GENERAL INFORMATION ........................................................................................................ 4
  WARRANTY .......................................................................................................................... 4
  DESIGN CHANGES ........................................................................................................... 4
  SPECIFICATION CHANGES .............................................................................................. 4
  REPAIRS ............................................................................................................................. 4

GETTING STARTED ............................................................................................................. 5
  TELNET .............................................................................................................................. 5
  RAW ................................................................................................................................... 5
  ENVIRONMENTAL CONSIDERATIONS ............................................................................. 6

REFERENCE SECTIONS ..................................................................................................... 7
  SYSTEM FUNCTIONS AND FEATURES ............................................................................ 7
     Power up Procedure .......................................................................................................... 7
     Instrument Errors ............................................................................................................ 8
     Firmware Upgrades ....................................................................................................... 8

ETHERNET COMMAND STRUCTURE ............................................................................... 9
  NOTATION ........................................................................................................................... 9
     Query Commands ............................................................................................................ 9
  COMMAND SET .................................................................................................................. 9
  STATUS BYTE .................................................................................................................. 11
  COMMAND SUMMARY .................................................................................................... 11

REGULATORY INFORMATION ........................................................................................... 13
  DECLARATION OF CONFORMITY .................................................................................... 13
  WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) REGULATIONS .......... 13
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.

Flann Microwave Ltd
Dunmere Road
Bodmin
Cornwall
PL31 2QL
United Kingdom

Tel: +44 (0) 1208 77777
Fax: +44 (0) 1208 76426
Email: mail@flann.com
http://www.flann.com

In USA contact

Flann Microwave Inc
One Boston Place
Suite 2600
Boston
Massachusetts
MA 02108 - 4407

Tel: (617) 621 7034
Fax: (617) 577 8234
Email mail@flann.com
http://www.flann.com
GETTING STARTED

Plug an Ethernet cable into a switch or router capable of providing Power-over-Ethernet (PoE) to IEEE 802.3af.

The Ethernet interface is provided by a Lantronix XPort AR device. Under no circumstances should this device be re-configured.

In the event that the label showing the instrument IP address is accidentally removed from the instrument, it is possible to run a utility that will read the instrument’s IP address. This ‘DeviceInstaller’ program can be downloaded from:


When supplied from the factory, the device is configured to connect automatically to a network using the DHCP protocol – the device name is shown on the instrument label.

The following are examples of establishing communication with the attenuator using Telnet or RAW:

TELNET
To control the instrument using a Telnet connection:

Enter the instrument’s IP address, eg 128.0.0.59, and the port number of 23;
Once connected, the terminal window should display an identification string, for example, ‘ci-19-Flann26624’.
Type ‘enable’ and press return;
The terminal window will now display ‘ci-19-Flann26624(enable)#’;
Type ‘connect line 1’ and press return to establish connection to the instrument;
To test the connection type ‘identity?’ and press return. The instrument will return its identity string, eg FLANN MICROWAVE, 624PRVA, 123456, V1.8.

Note that some control programs do not display the typed information, so care is required when entering control commands to prevent syntax errors. The \n terminator is not required in Telnet.

RAW
To control the instrument using a RAW connection:

Enter the IP address, eg 128.0.0.59 and use port 10001;
You are now connected to the instrument;
To test the connection, enter ‘identity\n’ and press return. The instrument will return its identity string, eg FLANN MICROWAVE, 624PRVA, 123456, V1.8.

Note that the \n terminator is required for RAW commands unless using a program, such as PuTTY, that terminates every command string.
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 1. 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.

<table>
<thead>
<tr>
<th>Environmental Condition</th>
<th>Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature Operating</td>
<td>+5°C to +35°C</td>
</tr>
<tr>
<td>Temperature Non-Operating</td>
<td>0 to +40°C</td>
</tr>
<tr>
<td>Humidity operating (max)</td>
<td>90 % without condensation</td>
</tr>
<tr>
<td>Humidity Non-operating (max)</td>
<td>95 % without condensation</td>
</tr>
</tbody>
</table>

Table 1: Environmental Considerations
REFERENCE SECTIONS

SYSTEM FUNCTIONS AND FEATURES

Power up Procedure

When the instrument is connected to a PoE compatible network the instrument 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 ‘PWR_ON_RST’ and ‘RESET_INST’ commands.

The instrument can be programmed to return to the last setting prior to power being removed. Refer to the ‘HOLD_SET’ 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 ‘STEPS_SET’ command and Table 2 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.

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

Table 2: 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_ATTEN’ command.

In ‘Steps’ mode, it is possible to enter a negative value up to -200 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 ‘INST_STAT?’ command on page 10 and the interpretation list, Table 3, on page 11.

**Firmware Upgrades**

Users will be able to upgrade to the latest version of the Model 624 firmware over the Ethernet 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.
ETHERNET 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, i.e., 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. e.g., {ON|OFF} shows that either ON or OFF can be attached to the root mnemonic.

For example, the ‘PWR_ON_RST’ command has three possible applications:

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

Each program command must be terminated with \n (Hex 0x0a), unless using Telnet.

For example:  ‘VALUE_SET45.3\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 VALUE_SET value, using VALUE_SET? causes the instrument to respond by sending the function’s current value.

COMMAND SET

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

STEPS_SET [value]
Switches to Steps mode and sets the microwave instrument to value
Query:  Valid, returns number of steps from reference
Value  -200 to 2410

INCR_SET value
Sets the stored increment to value
Query:  Valid, returns stored increment
Value  0 to 50.0 (dB) if in value mode, or 0 to 2410 if in Steps mode

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

DECREMENT
Decrease microwave instrument setting by the stored increment
Query:  Invalid
**STORE_VAL 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 2410 if in Steps mode

**REC_SETTING**
Sets the instrument to the stored setting
Query: Invalid

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

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

**INST_MODE?**
Outputs the current operating mode
Query: Valid, returns either 0 for VALUE MODE or 1 for STEPS MODE

**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 both Steps and Value modes.

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

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

**RESET_INST**
Resynchronise the instrument by driving to the reference position of 50.0 dB
Query: Invalid

**IDENTITY?**
Outputs the identity string, eg ‘FLANN MICROWAVE, 624PRVA, 123456, V1.8’, where 123456 is the instrument serial number, and V1.8 is the firmware version
Query: Valid, returns the identity string of the instrument.

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

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

Table 3 – Status Byte interpretation

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

COMMAND SUMMARY

<table>
<thead>
<tr>
<th>Command</th>
<th>Suffix</th>
<th>Action</th>
<th>Query</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCREMENT</td>
<td></td>
<td>Increase setting by stored increment</td>
<td></td>
</tr>
<tr>
<td>DECREMENT</td>
<td></td>
<td>Decrease setting by stored increment</td>
<td></td>
</tr>
<tr>
<td>VALUE_SET</td>
<td>Value</td>
<td>Switches to value mode and sets to value</td>
<td></td>
</tr>
<tr>
<td>STEPS_SET</td>
<td>Value</td>
<td>Switches to steps mode and sets to value</td>
<td></td>
</tr>
<tr>
<td>INCR_SET</td>
<td>Value</td>
<td>Stores increment in the present operating mode</td>
<td></td>
</tr>
<tr>
<td>RESET_INST</td>
<td>Value</td>
<td>Reinitialise the instrument on the active channel</td>
<td></td>
</tr>
<tr>
<td>INST_MODE?</td>
<td></td>
<td>Outputs the current operating mode</td>
<td></td>
</tr>
<tr>
<td>HIGH_ATTEN</td>
<td>ON/OFF</td>
<td>Enable or disable the high attenuation feature</td>
<td></td>
</tr>
<tr>
<td>PRECISION</td>
<td>ON/OFF</td>
<td>Enable or disable the precision setting feature</td>
<td></td>
</tr>
<tr>
<td>REC_SETTING</td>
<td></td>
<td>Returns the instrument to the stored setting (see below)</td>
<td></td>
</tr>
<tr>
<td>STORE_VAL</td>
<td>Value</td>
<td>Store a setting determined by value (mode dependent)</td>
<td></td>
</tr>
<tr>
<td>INST_STAT?</td>
<td></td>
<td>Returns the Status Register value from 0 to 255</td>
<td></td>
</tr>
<tr>
<td>PWR_STAT?</td>
<td></td>
<td>Returns the power-up statistics</td>
<td></td>
</tr>
<tr>
<td>PWR_ON_RST</td>
<td>ON/OFF</td>
<td>Enable/Disable power-on reset</td>
<td></td>
</tr>
<tr>
<td>HOLD_SET</td>
<td>ON/OFF</td>
<td>Return instrument to last power-off condition</td>
<td></td>
</tr>
</tbody>
</table>

Table 4 – Command Summary
Examples:

RESET_INST\nreset the instrument

VALUE_SET? \nreturns a value of 50

VALUE_SET23.4 \nposition to 23.4 dB

VALUE_SET?\nreturns the value 23.4

STEPS_SET453\nswitch to steps mode and position to 453

STEPS_SET?\nreturns the value 453

INCR_SET10\nstore an incremental value of 10 steps

INCREMENT\nmoves +10 steps

DECREMENT\nmoves -10 steps

A command string must be no more than 50 bytes, and terminated by a newline (Hex 0x0a) when in RAW. Note that the \nterminator is not required when using Telnet.
REGULATORY INFORMATION

DECLARATION OF CONFORMITY

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Flann Microwave Ltd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dunmere Road</td>
</tr>
<tr>
<td></td>
<td>Bodmin</td>
</tr>
<tr>
<td></td>
<td>Cornwall</td>
</tr>
<tr>
<td></td>
<td>PL31 2QL</td>
</tr>
<tr>
<td></td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Product</td>
<td>Programmable System Attenuator</td>
</tr>
<tr>
<td></td>
<td>Model Number: xx624-8395 where ‘xx’ is the waveguide size. For example, model 26624 is WG26</td>
</tr>
<tr>
<td>European Standards</td>
<td>EN61000-6-1:2007</td>
</tr>
<tr>
<td></td>
<td>EN61000-6-3:2007</td>
</tr>
<tr>
<td>Technical File Number</td>
<td>TCF11</td>
</tr>
</tbody>
</table>

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: 19 January 2015

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. 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.