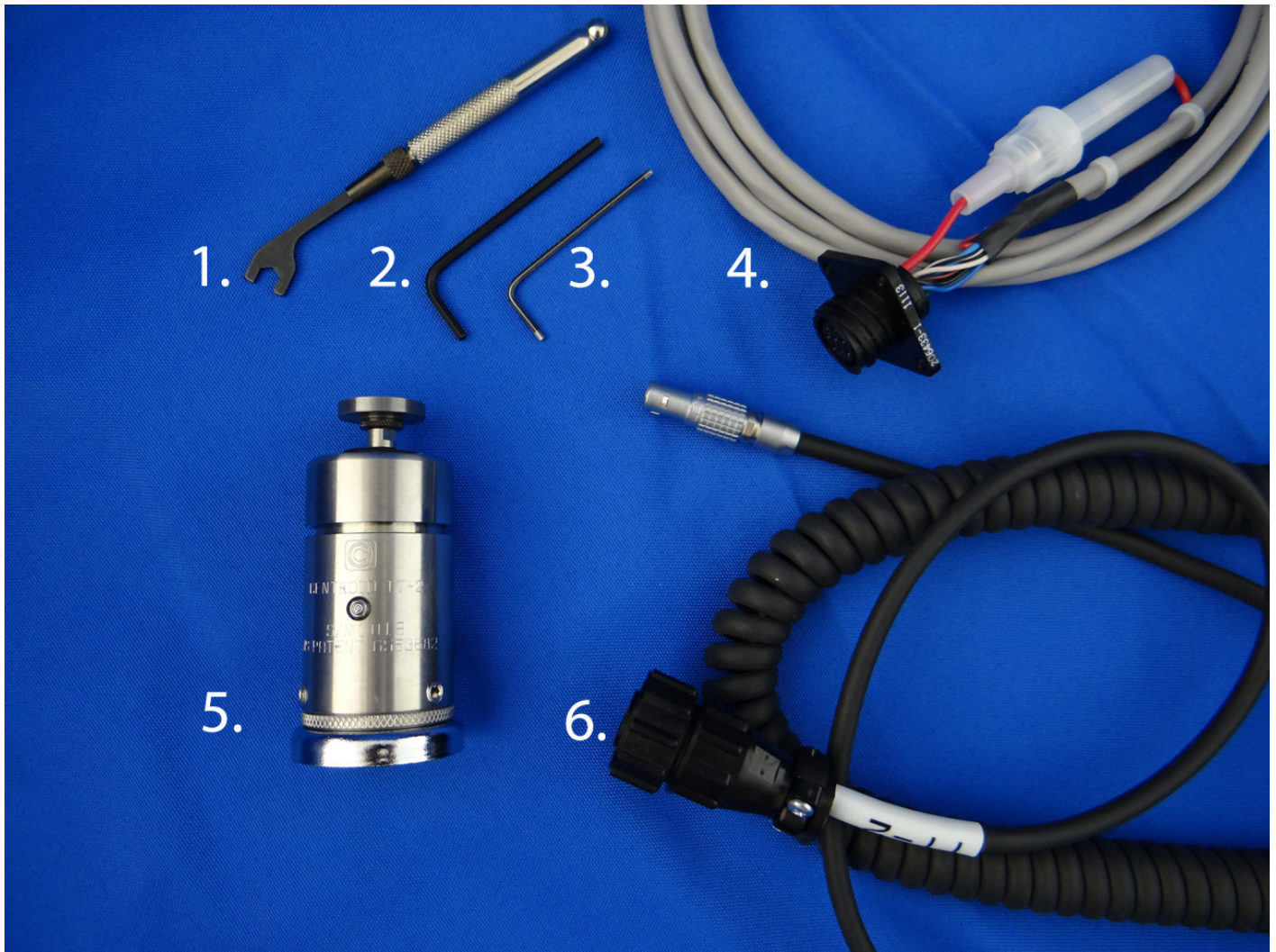
User repairs. The TT-2 has no internal user serviceable parts or adjustments and should only be serviced by Centroid.

Alignment adjustments. Regularly check alignment. Any time the TT-2 is removed from its holder, the disc is changed or the TT-2 is used in a different machine, the alignment procedure should be repeated to ensure accuracy. The user should also repeat the alignment procedure if the unit is dropped or receives any sudden external shock. It is good practice to periodically check alignment for quality control and to establish a base line maintenance schedule. See "ADJUSTMENT" section. If the TT-2 cannot be adjusted properly then it should be sent in for evaluation and repair.

SHIPPING INSTRUCTIONS

Contact Centroid Technical Support at 1-814-353-9290 for a description of the return policy and assistance in determining if return is necessary. If the TT-2 must be shipped use the original plastic shipping tube and insert the TT-2 in the tube with the stylus disc end located inside the foam ring in the tube. The foam should prevent the stylus or stylus mount boss from touching the end of the plastic tube if jarred during shipping. Do not ship or store the TT-2 with the stylus mount boss pushed into the probe body as this will negatively affect internal lubrication and damage the TT-2 if jarred on that end.

TT2 KIT CONTENTS



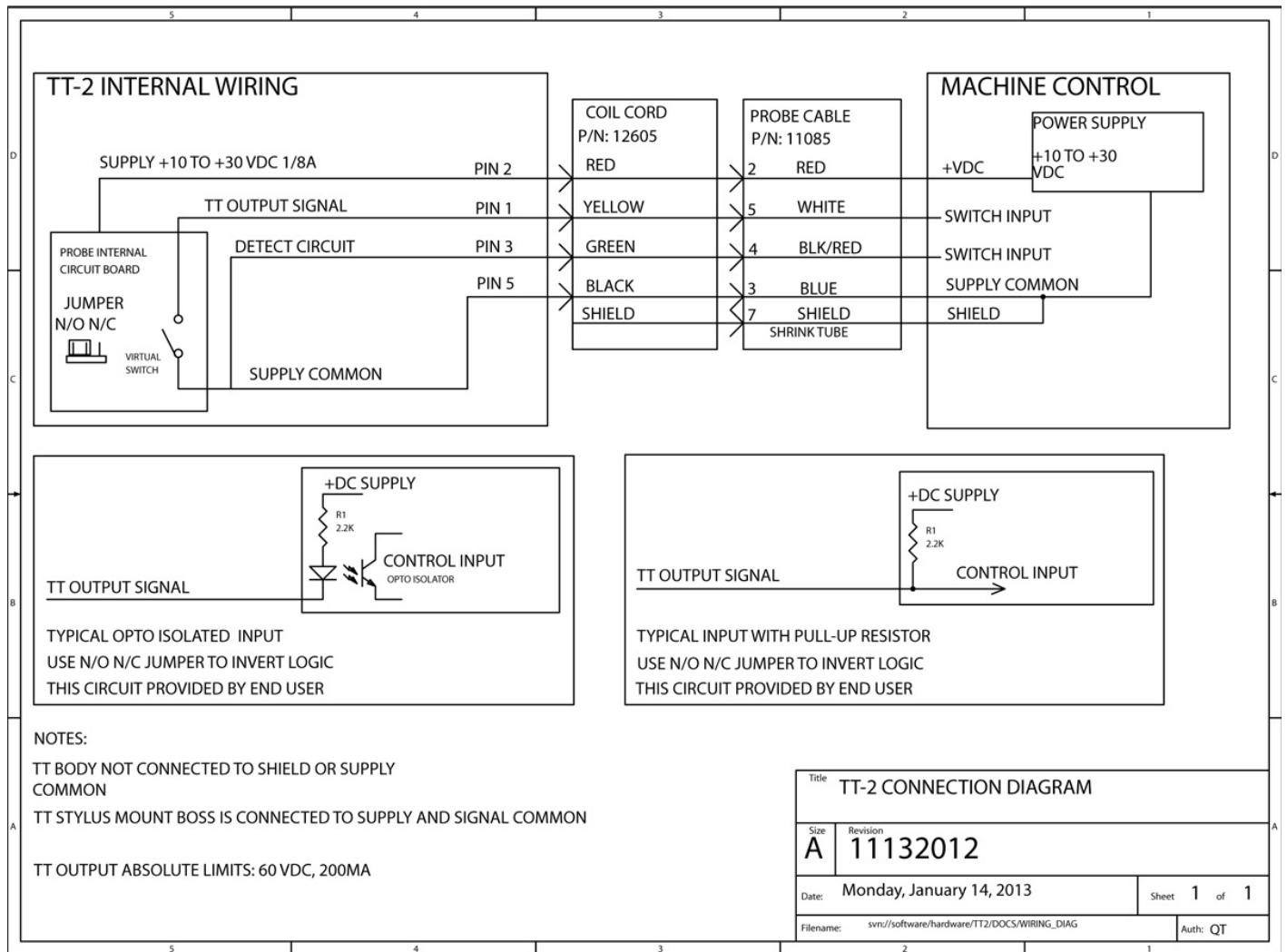
Contents Description:

1. 3/16" Open End Wrench P/N: 2902
2. 3/32" Hex Key P/N: 2898
3. 1/16" Hex Key P/N: 2510
4. Probe Cable Assembly #11085
5. TT2 Assembly #12486
6. Coil Cord Assembly TT2 P/N: 12605



TT2 Carrying Case

CONNECTION DIAGRAM UNIVERSAL



APPENDIX A
CENTROID CONTROL SAE TT PARAMETERS
(see control manual for additional information)

CNC10 systems (recommended basic SAE inch):

Parameter	Setting	Description
3	0	Modal Tool and Height Offset Control
13	0.020	Clearance amount nominal
14	30	Fast Probing Rate
15	3	Slow Probing Rate
17	0	Detector location return point
43	0	Automatic tool measurement options
44	14	TT PLC input number
71	0	Part setup detector height
257	N/A	TT connection detection PLC input
367	1	TT Deceleration Multiplier

CNC11 systems (recommended basic SAE inch):

Parameter	Setting	Description
3	0	Modal Tool and Height Offset Control
13	0.020	Clearance amount nominal
14	30	Fast Probing Rate
15	3	Slow Probing Rate
17	0	Detector location return point
43	0	Automatic tool measurement options
44	50769	TT PLC input number
71	0	Part setup detector height
257	50772	TT connection detection PLC input
367	1	TT Deceleration Multiplier

CENTROID CONTROL METRIC TT PARAMETERS

CNC10 systems (recommended basic METRIC mm):

Parameter	Setting	Description
3	0	Modal Tool and Height Offset Control
13	0.508	Clearance amount nominal
14	762	Fast Probing Rate
15	76.2	Slow Probing Rate
17	0	Detector location return point
43	0	Automatic tool measurement options
44	14	TT PLC input number
71	0	Part setup detector height
257	N/A	TT connection detection PLC input
367	1	TT Deceleration Multiplier

CNC11 systems (recommended basic METRIC mm):

Parameter	Setting	Description
3	0	Modal Tool and Height Offset Control
13	0.508	Clearance amount nominal
14	762	Fast Probing Rate
15	76.2	Slow Probing Rate
16	127	Maximum Search Distance
17	0	Detector location return point
43	0	Automatic tool measurement options
44	50769	TT PLC input number
71	0	Part setup detector height
257	50772	TT connection detection PLC input
367	1	TT Deceleration Multiplier

