**RS485 CONTROLLED
SYSTEM ATTENUATOR
MODEL 624**

INSTRUMENT MANUAL

Version 1.2

December 2020

GENERAL INFORMATION

WARRANTY

Flann Microwave Ltd warrants each product of its manufacture to be free from defects in material and workmanship. Our obligation under this warranty is limited to servicing or adjusting any products returned to our address for that purpose and to make good at our facility any part or parts thereof (power supplies, transistors, integrated circuits, batteries, diodes and displays) within one year after making delivery to the original purchaser and which in our examination shall disclose to our satisfaction to have been thus defective. Such returns must have prior authorization from Flann Microwave Ltd and must be returned as per our detailed instructions with transportation charges prepaid. Warranty returns or repairs must first be authorized by Flann. Flann does not authorize any third party to assume for them any other liability in connection with the original sale than the foregoing. ***Unauthorized tampering with sealed screws will invalidate the warranty and may result in damage to the product.***

DESIGN CHANGES

Flann Microwave Ltd reserves the right to make changes in the design of its products without reference and without incurring any obligation to make the same alterations on products previously purchased.

SPECIFICATION CHANGES

Flann Microwave Ltd reserves the right to change any specification noted herein without prior notice.

REPAIRS

When wishing to return instruments for repairs, or for any other reason, please contact this Company for shipping instructions. To expedite repair service, it is important to provide type number, serial number and a detailed description of the reason, including all fault symptoms, for the return of the instrument.

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GETTING STARTED

CONNECTOR ASSEMBLY

The Model 624 instrument incorporating the RS485 interface is supplied with the following mating connectors to MIL-C-26482, to be assembled as detailed in Tables 1 and 2.

6-Way Socket Pin	Attenuator Signal
A	RXD+
B	RXD-
C	TXD-
D	TXD+
E	Ground
F	Not used

Table 1: RS485 Interface

Note 1: Cable screen is not connected at the attenuator end; it will require termination to ground at the controller.

Note 2: For 2-wire interface control, connect pins A and D (RXD+ and TXD+) together for the DATA+ line, and B and C (RXD- and TXD-) together for the DATA- line.

2-Way Socket Pin	Input	Specification
A	+12 V supply	12 V ± 1 V, max 2.2 W
B	0 V supply	

Table 2: Power Supply

ENVIRONMENTAL CONSIDERATIONS

The attenuator is designed to operate in 'non-hazardous' areas. The environment in which the product is to be used is commercial, light industrial, either indoors or in a protected outdoor environment.

The operating environment must conform to the conditions shown in Table 3. Operation outside these ranges cannot be guaranteed and may pose dangerous implications to the operator or cause mechanical or electrical failure to the equipment. ***The device will generate heat during operation, and it is important to maintain adequate ventilation or cooling at all times.***

Environmental Condition	Ranges
Temperature operating	+5°c to +35°c
Temperature non-operating	0°c to +40°c
Humidity operating (max)	85 % without condensation
Humidity non-operating (max)	90 % without condensation

Table 3: Environmental Considerations

COMMUNICATIONS SET-UP

When connecting to the controlling computer, each computer I/O port is assigned a different COM Port number. These port numbers can change each time the computer is started, so it is recommended that the user interrogates each assigned COM Port to identify the ones that have Model 624 attenuators connected. Sending the *IDN? command will cause the instrument to return its identity string including the instrument's serial number. Refer to the Command Set section for details of the *IDN? command.

The input buffer is 50 bytes maximum.

The interface used is RS485, 9600 baud rate 8n1. Either 2 or 4 wire is supported (see Table 1 above).

SYSTEM FUNCTIONS AND FEATURES

POWER-UP PROCEDURE

When the instrument is initially connected to the power supply it resets to the 50 dB reference position. This action may be disabled if required, however the instrument must be reset as soon as possible to establish the correct reference alignment. Refer to the 'PONRST' and 'RESET' commands.

The instrument can be programmed to return to the last setting prior to power being removed. Refer to the 'HOLDSET' command.

The instrument is supplied in value mode, covering the range of 0.0 dB to 50.0 dB, with the smallest incremental value being 0.1 dB. It is possible to position the instrument using motor steps in the range 0 to 2410, giving increased resolution at lower attenuation settings. Refer to the 'SSET' command and Table 4 below. Note that the steps are from the reference position of 50.0 dB.

Also note that when changing from 'steps' mode to 'value' mode, the attenuator will enter the reset procedure to re-synchronise to the reference position.

Attenuation dB	Steps	Attenuation dB	Steps	Attenuation dB	Steps
50.0	0	33.0	149	16.0	562
49.0	5	32.0	164	15.0	603
48.0	11	31.0	179	14.0	647
47.0	17	30.0	195	13.0	695
46.0	23	29.0	212	12.0	746
45.0	30	28.0	230	11.0	801
44.0	37	27.0	249	10.0	861
43.0	45	26.0	270	9.0	926
42.0	52	25.0	291	8.0	997
41.0	61	24.0	314	7.0	1075
40.0	70	23.0	339	6.0	1162
39.0	79	22.0	365	5.0	1260
38.0	89	21.0	393	4.0	1371
37.0	100	20.0	422	3.0	1501
36.0	111	19.0	454	2.0	1661
35.0	123	18.0	488	1.0	1875
34.0	136	17.0	524	0.0	2410

Table 4: Attenuation – Steps from Reference

When the high attenuation setting is active, this enables a coarse attenuation setting of approximately 85 dB. Refer to the 'HIGH' command.

In 'Steps' mode, it is possible to enter a negative value up to -180 to achieve a very approximate high attenuation value. For example, -39 steps roughly equates to 60 dB. The attenuation accuracy beyond 50 dB cannot be guaranteed.

INSTRUMENT ERRORS

Instrument errors can be identified by interrogating the Status Byte. Refer to the 'STATUS?' command description and the Status Byte interpretation list, Table 5.

FIRMWARE UPGRADES

Users will be able to upgrade to the latest version of the Model 624 firmware over the RS485 interface by following the instructions given in the Flann Microwave Ltd website, www.flann.com.

A copy of the latest issue of this manual will also be available for download.

RS485 COMMAND STRUCTURE

This section details the commands available and the valid operands that may accompany them.

NOTATION

Upper case bold characters represent the program codes, which must appear exactly as listed. Program code commands are not case sensitive, ie upper and lower case characters are accepted. Note that the input buffer is 50 bytes maximum.

Characters enclosed in the {} brackets are qualifiers attached to the root mnemonic. A space may be inserted between it and the root mnemonic. eg {ON|OFF} shows that either ON or OFF can be attached to the root mnemonic.

For example, the 'PONRST' command has three possible applications: -

1. **PONRST ON**   -   Switch on the Power-on Reset
2. **PONRST OFF**   -   Switch off the Power-on Reset
3. **PONRST?**   -   Query the present state of the Power-on Reset

Each program command must be terminated with \n (Hex 0x0a)
For example: 'VSET45.3\n'

QUERY COMMANDS

For instrument state commands (identified with 'Query: Valid'), append the question mark character (?) instead of the {ON|OFF} to interrogate the state of the functions. The instrument responds to the query with a '1' or a '0' to indicate On or Off, respectively. For a settable function such as VSET *value*, using VSET? causes the instrument to respond by sending the current value of that function.

COMMAND SET

VSET [*value*]
Switches to value mode and sets the microwave instrument to *value*
Query: Valid, returns setting
Value   0 to 50.0 (dB)

SSET [*value*]
Switches to steps mode and sets the microwave instrument to *value*
Query: Valid, returns number of steps from reference
Value   0 to 1410

**ASET [*value]*
Switches to angle mode and sets the microwave instrument to *value*
Query: Valid, returns vane angle
Value   0 to 86.776

ISET *value*
Sets the stored increment to *value*
Query: Valid, returns store increment
Value   0 to 50.00 (dB) if in value mode, or 0 to 1410 if in steps mode, 0 to 86.776 if in angle mode

INC
Increase the microwave instrument setting by the stored increment
Query: Invalid

DEC
Decrease microwave instrument setting by the stored increment
Query: Invalid

STORE *value*
Sets the stored setting to *value*
Query: Valid, returns stored setting
Value   0 to 50.0 (dB) if in value mode, or 0 to 1410 if in steps mode, 0 to 86.776 if in angle mode

RECALL
Sets the instrument to the stored setting
Query: Invalid

HIGH {ON|OFF}
Sets the high attenuation feature on or off
Query: Valid, returns 1 for on, or 0 for off

HOLDSET {ON|OFF}
Returns the microwave instruments to the position when power was removed
Query: Valid, returns 1 for on, or 0 for off

MODE?
Outputs the current operating mode
Query: Valid, returns either 0 for value mode or 1 for steps mode or 2 for angle mode

PONRST {ON|OFF}
Enables or disables the power-on reset
Query: Valid, returns 1 for on, or 0 for off

PRECISION {ON|OFF}
Enables or disables the precision setting feature
Query: Valid, returns 1 for on, or 0 for off

Note: When ON, this feature gives higher attenuation accuracy and repeatability by always driving to the required position from the same direction. The attenuation value will go higher than the required setting momentarily during positioning from the 0 dB direction. This applies to all modes (angle, steps and value).

PWRSTAT?
Outputs the power-up statistics
Query: Valid, returns a string of 50 characters maximum

RESET
Resynchronise the instrument
Query: Invalid

*IDN?
Outputs the full instrument identity string
Query: Valid, returns the identity string of the instrument including the serial number

STATUS?
Request the value of the status register
Query: Valid, return the status register value, a value from 0 to 255

COMMAND EXAMPLES

RESET;VSET?	reset the instrument and return a value of 50.0
VSET23.4	position to 23.4 dB
VSET?	return the value 23.4
SSET453	switch to steps mode and position to 453
SSET?	return the value 453
ISET10	store 10 steps
INC	move +10 steps
DEC	move -10 steps
VSET23.6;ISET7;INC;VSET?	Position to 23.6 dB, store 7 dB, increment 7 dB, return value is 30.6
DEC;VSET?	decrement 7 dB, return value is 23.6
INC;INC;INC	increment 7 dB three times, position is now 44.6 dB

Note: 'Query' refers to the addition of '?' after the command. For example, 'VSET25' will move the instrument to a setting of 25 dB, and 'VSET?' will return the setting value ('25' in this case) because it is a 'Valid' command. Data is only sent by the instrument when '?' is used with a command.

Commands must be separated by a semicolon. A command string must be terminated by a newline '\n' (0x0a).

STATUS BYTE

Bit	Value	Error
0	1	EEPROM error – failure to read or write to the EEPROM
1	2	Out of range request – incorrect value requested
2	4	Power on – a power-on has occurred since the last read of the register
3	8	Command error – incorrect syntax in a command line
4	16	Execution error – failure to achieve setting
5	32	Not used
6	64	Error E2 – no encoder output found
7	128	Error E1 – encoder index not found

Table 5: Status Byte interpretation

Note: The value of the Status Register will return to zero after being read.

COMMAND SUMMARY

Command	Suffix	Action	Query
INC		Increase setting by stored increment	
DEC		Decrease setting by stored increment	
VSET	Value	Switches to value mode and sets to value	✓
SSET	Value	Switches to steps mode and sets to value	✓
ASET	Value	Switches to angle mode and sets to value	✓
ISET	Value	Stores increment in the present operating mode	✓
RESET		Reinitialise the instrument on the active channel	
MODE?		Outputs the current operating mode	✓
HIGH	ON/OFF	Enable or disable the high attenuation feature	✓
PRECISION	ON/OFF	Enable or disable the precision setting feature	✓
RECALL		Returns the instrument to the stored setting (see below)	
STORE	Value	Store a setting determined by value (mode dependent)	✓
*IDN?		Returns the instrument identity string	✓
STATUS?		Returns the Status Register value from 0 to 255	✓
PONRST	ON/OFF	Enable or disable power-on reset	✓
PWRSTAT?		Outputs the power-up statistics	✓
HOLDSET	ON/OFF	Return instrument to last power-on condition	✓

Table 6: Command Summary
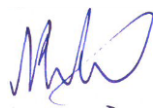
REGULATORY INFORMATION

DECLARATION OF CONFORMITY

Manufacturer	Flann Microwave Ltd Dunmere Road Bodmin Cornwall PL31 2QL United Kingdom
Product	Programmable System Attenuator (RS485) Model Number: xx624 where 'xx' is the waveguide size. For example, model 26624 is WG26
European Standards	EN61000-6-1:2007 EN61000-6-3:2007
Technical File Number	TCF09

It is declared that the above product conforms to the essential requirements of the Electromagnetic Compatibility Directive 2004/108/EC and the Low Voltage Directive 2006/95/EC when used in accordance with the instructions for use, as detailed in the appropriate technical file.

Signed

Dr James Watts
For and on behalf of Flann Microwave Ltd
Date: 1 November 2016

WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) REGULATIONS

Flann Microwave is registered with the United Kingdom Environment Agency as a supplier of electrical and electronic equipment, and makes the required declarations in accordance with WEEE Regulations.

Where this product was supplied to a customer in the United Kingdom:

When this product is at the end of its life, Flann Microwave will accept its return for safe disposal and recycling, if required by the Customer. Please contact Flann Microwave for full instructions before returning any WEEE. The return address is:

> Flann Microwave Ltd
> Dunmere Road
> Bodmin
> Cornwall PL31 2QL
>
> Tel. 01208 77777

Where this product was supplied to a customer outside the United Kingdom:

Please follow local regulations regarding the disposal and recycling of WEEE, or contact your distributor for advice.

Flann Microwave Ltd can provide information on the materials used in this instrument to assist in their recycling or safe disposal.