Operational Manual

Broadband Isotropic Electric Field Probe Metering Unit

Model 7120

ETS™
EMC TEST SYSTEMS, L.P. – An ESCO Company
E M C O

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REV D - PN 399122

Funkentstörung

Bescheinigung des Herstellers

Hiermit wird bescheinigt, dass das Gerät Serie 7100 Isotropic, Broadband, E-Field Probe System (bestehend aus Model 7110 Data Processing/Interface Unit, Model 7120 Metering Unit and Model 7130 Probe) in Übereinstimmung mit den Bestimmungen der Vfg 1046/1984 funkentstört ist.

Der Deutschen Bundespost wurde das Inverkehrbringen dieses Gerätes angezeigt und die Berechtigung zur überprüfung der Serie auf Einhaltung der Bestimmung eingeräumt.

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RFI DECLARATION

We hereby certify that the Series 7100 Isotropic, Broadband, E-Field Probe System (consisting of Model 7110 Data Processing/Interface Unit; Model 7120 Metering Unit and Model 7130 Probe) complies with the RFI suppression requirements of Vfg 1046/1984. The German Postal Service was notified that equipment is being marketed. The German Postal Service has the right to re-test the equipment and verify compliance.

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TABLE OF CONTENTS

	Page
Warranty	3
Caution	4
Description	5
Specifications	5
Input Connector Pin Assignment	6
Operation	6
Transmission Protocol	7
- Communication Protocol	7
- Data Packet Format	7
- Data Packet Fields Description	9
– Gain Status	9
– Error Status	9
– Probe Type	10
– X, Y, Z, R, Theta, Phi	10
Declaration of Conformity	

WARRANTY

The Electro-Mechanics Company (EMCO) warrants that our products are free from defects in materials and workmanship for a period of two years from the date of shipment. If you notify us of a defect within the warranty period, we will, at our option, either repair or replace those products which prove to be defective. If applicable, we will also recalibrate the product.

There will be no charge for warranty services performed at the location we designate. You must however, prepay inbound shipping costs and any duties or taxes. We will pay outbound shipping costs for a carrier of our choice, exclusive of any duties or taxes. You may request warranty services to be performed at your location, but it is our option to do so. If we determine that warranty service can only be performed at your location, you will not be charged for our travel related costs.

This warranty does not apply to:

1. Normal wear and tear of materials
2. Consumable items such as fuses, batteries, etc.
3. Products which have been improperly installed, maintained, or used.
4. Products which have been operated outside of specifications.
5. Products which have been modified without authorization.
6. Calibration of products, unless necessitated by defects.

THIS WARRANTY IS EXCLUSIVE. NO OTHER WARRANTY, WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

THE REMEDIES PROVIDED BY THIS WARRANTY ARE YOUR SOLE AND EXCLUSIVE REMEDIES. IN NO EVENT ARE WE LIABLE FOR ANY DAMAGES WHATSOEVER, INCLUDING BUT NOT LIMITED TO, DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

Please contact our Sales Department for a Return Material Authorization Number before shipping equipment to us.

CAUTION:

In order to keep the 7120 Metering unit free of damage and its calibration accurate, the following precautions should be taken. Not complying to the following voids the warranty.

- Never expose the unit to conditions exceeding what are specified in the specifications table.
- Avoid physical shock such as dropping, harsh vibration, etc. to the unit.
- Do not open the unit. If any problem occurs with the unit, please contact your sales representative or the factory.

DESCRIPTION

Model 7120 Isotropic Field Probe Metering Unit is the preprocessing subsystem for the Isotropic Field Probe Systems. Its main functions are pre-amplification, noise filtering, and data processing and transmission.

SPECIFICATIONS

Input Voltage Range (Each Channel)	0 - 4.9 VDC
Input Data Sampling Rate	3.3 KHz for Three Channels
Output Data Link	Fiber Optic
Output Communication Protocol	Serial 9600 bps 7 Data Bits Even Parity 1 Stop Bit
Output Data Code	ASCII
Output Data Packet Size	58 Characters
Output Data Packet Rate	10 Packets/sec.
Output Cable Length	10 Meters
Power Requirement	12 VDC Supplied by an Internal Rechargeable Lead Acid Battery
Battery Life (Minimum)	18 Hours Between Charges
Power for Battery Charger	110 VAC, 60 Hz for 7120/1 220 VAC, 50 Hz for 7120/2
Operating Temperature	0 - 50 Degrees C
Storage Temperature	-10 - +80 Degrees C
Length	9 in (22.9 cm)
Width	4 in (10.2 cm)
Height	2 in (5.1 cm)
Weight	3.75 lb (1.7 kg)

INPUT CONNECTOR PIN ASSIGNMENT

PIN	DESCRIPTION
1	Channel X +
2	Channel X -
3	Channel Y +
4	Channel Y -
5	Channel Z +
6	Channel Z -
7	Shield

OPERATION

Model 7120 provides three independent input amplifier channels for the three antenna outputs of each isotropic probe. For notation compatibility, these channels are called X, Y, and Z. The gains of the amplifiers are automatically set to 1, 25, or 1000 depending on the input DC voltage level.

The on-board microcontroller sets the gains of the amplifiers, reads the amplified signals, performs digital filtering and processes and transmits the data. The microcontroller, also, calibrates the amplifier channels periodically, starting at the turn-on time, in order to account for the performance changes due to temperature changes, time, etc.

From the output values of the probe, the microcontroller calculates the corresponding field strength values for each antenna at the calibrated frequency. The calibration factors are stored in a look-up table in the ROM of the microcontroller.

Since each antenna of each probe is orthogonal to the other two antennas, the field values corresponding to the X, Y,and Z channels are considered to be the rectangular(cartesian) coordinates readings of the probe. The microcontroller also calculates the corresponding spherical(polar) coordinates values of the probe. These values are called R, the total field strength, Theta, the angle between the projection of R on the X-Y plane and the X axis, and Phi, the angle between R and the Z axis.

TRANSMISSION PROTOCOL

The 7120 Metering Unit transmits two kinds of data packets. One kind of packet is a regular data packet, the contents of which will be described later, which is transmitted once every 100 ms.

The other kind of packet is sent when the metering unit is operational but is not ready to transmit a regular data packet because it is either changing the amplifier(s) gain(s) or calibrating its amplifier channels. This packet consists of three ASCII characters in the following order: LF CR R or 0A 0D 52 in Hexadecimal. This packet will be referred to as the Metering Unit Busy (MUB) packet.

- Communication Protocol:

The data is transmitted serially over a fiber optic link with the following parameters:

Transmission Rate:	9600 bps
Data Bits:	7
Parity:	Even
Stop Bits:	1

- Data Packet Format:

The regular data packet, before transmission, contains 28 data bytes. The format of the packet is as follows:

BYTE 1	2	3	4	5	9	13	17	21	25	28
GAIN ST	ERR ST1	ERR ST2	PROBE TYPE	X	Y	Z	R	THETA	PHI	

A two-byte header leads every transmitted data packet. The header consists of the ASCII codes for LF and CR (0A 0D Hexadecimal), in that order. Each byte in the data packet is divided into two 4-bit nibbles which in turn are converted to their ASCII representation and transmitted with the Least Significant Nibble transmitter first. Thus, the total number of transmitted characters per packet is 58. An example data packet and its corresponding transmitted character string follows:

Data Packet:

BYTE 1	2	3	4	5	9	13	17
24	E0	80	01	4266B400	3EA31902	426C19D0	42A50D68
GAIN ST	ERR ST1	ERR ST2	PROBE TYPE	X	Y	Z	R

BYTE 21	25
3EA2057E	422A2DEB
THETA	PHI

Transmitted Character String:

BYTE 1	3	5	7	9	11	19
0A0D	3432	3045	3038	3130	3234363634423030	4533334139313230
HEADER	GAIN ST	ERR ST1	ERR ST2	PROBE TYPE	X	Y

BYTE 27	35	43
3234433639313044	3234354144303836	4533324135304537
Z	R	THETA

BYTE 51	58
3234413244324245	
PHI	

- Data Packet Fields Description:

The data packet contains 10 data fields. After the header a gain status byte is sent. This is followed by two error status bytes, and a probe type byte. The last 6 fields contain the data, first in cartesian coordinates and then in polar coordinates.

-- Gain Status:

The gain status byte, GAIN ST, represents the gain setting for the amplifier on each channel. The following table details the coding:

BIT								DESCRIPTION
7	6	5	4	3	2	1	0	
X	X	X	X	X	X	0	0	CHANNEL X GAIN OF 1
X	X	X	X	X	X	0	1	" X " " 25
X	X	X	X	X	X	1	0	" X " " 1000
X	X	X	X	0	0	X	X	" Y " " 1
X	X	X	X	0	1	X	X	" Y " " 25
X	X	X	X	1	0	X	X	" Y " " 1000
X	X	0	0	X	X	X	X	" Z " " 1
X	X	0	1	X	X	X	X	" Z " " 25
X	X	1	0	X	X	X	X	" Z " " 1000

-- Error Status:

Each bit in the two error status bytes, ERR ST1 and ERR ST2, when set, indicates the presence of an error condition. The following table identifies each bit in these two bytes:

BIT	ERR ST1 ERROR CONDITION	ERR ST2 ERROR CONDITION
7	RAM SELF TEST	BATTERY LOW
6	ROM SELF TEST	NOT USED (0)
5	TIMER SELF TEST	NOT USED (0)
4	NOT USED (0)	NOT USED (0)
3	NOT USED (0)	NOT USED (0)
2	NOT USED (0)	NOT USED (0)
1	NOT USED (0)	NOT USED (0)
0	NOT USED (0)	NOT USED (0)

On power up the microcontroller checks its own RAM, ROM and TIMER accuracy. If any of these tests fail, the appropriate bit in ERR ST1 will be set. Once the battery falls below a certain threshold, nominally 10.3 VDC, bit 7 of ERR ST2 is set. At this point the battery should be recharged. The data may be valid for a while but at some point it will begin to be in error.

-- Probe Type:

This byte represents the code for the probe type the microcontroller is using when it consults its calibration tables. Type 01 refers to Model 7130 Isotropic, E-Field Probe.

-- X, Y, Z, R, Theta, Phi:

These data fields represent the values of X, Y, Z, R, Theta and Phi in single precision, binary floating point format as suggested by the IEEE Standard for Binary Floating Point Arithmetic (ANSI-IEEE Std 754-1985). A brief description of the format follows:

The numbers are represented in four bytes as:

Bit 1	2	10	32
s	exp	significand	

The exponent is biased by +127. For example, an exponent of 0 is represented as 127, of 2 is 129, and of -2 is 125. The significand is stored in sign magnitude rather than two's complement form. The equation for the single form representation is:

$$x = (-1)^s \times 2^{(exp - 127)} \times (1.significand)$$

s - sign of the significand
exp - biased exponent
significand - bit string of length 23 encoding the significant bits of the number that follow the binary point, yielding a 24-bit significant digit field for the number that always begins "1_____."

Examples:

$+1.0 = 1.0 \times 2^0 =$ $3F 80 00 00
$+3.0 = 1.5 \times 2^1 =$ $40 40 00 00
$-1.0 = -1.0 \times 2^0 =$ $BF 80 00 00

EUROPEAN COMMUNITY DECLARATION OF CONFORMITY

The EC Declaration of Conformity is the method by which EMC Test Systems, L.P. declares that the equipment listed on this document complies with the Low-voltage and EMC Directives.

Factory:
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Issued by:
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The products manufactured under the EMCO product name and listed below are eligible to bear the EC Mark:

Model 7120 Metering Unit
Part Number 102615 Battery Charger

Applicable Requirements:

Standard	Criteria
EN61010-1	Safety requirements for electrical equipment for measurement, control and laboratory use
EN60742/1989	Isolating transformers and safety isolating transformers
EN55022	Class B
IEC 801-2	Level 2 4/8kV
IEC 801-3	Level 2 3V/m
IEC 801-4	Level 2 .5 I/O, 1kV AC

Authorized Signatories

Bruce Butler, General Manager

James C. Psencik, Engineering Mgr.

Charles Garrison, Quality Assurance

Date of Declaration: December 10, 1996

The authorizing signature on the EC Declaration of Conformity document authorizes EMC Test Systems, L.P. to affix the CE mark to the indicated product. CE marks placed on these products will be distinct and visible. Other marks or inscriptions liable to be confused with the CE mark will not be affixed to these products.
EMC Test Systems, L.P. has ensured that appropriate documentation shall remain available on premises for inspection and validation purposes for a period of no less than 10 years.

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1002