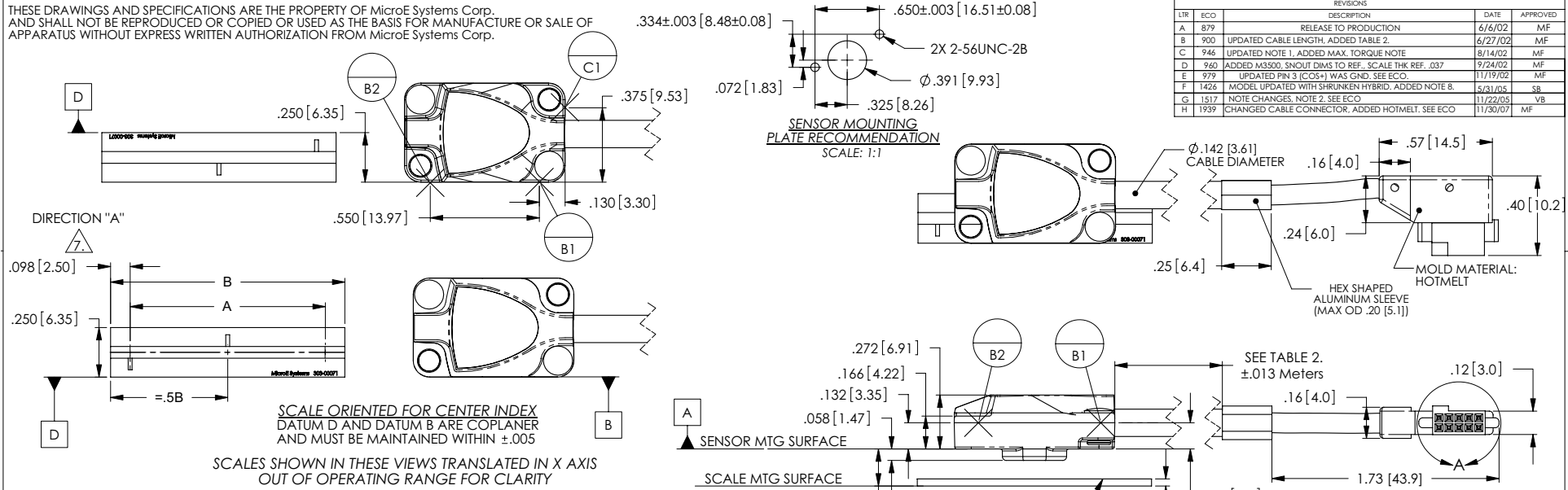


Mercury 2000, 3000 & 3500 Encoder System Interface Drawing: Short Linear Scales

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF MicroE Systems Corp. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS WITHOUT EXPRESS WRITTEN AUTHORIZATION FROM MicroE Systems Corp.

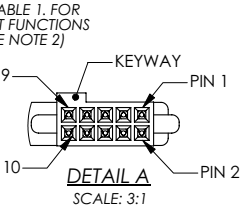


REVISIONS				
LTR	ECO	DESCRIPTION	DATE	APPROVED
A	879	RELEASE TO PRODUCTION	6/6/02	MF
B	900	UPDATED CABLE LENGTH, ADDED TABLE 2.	6/27/02	MF
C	946	UPDATED NOTE 1. ADDED MAX. TORQUE NOTE	8/14/02	MF
D	960	ADDED M3000, SNOUT DIMS TO REF. SCALE THK REF. .037	9/24/02	MF
E	979	UPDATED PIN 3 (COS+) WAS GND. SEE ECO.	11/19/02	MF
F	1426	MODEL UPDATED WITH SHRUNKEN HYBRID. ADDED NOTE 8.	5/31/05	SB
G	1517	NOTE CHANGES. NOTE 2. SEE ECO	11/22/05	VB
H	1939	CHANGED CABLE CONNECTOR. ADDED HOTMELT. SEE ECO	11/20/07	MF

- NOTE:**
- RECOMMENDED MOUNTING HARDWARE:
2-56 OR M2 SCREWS w/ 4 FLAT WASHERS (2 ON EACH SCREW) (OD OF WASHER NOT TO EXCEED .150 [3.81]).
MAX. TORQUE: 3.3 in. lbs
 - FOR APPLICATIONS USING THE SMARTPRECISION ELECTRONICS THIS CONNECTOR (FCI p/n 87012-605 or SAMTEC p/n SFM-105-03-S-D) IS INSIDE THE ENCLOSURE (see Interface drawings). ADDITIONAL STRAIN RELIEF MUST BE PROVIDED IF MICROE SUPPLIED ELECTRONICS IS NOT USED.
RECOMMENDED MATING CONNECTOR: FCI p/n 87407-105/SAMTEC p/n TFM series OR EQUIVALENT.
 - IF BENCHING PINS ARE TO BE USED, PINS MUST BE PLACED ALONG DATUM EDGES OF BOTH THE SENSOR AND THE SCALE FOR PROPER ALIGNMENT. (REFERENCE DATUMS B1, B2 AND C1 FOR SENSOR BENCHING PINS)
 - HEIGHT OF SENSOR BENCHING PINS MUST BE A MINIMUM OF .170 [4.32] IN HEIGHT FROM DATUM A.
 - HEIGHT OF SCALE BENCHING PINS NOT TO EXCEED THE THICKNESS OF THE SCALE.
 - RECOMMENDED SENSOR MOUNTING PLATE THICKNESS:
MINIMUM- 4 SCREW THREADS
MAXIMUM- ALLOW CLEARANCE TO SCALE AND SCALE MOUNTING HARDWARE (BENCHING SURFACES, CLAMPS, HUBS, ETC.)

TABLE 2.

Cable Length	
(1500H)	(2000/3000/3500)
1 Meter	.5 Meter
2 Meter	1 Meter
5 Meter	2 Meter



SCALE IDENTIFICATION AND SIZE

Scale	Dim A.	Dim B.
Identification #	Measured Length	Scale Length
LXX	XXmm-5mm	XXmm
L30	30mm-5mm = 25mm	30mm
(max) L130	130mm-5mm = 125mm	130mm

THESE ARE EXAMPLES

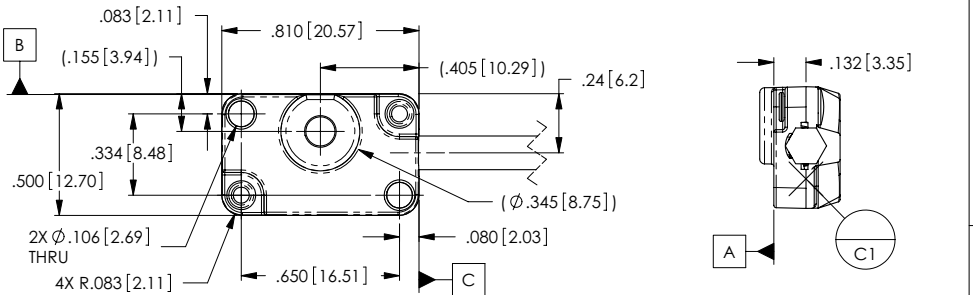


TABLE 1.

5x2.050" PITCH HEADER		
PIN	Function (2000/3000/3500)	Function (1500H)
1	SIN+	SIN+
2	INDEX WINDOW-	INDEX WINDOW-
3	SIN-	COS+
4	GND	GND
5	COS+	A+
6	INDEX WINDOW+	INDEX WINDOW+
7	COS-	A-
8	+5V	+5V
9	N/C	B+
10	N/C	B-

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES (millimeters) DIM. APPLY AFTER PROCESSING INTERPRET ALL GEOMETRIC TOLS. PER ANSI Y14.5M-1994

TOLERANCES ARE:
DECIMALS: .XX [X]±.01 [25]
ANGULAR: .XXX [XX]±.005 [1.3] ±30 MIN.

APPROVALS	DATE
DRAWN: S.BUTURLIA	4/18/01
CHECKED:	
ENGRS: DON GRIMES	6/5/02
MFG ENG: M.SKWIRA	6/6/02
QA: J.FARNAM	6/6/02

MicroE Systems
8 Erie Drive
Natick, MA 01760

DESCRIPTION: INTERFACE, ENCODER, 20um, SHORT LINEAR, CABLE OUT, MERCURY 1500H/2000/3000/3500 SENSOR

SCALE: 2:1 CAD FILE: ID-00200

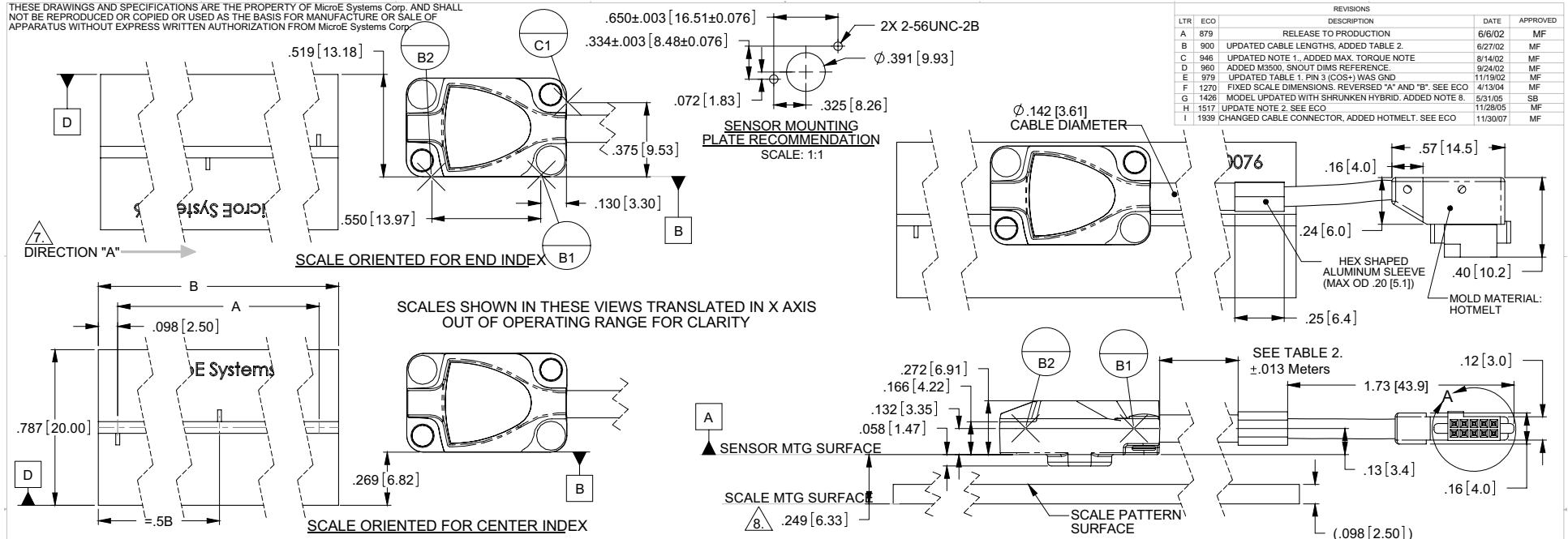
REV: H

7. WHEN SCALE MOVES IN DIRECTION "A" WITH RESPECT TO A STATIONARY READHEAD, OUTPUT SIGNAL COS+/B+ (PIN 5/PIN 9) LEADS OUTPUT SIGNAL SIN+/A+ (PIN 1/PIN 5).

8. FOR SCALES ATTACHED WITH ADHESIVE TAPE (LXX-T), THE SCALE MOUNTING SURFACE MUST BE .006" FURTHER AWAY FROM SENSOR MOUNTING SURFACE FOR NOMINAL Z HEIGHT. DIM = .193 [4.90]

Mercury 2000, 3000 & 3500 Encoder System Interface Drawing: Long Linear Scales

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF MicroE Systems Corp. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS WITHOUT EXPRESS WRITTEN AUTHORIZATION FROM MicroE Systems Corp.



LTR	ECO	DESCRIPTION	DATE	APPROVED
A	879	RELEASE TO PRODUCTION	6/6/02	MF
B	900	UPDATED CABLE LENGTHS, ADDED TABLE 2	6/27/02	MF
C	946	UPDATED NOTE 1, ADDED MAX. TORQUE NOTE	8/14/02	MF
D	960	ADDED M3500, SNOUT DIMS REFERENCE.	9/24/02	MF
E	979	UPDATED TABLE 1, PIN 3 (COS+) WAS GND	11/19/02	MF
F	1270	FIXED SCALE DIMENSIONS, REVERSED "A" AND "B". SEE ECO	4/13/04	MF
G	1426	MODEL UPDATED WITH SHRUNKEN HYBRID. ADDED NOTE 8.	5/31/05	SB
H	1517	UPDATE NOTE 2. SEE ECO	11/28/05	MF
I	1939	CHANGED CABLE CONNECTOR, ADDED HOTMELT. SEE ECO	11/30/07	MF

- NOTES:**
- RECOMMENDED MOUNTING HARDWARE: 2-56 OR M2 SCREWS w/ 4 FLAT WASHERS (2 ON EACH SCREW) (OD OF WASHER NOT TO EXCEED .150 [3.81]). MAX. TORQUE: 3.3 in. lbs
 - FOR APPLICATIONS USING THE SMARTPRECISION ELECTRONICS THIS CONNECTOR (FCI p/n 87012-605 or SAMTEC p/n SFM-105-03-S-D) IS INSIDE THE ENCLOSURE (see Interface drawings). ADDITIONAL STRAIN RELIEF MUST BE PROVIDED IF MICROE SUPPLIED ELECTRONICS IS NOT USED. RECOMMENDED MATING CONNECTOR: FCI p/n 87407-105/SAMTEC p/n TFM SERIES OR EQUIVALENT.
 - IF BENCHING PINS ARE TO BE USED, PINS MUST BE PLACED ALONG DATUM EDGES OF BOTH THE SENSOR AND THE SCALE FOR PROPER ALIGNMENT (SEE TABLE 1. FOR PINOUT FUNCTIONS (SEE NOTE 2))
 - HEIGHT OF SENSOR BENCHING PINS MUST BE A MINIMUM OF .170 [4.32] IN HEIGHT FROM DATUM A.
 - HEIGHT OF SCALE BENCHING PINS NOT TO EXCEED THE THICKNESS OF THE SCALE.
 - RECOMMENDED SENSOR MOUNTING PLATE THICKNESS: MINIMUM- 4 SCREW THREADS MAXIMUM- ALLOW CLEARANCE TO SCALE AND SCALE MOUNTING HARDWARE (BENCHING SURFACES, CLAMPS, HUBS, ETC.)

TABLE 2.

Cable Length	
(1500H)	(2000/3000/3500)
1 Meter	.5 Meter
2 Meter	1 Meter
5 Meter	2 Meter

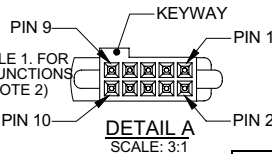


TABLE 1.

5x2, .050" PITCH HEADER

PIN	Function (2000/3000/3500)	Function (1500H)
1	SIN+	SIN+
2	INDEX WINDOW-	INDEX WINDOW-
3	SIN-	COS+
4	GND	GND
5	COS+	A+
6	INDEX WINDOW+	INDEX WINDOW+
7	COS-	A-
8	+5V	+5V
9	N/C	B+
10	N/C	B-

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES (millimeters) DIM. APPLY AFTER PROCESSING INTERPRET ALL GEOMETRIC TOLS. PER ANS Y14.5M-1994

TOLERANCES ARE:
DECIMALS: .XX [X]±.01 [25]
.XXX [XX]±.005 [13]

APPROVALS	DATE
DRAWN: S.BUTURLIA	4/18/01
CHECKED:	
ENGRG: DON GRIMES	6/5/02
MFG ENG: M.SKWIRA	6/6/02
GA: J.FARNAM	6/6/02

UNITS: .in [mm]

MicroE Systems
Division of GSI

8 Erie Drive
Natick, MA 01760

DESCRIPTION: INTERFACE, ENCODER, 20um, LONG LINEAR, CABLE OUT, MERCURY 1500H/2000/3000/3500 SENSOR

SIZE: B
DWG. NO.: ID-00201
SHEET 1 OF 1

- WHEN SCALE MOVES IN DIRECTION "A" WITH RESPECT TO A STATIONARY READHEAD, OUTPUT SIGNAL COS+/B+ (PIN 5/PIN 9) LEADS OUTPUT SIGNAL SIN+/A+ (PIN 1/PIN 5).
 - FOR SCALES ATTACHED W/ADHESIVE TAPE (LXX-T), THE SCALE MOUNTING SURFACE MUST BE .006" FURTHER AWAY FROM SENSOR MOUNTING SURFACE FOR NOMINAL Z HEIGHT. DIM = .255[6.48]
- THESE ARE EXAMPLES

SCALE IDENTIFICATION AND SIZE

Scale	Dim A.	Dim B.
Identification #	Measured Length	Scale Length
LXX	XXmm-5mm	XXmm
L155	155mm-5mm = 150mm	155mm
(max) L2025	2025mm-5mm = 2020mm	2025mm

Mercury 2000, 3000 & 3500 Encoder System Interface Drawing: Rotary Scales with Hub

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF MicroE Systems Corp. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS WITHOUT EXPRESS WRITTEN AUTHORIZATION FROM MicroE Systems Corp.

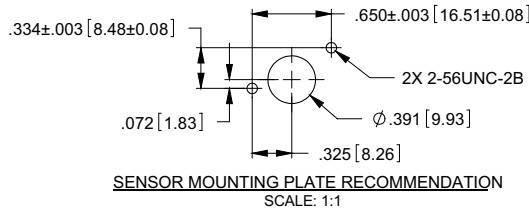
NOTE:

1. RECOMMENDED MOUNTING HARDWARE:
2-56 OR M2 SCREWS w/ 4 FLAT WASHER (2 ON EACH SCREW)
(OD OF WASHERS NOT TO EXCEED .150 [3.81]).
MAX TORQUE: 3.3 in. lbs
2. FOR APPLICATIONS USING THE SMARTPRECISION ELECTRONICS THIS CONNECTOR (FCI p/n 87012-605 or SAMTEC p/n SFM-105-03-S-D) IS INSIDE THE ENCLOSURE (see Interface drawings). ADDITIONAL STRAIN RELIEF MUST BE PROVIDED IF MICROE SUPPLIED ELECTRONICS IS NOT USED. RECOMMENDED MATING CONNECTOR: FCI p/n 87407-105/SAMTEC p/n TFM SERIES OR EQUIVALENT.
3. IF BENCHING PINS ARE TO BE USED, PINS MUST BE PLACED ALONG DATUM EDGES OF SENSOR FOR PROPER ALIGNMENT. (REFERENCE DATUMS B1, B2 AND C1).
4. HEIGHT OF SENSOR BENCHING PINS MUST BE A MINIMUM OF .170 [4.32] IN HEIGHT FROM DATUM A.
5. RECOMMENDED SENSOR MOUNTING PLATE THICKNESS:
MINIMUM- 4 SCREW THREADS
MAXIMUM- ALLOW CLEARANCE TO SCALE AND SCALE MOUNTING HARDWARE (BENCHING SURFACES, CLAMPS, HUBS, ETC.)

△ WHEN SCALE MOVES IN DIRECTION "A" WITH RESPECT TO A STATIONARY READHEAD, OUTPUT SIGNAL COS+ / B+ (PIN 5 / PIN 9) LEADS OUTPUT SIGNAL SIN+ / A+ (PIN 1 / PIN 5).

TABLE 2.
Cable Length

(1500H)	(2000/3000/3500)
1 Meter	.5 Meter
2 Meter	1 Meter
5 Meter	2 Meter



SCALE IDENTIFICATION AND SIZE. DIMENSIONS IN INCHES [MILLIMETERS]

Scale Identification	Counts/Rev	Dim. A Scale O.D.	Scale I.D.	Dim. B Optical Dia.	Dim. C Mounting Dim.	Dim D. Hub I.D.	Dim E. Mounting Hole Dia.	Thread F	Dim H. Bolt Circle	Dim. J Hub Height	Dim. K Scale Thickness	Dim. L Hub Relief
R1206	1,650	0.472 [12.00]	.250+/-0.005 [6.35+/-0.13]	0.413 [10.50]	0.348+/-0.002 [8.84+/-0.05]	0.1253+0.0005/-0.0000 [3.182+0.13/-0.000]	N/A	N/A	N/A	0.040 [1.02]	.036+/-0.002 [0.91+/-0.05]	0.045 [1.14]
R1910	2,500	0.750 [19.05]	.375+/-0.005 [9.53+/-0.13]	0.627 [15.92]	0.454+/-0.002 [11.53+/-0.05]	0.1253+0.0005/-0.0000 [3.182+0.13/-0.000]	0.047 [1.19]	0-80 [6.35]	0.250 [6.35]	0.040 [1.02]	.090+/-0.004 [2.29+/-1.0]	0.105 [2.67]
R3213	4,096	1.250 [31.75]	.500+/-0.005 [12.70+/-0.13]	1.027 [26.08]	0.654+/-0.002 [16.62+/-0.05]	0.2503+0.0005/-0.0000 [6.357+0.13/-0.000]	0.070 [1.78]	2-56 [9.40]	0.370 [9.40]	0.050 [1.27]	.090+/-0.004 [2.29+/-1.0]	0.105 [2.67]
R5725	8,192	2.250 [57.15]	1.000+/-0.005 [25.40+/-0.13]	2.053 [52.15]	1.168+/-0.002 [29.66+/-0.05]	0.5003+0.0005/-0.0000 [12.707+0.13/-0.000]	0.136 [3.45]	8-32 [19.05]	0.750 [19.05]	0.060 [1.52]	.090+/-0.004 [2.29+/-1.0]	0.105 [2.67]
R10851	16,384	4.250 [107.95]	2.000+/-0.005 [50.80+/-0.13]	4.106 [104.30]	2.194+/-0.002 [55.73+/-0.05]	1.0003+0.0005/-0.0000 [25.408+0.13/-0.000]	0.136 [3.45]	8-32 [34.93]	1.375 [34.93]	0.080 [2.03]	.090+/-0.004 [2.29+/-1.0]	0.105 [2.67]

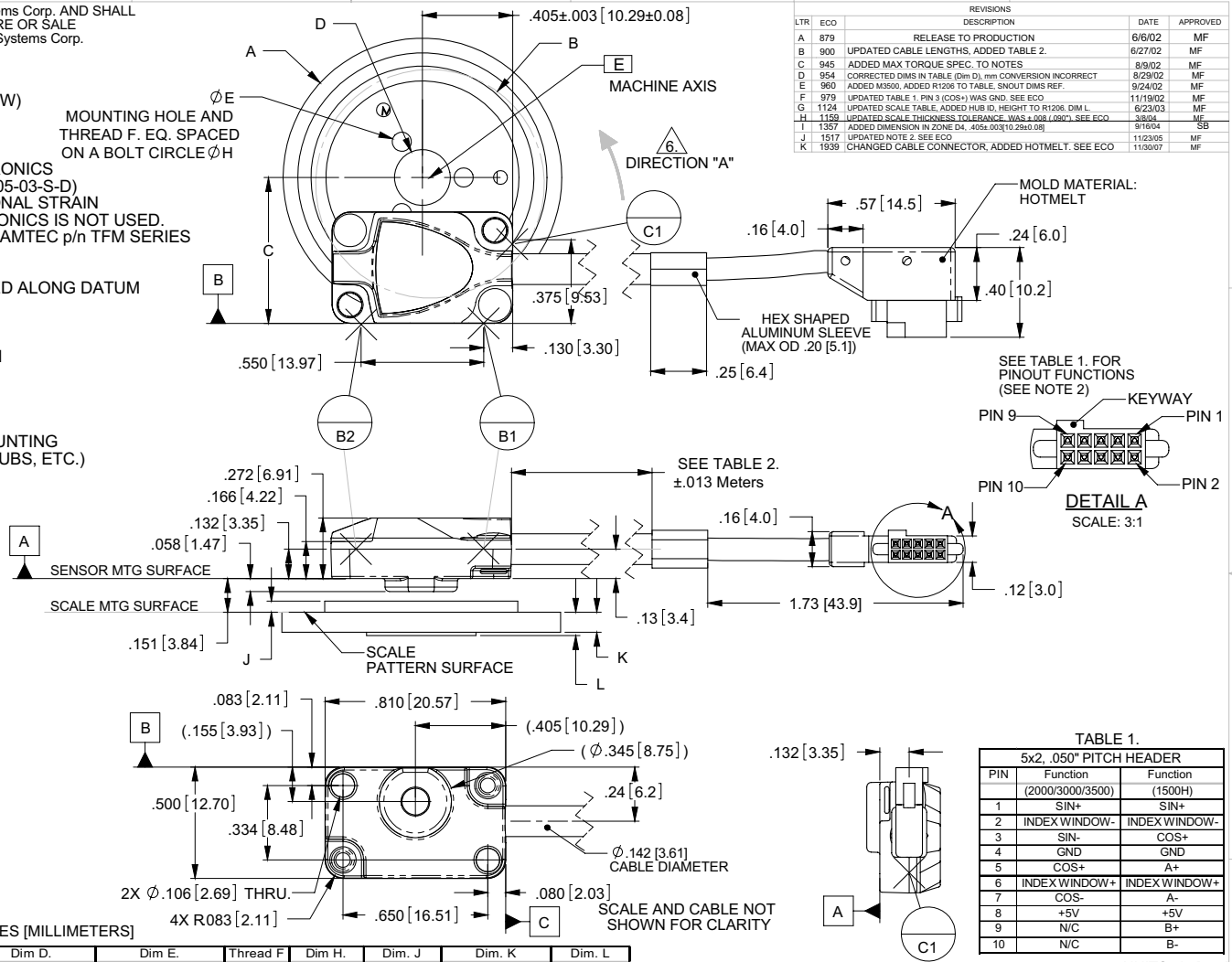


TABLE 1.
5x2, .050" PITCH HEADER

PIN	Function (2000/3000/3500)	Function (1500H)
1	SIN+	SIN+
2	INDEX WINDOW-	INDEX WINDOW-
3	SIN-	COS+
4	GND	GND
5	COS+	A+
6	INDEX WINDOW+	INDEX WINDOW+
7	COS-	A-
8	+5V	+5V
9	N/C	B+
10	N/C	B-

UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN INCHES [millimeters]. DIM. APPLY AFTER PROCESSING INTERPRET ALL GEOMETRIC TOLS. PER ANSI Y14.5M-1994.

TOLERANCES ARE:
DECIMALS: .XX [X±.01 (25)]
XXX [XX±.005 (13)]

ANGULAR: ±30 MIN.

APPROVALS: DATE: 4/20/01
DRAWN: S.BUTURLIA
CHECKED: [Signature]
ENGR: DON GRIMES 6/5/02
MFG ENGR: M.SKWIRA 6/6/02
QA: J.FARNAM 6/6/02

DESCRIPTION: INTERFACE, ENCODER, 20um, ROTARY w/HUB, CABLE OUT, MERCURY 1500H/2000/3000/3500 SENSOR

UNITS: .in [mm]
MicroE Systems Division of GSI
8 Erie Drive
Natick, MA 01760

SCALE: 2:1 CAD FILE: ID-00202 REV K

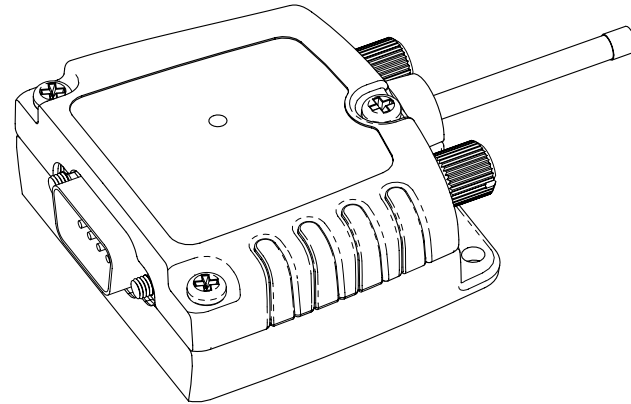
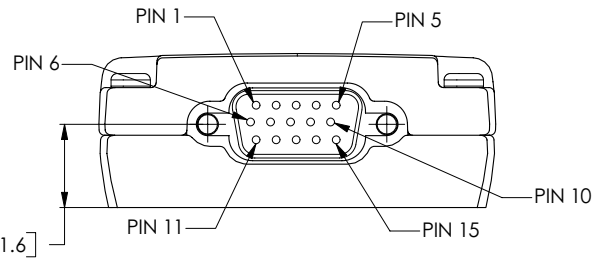
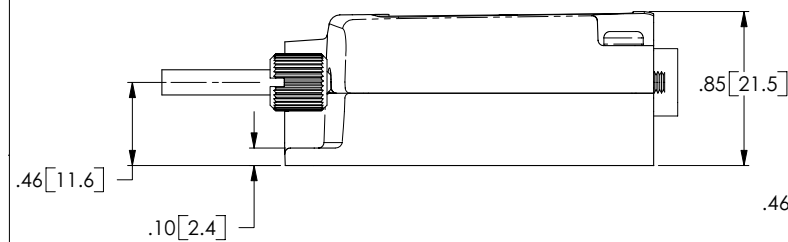
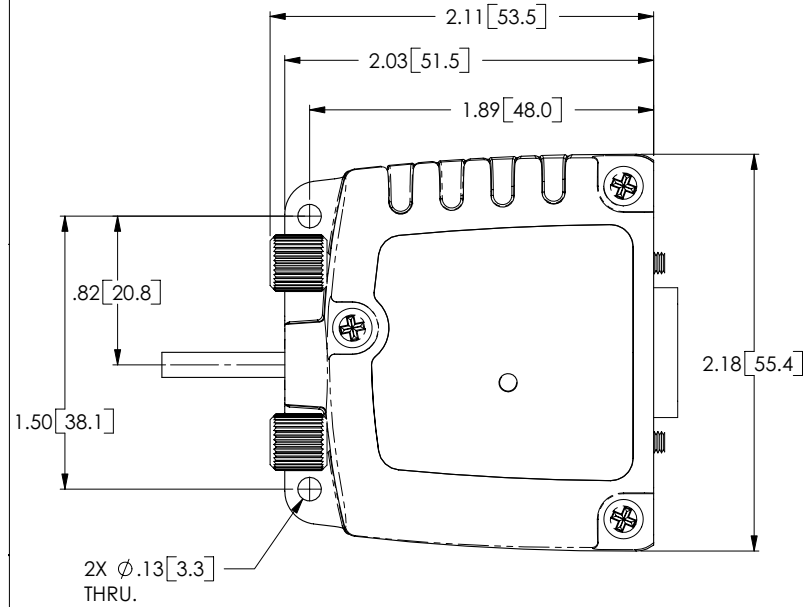
REVISIONS

LTR	ECO	DESCRIPTION	DATE	APPROVED
A	879	RELEASE TO PRODUCTION	6/6/02	MF
B	900	UPDATED CABLE LENGTHS, ADDED TABLE 2.	6/27/02	MF
C	945	ADDED MAX TORQUE SPEC. TO NOTES	8/9/02	MF
D	954	CORRECTED DIMS IN TABLE (Dim D), mm CONVERSION INCORRECT	8/29/02	MF
E	960	ADDED M3500, ADDED R1206 TO TABLE, SINGOUT DIMS REF.	9/24/02	MF
F	979	UPDATED TABLE 1. PIN 3 (COS+) WAS GND. SEE ECO	11/19/02	MF
G	1124	UPDATED SCALE TABLE, ADDED HUB ID, HEIGHT TO R1206, DIM L	6/23/03	MF
H	1159	UPDATED SCALE THICKNESS TOLERANCE, WAS ±.008 (.020"), SEE ECO	3/9/04	MF
I	1357	ADDED DIMENSION IN ZONE DA, .405±.003(10.29±0.08)	9/16/04	SB
J	1517	UPDATED NOTE 2. SEE ECO	11/23/05	MF
K	1939	CHANGED CABLE CONNECTOR, ADDED HOTMELT. SEE ECO	11/30/07	MF

Mercury 2000, 3000 & 3500 Encoder System

Interface Drawing: SmartPrecision Electronics Module (Interpolator)

THESE DRAWINGS AND SPECIFICATIONS ARE THE PROPERTY OF MicroE Systems Corp. AND SHALL NOT BE REPRODUCED OR COPIED OR USED AS THE BASIS FOR MANUFACTURE OR SALE OF APPARATUS WITHOUT EXPRESS WRITTEN AUTHORIZATION FROM MicroE Systems Corp.



REVISIONS				
LTR	ECO	DESCRIPTION	DATE	APPROVED
A	--	RELEASE TO PRODUCTION	1/23/02	PD
B	862	UPDATED ENCLOSURE HEIGHT	5/14/02	PD
C	879	CREATED ONE INTERFACE. UPDATED TABLE 1. SEE ECO	6/5/02	MF
D	940	ADDED SS300c TO TABLE. ADDED NOTES PIN 6 AND PIN 10	9/24/02	MF
E	1058	ADDED SS350c TO TABLE. SEE ECO	2/14/03	MF
F	1156	ADDED NOTE 1	9/5/03	SB
G	1517	CHANGED SMARTSIGNAL TO SMARTPRECISION.	11/28/05	MF

TABLE 1.

DB15-HD PINOUTS				
Pin	Functions (SS200c)	Functions (SS300c/SS350c)	Functions (SS300cSi)	Functions (SS350cSi)
1	GND	GND	GND	GND
2	Transmit	Transmit	Transmit	Transmit
3	Receive	Receive	Receive	Receive
4	A-	A-	SDO-	SDO-
5	A+	A+	SDO+	SDO+
6	Reserved	Reserved	Reserved	Reserved
7	Reserved	Reserved	N_CS+	N_CS+
8	Reserved	Reserved	N_CS-	N_CS-
9	B-	B-	Trigger-	SCK_FBK-
10	B+	B+	Trigger+	SCK_FBK+
11	Reserved	Alarm	Alarm	Alarm
12	+5V	+5V	+5V	+5V
13	GND	GND	GND	GND
14	Index+	Index+	SCK+	SCK+
15	Index-	Index-	SCK-	SCK-

NOTES:

- PIN 1 IS A "RESERVED" PIN THAT SHOULD BE GROUNDED FOR PROPER SYSTEM PERFORMANCE. THE GROUND CONNECTION SHOULD BE MADE TO PIN 13 IN THE MATING CONNECTOR.

UNLESS OTHERWISE SPECIFIED
 ALL DIMENSIONS ARE IN INCHES [millimeters]
 DIM. APPLY AFTER PROCESSING
 INTERPRET ALL GEOMETRIC TOLS.
 PER ANSI Y14.5M-1994
 TOLERANCES ARE:
 DECIMALS: .XX [X] ±.01 [.25]
 .XXX [XX] ±.005 [.13]
 ANGULAR: ±30 MIN.

APPROVALS DATE
 DRAWN PAUL DEVINE 1/10/02
 CHECKED
 ENGRG. PAUL REMILLARD 1/23/02
 MFG ENG. MIKE SKWIRA 1/23/02
 QA JACK FARNAM 1/23/02

MicroE Systems
 MicroE Systems
 Division of GSI
 8 Erie Drive
 Natick, MA 01760

DESCRIPTION:
 INTERFACE, SMARTPRECISION
 INTERPOLATOR

SIZE DWG. NO. ID-00220 REV. G
 SCALE: 1X CAD FILE SHEET 1 OF 1