DIGITAL TABLET WRITING INSTRUMENT

PRODUCT AND TEST SPECIFICATION

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Performance and test specification for Cross Digital Tablet Writing Instruments

1.0 Scope

1.1 This document specifies the operational, qualification, and acceptance requirements of A. T. Cross digital writing instruments. This document, when specified on the applicable drawing, forms part of the drawing.
1.2 Paragraphs in this document specifying operational or test requirements for components that do not exist in the final product are to be disregarded.
1.3 Where there is a conflict between a specification in this document and an individual unit drawing, the drawing requirement shall be governing.

2.0 Applicable Documents

2.1 A. T. Cross Specifications
- 2.1.1 Quality Matrix
- 2.1.2 TP088 - Cap Pull Off Inspection Procedure
- 2.1.3 TP114 - Heat/Freeze Test
- 2.1.4 TP115 - Qualification/Evaluation Drop Test
- 2.1.5 TP139 - Clip Cycle Preload and Life Cycle Testing
- 2.1.6 TP143 - Heat Aging Test
- 2.1.7 TP156 - Ship, Drop, and Vibration Tests
- 2.1.8 TP158 - Dashboard Test
- 2.1.9 TP190 - Digital Tablet Pen Tip Switch Cycling Test
- 2.1.10 TP191 - Digital Tablet Pen Side Switch Cycling Test
- 2.1.11 TP192 - Digital Tablet Pen Side Switch Functional Test
- 2.1.12 TP193 - Digital Tablet Pen Refill Insertion/Removal Test
- 2.1.13 TP194 - Digital Tablet Pen Maximum Tip Switch Travel Test
- 2.1.14 TP195 - Digital Tablet Pen Current Consumption Test
- 2.1.15 TP196 - Digital Tablet Pen Functional Test
- 2.1.16 TP197 - Digital Tablet Pen Tip Switch Actuation Force Test
- 2.1.17 TP198 - Digital Tablet Pen Barrel Torque Test

2.2 Compliance Specifications
- 2.2.1 CISPR Publication 22 - Limits and Methods of Measurement of Radio Interference Characteristics of Information Technology Equipment
- 2.2.2 IEC 61000-4-2 - Electrostatic Discharge Immunity Test
- 2.2.3 IEC 61000-4-3 - Radiated, RF, EMF Electromagnetic Fields Immunity Test
- 2.2.4 Title 47 CFR, Part 15, Subpart B - FCC, Radio Frequency Devices, Unintentional Radiators
- 2.2.5 EN 60950
- 2.2.6 UL 60950 - Underwriter's Laboratories Standard for Safety of Information Technology Equipment
- 2.2.7 VCCI

2.3 Other
- 2.3.1 ANSI/NEDA 25A
- 2.3.2 IEC LR61
- 2.3.3 NSTA - National Safe Transit Association Pre Shipment Test Procedures

3.0 Specifications

3.1 Environmental - The pen shall be capable of operation under the following operating conditions and sustain no damage after exposure to the non-operating conditions. The pen shall be capable of normal operation after removal from exposure to the non-operating conditions.

3.1.1 Temperature

3.1.1.1 Operating	0°C to +50°C (+32°F to +122°F)
3.1.1.2 Non-Operating (continuous)	-20°C to +60°C (-4°F to +140°F)

3.1.1.3 Extreme (10 minutes) 99°C (210°F)

3.1.2 Thermal Cycling (non-operating) - The unit shall be capable of cycling between the extremes of the non-operating temperatures of paragraph 3.1.1.2.

3.1.3 Relative Humidity (Non-Condensing)

3.1.3.1 Operating 5% to 95% RH

3.1.3.2 Non-Operating 5% to 95% RH

3.1.4 Altitude

3.1.4.1 Operating <3657m above MSL (12,000 ft.)

3.1.4.2 Non-Operating <12,000 m above MSL (39,360 ft.)

3.1.5 Shock

3.1.5.1 Unit Drop Test - The pen shall operate as specified after dropping from 91.5 cm (36 in.) and landing in any orientation on to a linoleum-covered concrete floor. This requirement does not apply to the stylus or inking refill but one must be installed for proper testing.

3.1.5.2 Packaging Drop Test - When properly packaged, the pen shall operate after being dropped from a height of 152.5 cm (60 in.) and landing on any package edge or vertex on a concrete floor.

3.1.6 Vibration (non-operating)

3.1.6.1 Random 6.1G, rms

3.1.6.2 Sine 1.0G, peak, 5Hz to 500Hz

3.1.6.3 Packaged Packaged product shall be capable of withstanding the vibration set fort in the National Safe Transit Association Pre Shipment Test Procedures Project 1A, section B, Part 1.

3.1.7 Electromagnetic Interference Emissions - The unit must comply with the emissions requirements of the following:

3.1.7.1 IEC CISPR Publication 22 for a Class B device

3.1.7.2 FCC Rules and Regulations, Title 47, Part 15, Subpart B for a Class B device.

3.1.7.3 VCCI Class B ITE

3.1.8 Electromagnetic Interference Immunity - The unit must comply with the immunity requirements of IEC 61000-4-3

3.1.9 Electrostatic Discharge Immunity

3.1.9.1 Contact Discharge - The unit shall be capable of accepting an electrostatic contact discharge of ± 15kV with no user intervention required to resume proper functioning.

3.1.9.2 Air Discharge - The unit shall be capable of accepting an electrostatic air discharge of ± 15kV with no user intervention required to resume proper functioning.

3.2 Mechanical

3.2.1 Tip Switch - The device contains a tip switch that is activated when the pen tip, inking or non-inking user-replaceable refill, is depressed.

3.2.1.1 Normally Closed - The switch is normally closed when the tip is not depressed.

3.2.1.2 Actuation Force and Travel - The forces to activate the switch and the minimum activation travel and maximum travel of the switch are specified on the applicable drawing.

3.2.1.3 Cycle life - The tip switch shall be capable of 10 million cycles from the normally closed position to full actuation at a maximum load of 125 g_f (4.4 oz).

3.2.2 Single Action Side Switch - The device may contain a side switch that is actuated independently of the tip switch by a user action.

3.2.2.1 Momentary Switch - The side switch is a normally open momentary on/off switch with tactile feel.

3.2.2.2 Actuation Force - The side switch shall be activated by application of 160 ± 60 g_f (5.6 ± 2.1 oz).

3.2.2.3 Cycle life - The side switch shall be capable of 500,000 cycles of 0 g_f to 220 g_f (0 oz to 7.7 oz).

3.2.3 Dual Action Side Switch - The device may contain a dual action switch (rocker switch) or two independent side switches.

3.2.3.1 Momentary Switch - Each of the two switches is a normally open momentary on/off switch with tactile feel.

3.2.3.2 Actuation Force - Each of the side switches shall be activated by the application of 160 ± 60 g_f (5.6 ± 2.1 oz).

3.2.3.3 Cycle Life - Each of the side switches shall be capable of independently cycling 500,000 times between 0 g_f. and 220 g_f (0 and 7.7 oz).

3.2.4 Battery

3.2.4.1 Type - The device shall use a non-rechargable "AAAA" battery conforming to ANSI/NEDA 25A or IEC LR61.

3.2.4.2 Installation - The battery shall be installed with the positive terminal toward the front PCB and the negative terminal toward the back of the barrel. The battery must not be installed with the polarity reversed.

3.2.4.3 Removal - The device shall have the capability of internal battery removal and replacement by screwing/unscrewing the barrel section from the front section by hand without the use of separate tools.

3.2.5 Maximum Torque - There shall be no damage to the front section or barrel after application of .53 N-m (75 in-oz) of torque to tighten the threaded joint.

3.2.6 Refill Insertion and Removal - The refill (stylus or inking refill) shall be capable of being inserted with a maximum force of 4 kg_f (9 lb_f.) and shall require a removal force of 140 g_f (5 oz.) minimum.

3.2.7 Clip Preload - The clip shall require 181 g_f (.4 lb_f.) min and 635 g_f (1.4 lb_f.)max force to lift off of the installed position.

3.2.8 Clip Cycling - The clip shall be capable of being cycled between the installed height and 3.18 mm (.125 in.) for 6000 cycles with no degradation in preload below the minimum per paragraph 3.2.7and no cracking.

3.2.9 Cap on/off Force - The force required to install the cap or to remove the cap from either the barrel or front section shall be 907 g_f (2 lb_f.) min and 3.62 kg_f (8 lb_f.) max.

3.2.10 Cap on/off Cycling - The cap shall be capable of being cycled on and off of either the barrel or front section a minimum of 1500 times without a reduction in Cap on/off Force below the minimum per paragraph 3.2.9.

3.3 Electrical

3.3.1 Operational States

3.3.1.1 Standby Operation - Pen is inactive and has no output signal.

3.3.1.2 Normal Operation - Pen is transmitting signal per paragraph 3.3.3.

3.3.1.3 State switching - The pen will activate from Standby to Normal by actuating the tip switch. The pen will change from Normal to Standby after 10.5 ± 3.5 minutes of no tip switch activity with a fresh battery.

3.3.2 Power

3.3.2.1 Battery Size - The pen shall be capable of accepting a "AAAA" battery size as defined by ANSI/NEDA specification 25A or IEC specification LR61.

3.3.2.2 Voltage Limits - The pen shall operate according to specification with a battery supply voltage between 1.1 and 1.6 volts.

3.3.2.3 Power Consumption

3.3.2.3.1 Normal Operation	400 µA max
3.3.2.3.2 Standby Operation	8 µA max

3.3.3 Transmission Frequencies and Amplitude

3.3.3.1 Nominal Limits - Table 1 shows the nominal limits of pen output frequency and amplitude of the magnetic field for various switch-setting combinations with the pen in Normal mode. The nominal limits

are valid for a battery supply voltage of 1.5 volts and ambient conditions of 20°C to 26.5°C and 20% to 60% relative humidity and the pen axis held vertical with respect to the test surface.

3.3.3.2 Absolute Limits - The Absolute Limits of Table 1 show the output frequency and amplitude of the magnetic field for various switch-setting combinations with the pen in Normal mode. The absolute limits are valid for any individual limts of battery voltage, operating temperature, operating relative humidity, or operating altitude .

Switch Status	Nominal Limits		Absolute Limits	
	Frequency (kHz)	Amplitude*	Frequency (kHz)	Amplitude*
Idle (no switches)	458.0-465.0		454.0 - 469.6	
Tip switch only	482.0-494.0		475.6 - 498.0	
Tip switch + Single Side Switch or Primary dual side switch	433.8-445.4		431.0 - 447.6	
Single Side Switch or Primary dual side switch only	415.0-424.0		410.0 - 425.0	
Tip switch + Secondary dual side switch				
Secondary dual side switch only				

*Amplitude is A/D converter output count measured at the test surface

TABLE 1 - Output Limits

3.3.4 Tilt performance - The pen shall be capable of achieving Nominal Limits of frequency output in Table 1 with the pen angled ± 45° from vertical with respect to the test surface.

3.3.5 Hover performance - The pen shall be capable of achieving Nominal Limits of frequency output in Table 1 for Idle state with the tip held up to 12 mm (.47 in) above the test surface.

3.4 Safety - The unit must comply with applicable safety standards including:

3.4.1 European Standard EN60950

3.4.2 Underwriters Laboratories UL60950 as a Recognized Component for the US and Canada.

4.0 Qualification Testing

4.1 Qualification Test Plan - The vendor shall develop and submit to A. T. Cross Engineering a Qualification Test Plan to verify compliance of the production units to the specification and drawings. The plan shall consist of identification of the specific requirement, a description of the apparatus used to conduct the test, and a description of the method used to conduct the test.

4.1.1 Paragraphs of this specification stating requirements for components that are not applicable to the final product shall be clearly marked as "not applicable" in the test plan.

4.1.2 The Qualification Test Plan shall be date controlled and shall identify the specific part number and drawing revision of the test unit.

4.1.3 The Qualification Test Plan for a specific part shall include requirements listed on the drawing in addition to those of the specification.

4.2 Qualification Test Report - The vendor shall submit a Qualification Test Report to A. T. Cross Engineering at the completion of the pre-production run. The report shall include all information in the Qualification Test Plan in addition to the test data and an indication of pass/fail for each requirement. The report must be approved by A. T. Cross Engineering prior to the start of production unless otherwise agreed to in writing.

4.2.1 Paragraphs of this specification stating requirements for components that are not applicable to the final product shall be clearly marked as "not applicable" in the test report.

4.3 First Article Inspections (FAI) - An FAI shall be conducted on a minimum of 6 pieces of each mechanical component. The FAI report shall indicate the dimension being measured, the acceptable tolerance per the drawing, the measurement tool used, the actual measured value, an identification of go/no go and, if no go, an amount above or below the specified limit. FAI reports for each part shall be included in the Qualification Test Report.

4.4 Changes - The vendor shall submit updated Qualification Test Reports and/or FAI reports after any changes to materials or processes that may affect the outcome of the test. All changes must be preapproved by A. T. Cross Engineering prior to implementation. A determination will be made at that time by mutual agreement if qualification testing or new FAI's need to be conducted.

4.5 Requalification - The vendor shall conduct qualification testing periodically or as requested by A. T. Cross to insure that the performance requirements continue to be met. The qualification schedule shall be mutually agreed to by A. T. Cross and the vendor.

4.6 A. T. Cross Qualification - A. T. Cross reserves the right to conduct initial qualification testing as well as random lot qualification testing to insure that product continues to meet the performance requirements. Tests may include, but are not limited to:

4.6.1 Barrel Torque - Test per TP198
4.6.2 Refill Insertion/Removal - Test per TP193
4.6.3 Tip Actuation Force - Test per TP197
4.6.4 Tip Cycling - Test per TP190
4.6.5 Max Tip travel - Test per TP194
4.6.6 Max Tip force - Test per TP197
4.6.7 Side Switch Actuation - Test per TP192
4.6.8 Side Switch Cycling - Test per TP191
4.6.9 Reliability Drop - Test per TP115
4.6.10 Heat/Freeze Cycling - Test per TP114
4.6.11 Environmental Aging - Test per TP143
4.6.12 Cap on/off force - Test cap-off force per TP088
4.6.13 Cap on/off cycling
4.6.14 Clip Preload - Test per TP139
4.6.15 Clip Cycling - Test per TP139
4.6.16 Dashboard - Test per TP158
4.6.17 Package Drop - Test per TP156
4.6.18 Package Vibration - Test per TP156
4.6.19 Current Consumption
4.6.20 State Switching
4.6.21 Frequency Output - Test per TP196
4.6.22 Tilt Performance
4.6.23 Hover Performance
4.6.24 Electrostatic Discharge - Test per IEC 61000-4-2
4.6.25 Electromagnetic Interference Emissions - Test per CISPR 22
4.6.26 Electromagnetic Interference Immunity - Test per IEC 61000-4-3
4.6.27 Heavy Metal Content - Certify per paragraph 6.1
4.6.28 Workmanship
4.6.29 Dimensional - Inspect per QCI listed on drawing(s).

5.0 Acceptance Testing

5.1 Acceptance Test Plan - The vendor shall develop and submit to A. T. Cross Engineering an Acceptance Test Plan to verify the proper function of each production and/or ship lot. The plan shall consist of identification of the specific requirement, a description of the apparatus used to conduct the test, a description of the method used to conduct the test and a sampling rate.

- 5.1.1 Paragraphs of this specification stating requirements for components that are not applicable to the final product shall be clearly marked as "not applicable" in the test plan.
- 5.1.2 The Acceptance Test Plan shall be date controlled and shall identify the specific part number and drawing revision of the test unit.
- 5.1.3 The Acceptance Test Plan for a specific part may include requirements listed on the drawing in addition to those of the specification.

5.2 Acceptance Test Report - The vendor shall submit an Acceptance Test Report to A. T. Cross with each shipment. The report shall include acceptance test data used to determine the suitability of the production lot for shipment.

- 5.2.1 Paragraphs of this specification stating requirements for components that are not applicable to the final product shall be clearly marked as "not applicable" in the test report.

5.3 A. T. Cross Acceptance Testing - A. T. Cross reserves the right to reject any shipment based on acceptance testing conducted by A. T. Cross at its facility or by its designated representatives.

- 5.3.1 Tip Actuation Force
- 5.3.2 Max Tip Travel
- 5.3.3 Side Switch Actuation
- 5.3.4 Frequency Response
- 5.3.5 Test Writing
- 5.3.6 Workmanship
- 5.3.7 Dimensional

6.0 Notes

6.1 Packaging - Any packaging and all associated materials used to ship product to A. T. Cross or any other designated location must be certified free of lead, cadmium, mercury and hexavalent chromium per the requirements of the Council of State Governments. See http://www.statesnews.org/tpch/tpch.htm for additional data and requirements.

6.2 Electrical Testing - All electrical/electromagnetic compliance and safety testing shall be conducted in accordance with the parameters set forth by the IEC for test reports conforming to the IECEE CB Scheme and test facilities must be registered with the Voluntary Control Council for Interference by Information Technology Equipment of Japan (VCCI) (for applicable tests). Tests must include National Deviations for a minimum of the following countries:

- 6.2.1 United States.
- 6.2.2 Any country specifically listed on the drawing for the final product.

6.3

6.4 Applicability of Tests - All testing applied to this unit is applicable only to the unit. It is the system integrator's responsibility to insure compliance to all regulatory agency requirements for the function of the unit with higher level devices.

7.0 Revision History

REV:	Preliminary	DATE:	17 April, 2002	ECO #	-	INITIALS:	RSD
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