GEFRAN

# IR-12 / IR-24
MULTICHANNEL POWER CONTROLLER


## CONFIGURATION AND PROGRAMMING MANUAL

CE

Software version: **1.0x**

code: **80381 - 04-2015 - ENG**

This document supplements the following manuals:
- Instructions and warnings for IR-12/IR-24

**ATTENTION!**

This manual is an integral part of the product, and must always be available to operators.

This manual must always accompany the product, including if it is transferred to another user.

Installation and/or maintenance workers MUST read this manual and scrupulously follow all of the instructions in it and in its attachments. **GEFRAN** will not be liable for damage to persons and/or property, or to the product itself, if the following terms and conditions are disregarded.

The Customer is obligated to respect trade secrets. Therefore, this manual and its attachments may not be tampered with, changed, reproduced, or transferred to third parties without **GEFRAN's** authorization.

# TABLE OF CONTENTS AND SUMMARIES

# INTRODUCTION

The modular power controller described in this manual and shown on the cover is a separate unit for the independent control of 12/24 zones. It offers high applicative flexibility thanks to the extended configurability and programmability of its parameters.

Instrument configuration and programming must be performed with a PC connected in USB/RS232/RS485, with specific GF_eXpress application software.

Since it is impossible to foresee all of the installations and environments in which the instrument may be applied, adequate technical preparation and complete knowledge of the instrument's potentials are necessary.

*GEFRAN declines all liability if rules for correct installation, configuration, and/or programming are disregarded, as well as all liability for systems upline and/or downline of the instrument.*

## FIELD OF USE

The modular power controller is the ideal solution for applications in heat treatment furnaces, in thermoformers, in packaging and packing machines and, in general, in standard temperature control applications. Nevertheless, because it is highly programmable, the controller can also be used for other applications provided they are compatible with the instrument's technical data.

Although the instrument's flexibility allows it to be used in a variety of applications, the *field of use* must always conform to the limits specified in the technical data supplied.

*GEFRAN declines all liability for damage of any type deriving from installations, configurations, or programmings that are inappropriate, imprudent, or not conforming to the technical data supplied.*

### Prohibited use

It is absolutely prohibited:
- to utilize the instrument or parts of it (including software) for any use not conforming to that specified in the technical documentation supplied;
- to modify working parameters inaccessible to the operator, decrypt or transfer all or part of the software;
- to utilize the instrument in explosive atmospheres;
- to repair or convert the instrument using non-original replacement parts;
- to utilize the instrument or parts of it without having read and correctly understood the technical documentation supplied;
- to scrap or dispose of the instrument in normal dumps; components that are potentially harmful to the environment must be disposed of in conformity to the regulations of the country of installation.

## CHARACTERISTICS OF PERSONNEL

This manual is intended for technical personnel, who commission the instrument by connecting it to other units, and for service and maintenance personnel.
It is assumed that such persons have adequate technical knowledge, especially in the fields of electronics and automation.

The instrument described in this manual may be operated only by personnel who are trained for their assigned task, in conformity to the instructions for such task and, specifically, to the safety warnings and precautions contained in such instructions. Thanks to their training and experience, qualified personnel can recognize the risks inherent to the use of these products/systems and are able to avoid possible dangers

*It is forbidden to employ untrained personnel, persons with disabilities, legally disqualified persons, persons who are not sober, or persons who take drugs.*

## STRUCTURE OF THIS MANUAL

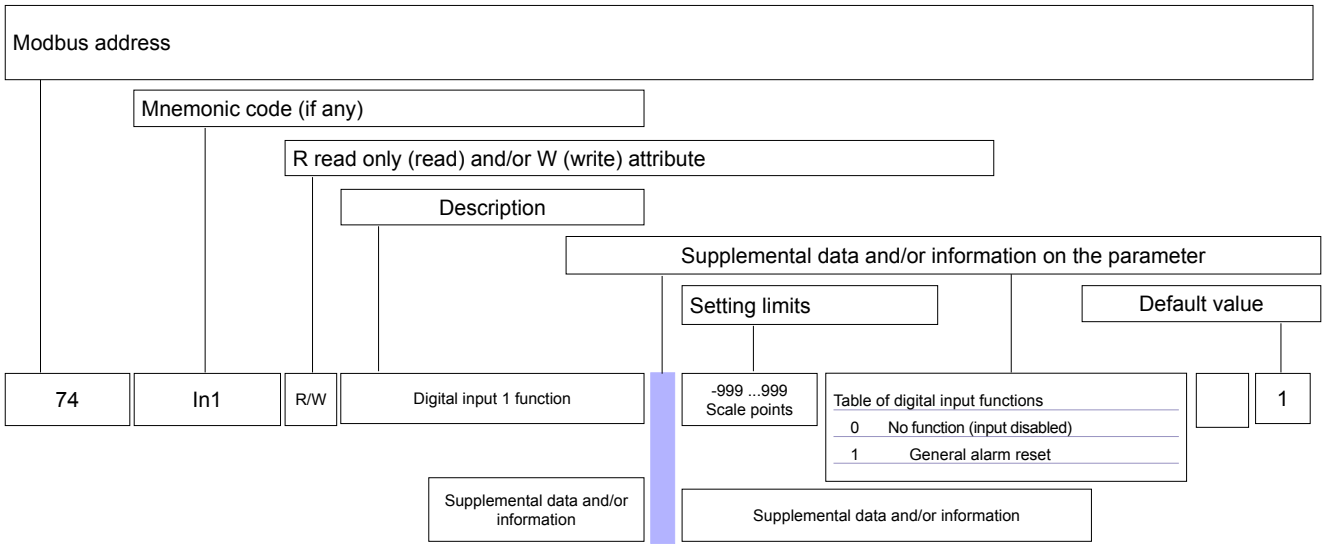
This manual was originally written in ITALIAN. Therefore, in case of inconsistencies or doubts, request the original manual or explanations from GEFRAN.
The instructions in this manual do not replace the safety instructions and the technical data for installation, configuration and programming applied directly to the product or the rules of common sense and safety regulations in effect in the country of installation.
For easier understanding of the controller's basic functions and its full potentials, the configuration and programming parameters are grouped according to function and are described in separate **chapters**.
Each **chapter** has from 1 to 3 sections:

- the first section presents a general description of the parameters described in detail in the following zones;
- the second section presents the parameters needed for the controller's **basic applications**, which users and/or installers can access clearly and easily, immediately finding the parameters necessary for quick use of the controller;
- the third section (ADVANCED SETTINGS ) presents parameters for advanced use of the controller: this section is addressed to users and/or installers who want to use the controller in special applications or in applications requiring the high performance offered by the instrument.

Some sections may contain a functional diagram showing interaction among the parameters described;

- terms used on other pages of the manual (related or supplemental topics) are shown in underlined italics and listed in the index (linked to IT support).

In each section, the programming parameters are shown as follows:




Unless indicated otherwise, these parameters are in decimal format and represent 16 bit words.

# CONTROLLING THE DEVICE VIA SERIAL

*All of the setting parameters are saved in internal memory EEPROM (non-volatile), for which a maximum of 10,000 delete/write cycles is guaranteed. To prevent rapid memory deterioration, write only when necessary, with the exception of a few parameters whose memorization in EEPROM can be disabled by setting the Option parameter.*

## CONNECTION

Each device has an optically isolated serial port RS485 with standard Modbus protocol via connectors PORT 1 (SER. IN) and PORT 2 (SER.OUT), 9-pin tray type.

The Cod parameter (read only) shows the node address value, which can be set from 00 to 99 with the two rotary switches; the hexadecimal settings are reserved.

A parameter can be read or written by both communication ports (PORT 1 and PORT 2).

*Changing the **Baud** parameters (baud rate selection), **Par** (parity selection) can cause a communication failure.*

To set parameters bAu and Par, follow the Autobaud procedure described in the “Operating instructions and warnings” manual.

### Installing the “MODBUS” serial network

A network typically has a Master object that “manages” communication by means of “commands” and Slaves that carry out these commands.

The IR-12/IR-24 modules are considered Slaves to the network master, which is usually a supervision terminal or a PLC.

The IR-12/IR-24 modules are preset as follows:

- node address = 0 (0 + 0) = Serial autobaud
- serial speed = 19200 bit/s
- serial parity = none

You can install a maximum of 99 IR-12/IR-24 modules in a serial network, with node address selectable from “01” to “99”.

### Settings

| | | | | | | |
|---|---|---|---|---|---|---|
| 45 | **Baud** | R/W | Select baud rate | *Baud rate table* | | 6 |

| | |
|---|---|
| 0 | 1200 bit/s |
| 1 | 2400 bit/s |
| 2 | 4800 bit/s |
| 3 | 9600 bit/s |
| 4 | 19200 bit/s |
| 5 | 38400 bit/s |
| 6 | 57600 bit/s |

| | | | | | | |
|---|---|---|---|---|---|---|
| 47 | **Par** | R/W | Select parity | *Parity table* | | 0 |

| | |
|---|---|
| 0 | no parity |
| 1 | odd |
| 2 | even |

### Reading status

| | | | | | |
|---|---|---|---|---|---|
| 46 | **Cod** | R | Device identification code | 1 ... 99 | Value acquired by rotary switches (tens+units) |

## LINE VOLTAGE VALUE

The RMS voltage values of each phase are shown in parameters **Volt.Lp** (with p = phase from 1 to 3).

A voltage presence check is active for each phase; the check switches off the module if the voltage value is incorrect

The **S.General** parameter contains information on line voltage status, including network frequency

### Reading status

| | | | |
|---|---|---|---|
| 24 | **Volt.L1** | R | Voltmeter input value phase L1 |
| 25 | **Volt.L2** | R | Voltmeter input value phase L2 |
| 26 | **Volt.L3** | R | Voltmeter input value phase L3 |

| | | | |
|---|---|---|---|
| 30 | **S.General** | R | General status |

*General status table*

| bit | |
|---|---|
| 0 | Frequency: 0=50Hz, 1=60Hz |
| 1 | Line voltage off spec |
| 2 | Alarm minimum voltage phase L1 |
| 3 | Alarm minimum voltage phase L2 |
| 4 | Alarm minimum voltage phase L3 |
| 5 | Alarm maximum voltage phase L1 |
| 6 | Alarm maximum voltage phase L2 |
| 7 | Alarm maximum voltage phase L3 |

| | | | |
|---|---|---|---|
| 31 | **S.Alarm** | R | Alarms status |

*Alarms status table*

| bit | |
|---|---|
| 0 | General alarm (OR all alarms) |
| 1 | |
| 2 | Alarm max. temp. exceeded heat sink 1 |
| 3 | Alarm max. temp. exceeded heat sink 2 |
| 4 | |
| 5 | |
| 6 | Warning first temp. threshold exceeded heat sink 1 |
| 7 | Warning first temp. threshold exceeded heat sink 2 |
| 8 | Alarm phase of synchronism L1 |
| 9 | Alarm phase of synchronism L2 |
| 10 | Alarm phase of synchronism L3 |
| 11 | Alarm no 24V power supply digital outputs |
| 12 | Generic alarm digital output in short circuit |
| 13 | Generic alarm power channel interrupted (FUSE_OPEN) |
| 14 | Generic alarm load interrupted or disconnected (LOAD_OPEN) |
| 15 | Generic alarm solid status relay in short circuit (SSR_SHORT) |

# DIGITAL INPUTS

Four digital inputs are always present.
Each input can perform different functions based on the setting of the following parameters:

## Settings

| | | | | | |
|---|---|---|---|---|---|
| 74 | **In.1** | R/W | Digital input 1 function | *Table of digital input functions* | 0 |
| 75 | **In.2** | R/W | Digital input 2 function | | 0 |
| 76 | **In.3** | R/W | Digital input 3 function | | 0 |
| 77 | **In.4** | R/W | Digital input 4 function | | 0 |

| | |
|---|---|
| 0 | No function (input disabled) |
| 1 | General alarm reset |
| 2 | Enable/Disable loads of L1 phase |
| 3 | Enable / Disable loads of L2 phase |
| 4 | Enable / Disable loads of L3 phase |
| 5 | Enable / Disable ALL loads (L1,L2,L3 phases) |
| +32 for input in denied logic | |

## Reading status

| | | | | |
|---|---|---|---|---|
| 29 | **S.IO** | R | Digital I/O states | *Digital I/O states table* |

| bit | |
|---|---|
| 0 | State input 1 |
| 1 | State input 2 |
| 2 | State input 3 |
| 3 | State input 4 |
| 4 | State output 1 |
| 5 | State output 2 |
| 6 | State output 3 |
| 7 | State output 4 |

## ALARM: thermal protection

Each IR-12/IR-24 module has two temperature sensors for the internal heat sinks.
The temperature values are show in variables **Temp.1** and **Temp.2** The overtemperature alarm shown in **S.Alarm** trips when at least one of the temperatures exceeds a set limit.
This condition may be caused by obstructed ventilation slits or by stopped cooling fans.
If the overtemperature alarm trips, the control disables the command outputs.

The general alarm (OR of all alarms) can be done by digital input function or by serial writing

| | | | | |
|---|---|---|---|---|
| 78 | **STATUS11** | R/W | Internal status | *Internal status table* |

| bit | |
|---|---|
| 0 | General alarm reset |

### Reading status

| | | | | |
|---|---|---|---|---|
| 27 | **Temp.1** | R | Temperature of heatsink 1 | |
| 28 | **Temp.2** | R | Temperature of heatsink 2 | |
| 31 | **S.Alarm** | R | Alarms status | *Alarms status table* |

| bit | |
|---|---|
| 0 | General alarm (OR all alarms) |
| 1 | |
| 2 | Alarm max. temp. exceeded heat sink 1 |
| 3 | Alarm max. temp. exceeded heat sink 2 |
| 4 | |
| 5 | |
| 6 | Warning first temp. threshold exceeded heat sink 1 |
| 7 | Warning first temp. threshold exceeded heat sink 2 |
| 8 | Alarm phase of synchronism L1 |
| 9 | Alarm phase of synchronism L2 |
| 10 | Alarm phase of synchronism L3 |
| 11 | Alarm no 24V power supply digital outputs |
| 12 | Generic alarm digital output in short circuit |
| 13 | Generic alarm power channel interrupted (FUSE_OPEN) |
| 14 | Generic alarm load interrupted or disconnected (LOAD_OPEN) |
| 15 | Generic alarm solid status relay in short circuit (SSR_SHORT) |

## ALARMS FUSE_OPEN, SSR_SHORT and LOAD_OPEN

Diagnostics is active to check correct functioning of the process:

- FUSE_OPEN alarm: trips at opening of internal fuse
- LOAD_OPEN alarm: trips when load is interrupted or disconnected
- SSR_SHORT alarm: trips when the solid status relay is in short circuit

**NOTE1** : In PA_mode, the diagnostic Alarms Load-Open and Fuse_open are detected for SCR power firing higher than 40%.

**NOTE2**: In PA_mode, the diagnostic Alarm SSR-SHORT is detected when SCR power firing is P=0% or when its channel is disabled.

The summary status of the alarms is shown in **S.Alarm** and the details for each output are shown in **S.Out.Lp.o** (with p = phase from 1 to 3, o = output from 1 to 8).

### Reading status

| | | | |
|---|---|---|---|
| 80 | **S.Out.L1.1** | R | Status of output 1 phase L1 |
| 81 | **S.Out.L1.2** | R | Status of output 2 phase L1 |
| 82 | **S.Out.L1.3** | R | Status of output 3 phase L1 |
| 83 | **S.Out.L1.4** | R | Status of output 4 phase L1 |
| 84 | **S.Out.L1.5** | R | Status of output 5 phase L1 |
| 85 | **S.Out.L1.6** | R | Status of output 6 phase L1 |
| 86 | **S.Out.L1.7** | R | Status of output 7 phase L1 |
| 87 | **S.Out.L1.8** | R | Status of output 8 phase L1 |
| 88 | **S.Out.L2.1** | R | Status of output 1 phase L2 |
| 89 | **S.Out.L2.2** | R | Status of output 2 phase L2 |
| 90 | **S.Out.L2.3** | R | Status of output 3 phase L2 |
| 91 | **S.Out.L2.4** | R | Status of output 4 phase L2 |
| 92 | **S.Out.L2.5** | R | Status of output 5 phase L2 |
| 93 | **S.Out.L2.6** | R | Status of output 6 phase L2 |
| 94 | **S.Out.L2.7** | R | Status of output 7 phase L2 |
| 95 | **S.Out.L2.8** | R | Status of output 8 phase L2 |
| 96 | **S.Out.L3.1** | R | Status of output 1 phase L3 |
| 97 | **S.Out.L3.2** | R | Status of output 2 phase L3 |
| 98 | **S.Out.L3.3** | R | Status of output 3 phase L3 |
| 99 | **S.Out.L3.4** | R | Status of output 4 phase L3 |
| 100 | **S.Out.L3.5** | R | Status of output 5 phase L3 |
| 101 | **S.Out.L3.6** | R | Status of output 6 phase L3 |
| 102 | **S.Out.L3.7** | R | Status of output 7 phase L3 |
| 103 | **S.Out.L3.8** | R | Status of output 8 phase L3 |

*Table of output states*

| bit | |
|---|---|
| 0 | = 0: output OFF; = 1: output ON |
| 1 | = 0: proper compensation;<br>= 1: output saturated (compensation is not correct) |
| 2 | |
| 3 | |
| 4 | Output state: power channel interrupted (fuse or solid state relay) |
| 5 | Output state: load interrupted or disconnected |
| 6 | Output state: solid state relay in short circuit |

# OUTPUTS

## ENABLING SSR OUTPUT CHANNELS

The 24 output channels can be enabled by means of parameters **En.Lp** (with p = phase from 1 to 3). Enabling of the channels is saved in eeprom to maintain the last saved status at the next power-up.
This saving can be disabled by means of the **Option** parameter.

### Settings

| | | | | | | |
|---|---|---|---|---|---|---|
| 32 | **En.L1** | R/W | Output channels enabling phase L1 | *Output channels enabling table* | | 255 |
| 33 | **En.L2** | R/W | Output channels enabling phase L2 | | | |
| 34 | **En.L3** | R/W | Output channels enabling phase L3 | | | |

| bit | |
|---|---|
| 0 | Enable channel 1 (0 =off, 1 = on) |
| 1 | Enable channel 2 (0 = off, 1 = on) |
| 2 | Enable channel 3 (0 = off, 1 = on) |
| 3 | Enable channel 4 (0 = off, 1 = on) |
| 4 | Enable channel 5 (0 = off, 1 = on) |
| 5 | Enable channel 6 (0 = off, 1 = on) |
| 6 | Enable channel 7 (0 = off, 1 = on) |
| 7 | Enable channel 8 (0 = off, 1 = on) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 43 | **Option** | R/W | Device options | *Device options table* | | 42 |

| bit | |
|---|---|
| 1 | Disables saving of parameters En.Lp in eeprom (with p = phase from 1 to 3) |
| 3 | Disables saving of parameters M.P.Lp.o in eeprom (with p = phase from 1 to 3, o = output from 1 to 8) |
| 5 | Disables compensation of line voltage |

## ASSIGNMENT OF DIGITAL OUTPUTS

The power controller has four digital outputs that can be configured with the following parameters:

### Settings

| | | | | | | |
|---|---|---|---|---|---|---|
| 125 | **Out.1** | R/W | Digital outputs assignment OUT 1 | *Digital outputs assignment table* | | 0 |
| 126 | **Out.2** | R/W | Digital outputs assignment OUT 2 | | | |
| 127 | **Out.3** | R/W | Digital outputs assignment OUT 3 | | | |
| 128 | **Out.4** | R/W | Digital outputs assignment OUT 4 | | | |

| | |
|---|---|
| 0 | Digital output disabled |
| 1 | Hardware drive OK |
| 3 | Loads consent |
| 4 | Alarm present |
| +32 | to invert the output status |

### Reading status

| | | | | |
|---|---|---|---|---|
| 29 | **S.IO** | R | Digital I/O states | *Digital I/O states table* |

| bit | |
|---|---|
| 0 | Input state 1 |
| 1 | Input state 2 |
| 2 | Input state 3 |
| 3 | Input state 4 |
| 4 | Output state 1 |
| 5 | Output state 2 |
| 6 | Output state 3 |
| 7 | Output state 4 |

In manual power control mode you can drive the outputs with a settable power percentage defined by:
**M.P.Lp.o** (with p = phase from 1 to 3, o = output from 1 to 8).

You can disable the saving of these parameters in EEPROM by means of the **Option** parameter (for example, in case of repeated changes by a PLC).

A softstart ramp can be configured when each channel is switched on. Ramp length is defined by **M.Ramp.tm.**

## Settings

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 43 | **Option** | R/W | Device options | Bit | *Device options table* | | 42 |
| | | | | 1 | Disables saving of parameters En.Lp in eeprom (with p = phase from 1 to 3) | | |
| | | | | 3 | Disables saving of parameters M.P.Lp.o in eeprom (with p = phase from 1 to 3) | | |
| | | | | 5 | Disables compensation of line voltage | | |
| 44 | **M.Ramp.tm** | R/W | Length of softstart ramp in manual mode | 0.0...25.5s | | | 0,0 |
| 130 | **M.P.L1.1** | R/W | Manual power of output 1 phase L1 | 0...100% | | | 0 |
| 131 | **M.P.L1.2** | R/W | Manual power of output 2 phase L1 | 0...100% | | | 0 |
| 132 | **M.P.L1.3** | R/W | Manual power of output 3 phase L1 | 0...100% | | | 0 |
| 133 | **M.P.L1.4** | R/W | Manual power of output 4 phase L1 | 0...100% | | | 0 |
| 134 | **M.P.L1.5** | R/W | Manual power of output 5 phase L1 | 0...100% | | | 0 |
| 135 | **M.P.L1.6** | R/W | Manual power of output 6 phase L1 | 0...100% | | | 0 |
| 136 | **M.P.L1.7** | R/W | Manual power of output 7 phase L1 | 0...100% | | | 0 |
| 137 | **M.P.L1.8** | R/W | Manual power of output 8 phase L1 | 0...100% | | | 0 |
| 138 | **M.P.L2.1** | R/W | Manual power of output 1 phase L2 | 0...100% | | | 0 |
| 139 | **M.P.L2.2** | R/W | Manual power of output 2 phase L2 | 0...100% | | | 0 |
| 140 | **M.P.L2.3** | R/W | Manual power of output 3 phase L2 | 0...100% | | | 0 |
| 141 | **M.P.L2.4** | R/W | Manual power of output 4 phase L2 | 0...100% | | | 0 |
| 142 | **M.P.L2.5** | R/W | Manual power of output 5 phase L2 | 0...100% | | | 0 |
| 143 | **M.P.L2.6** | R/W | Manual power of output 6 phase L2 | 0...100% | | | 0 |
| 144 | **M.P.L2.7** | R/W | Manual power of output 7 phase L2 | 0...100% | | | 0 |
| 145 | **M.P.L2.8** | R/W | Manual power of output 8 phase L2 | 0...100% | | | 0 |
| 146 | **M.P.L3.1** | R/W | Manual power of output 1 phase L3 | 0...100% | | | 0 |
| 147 | **M.P.L3.2** | R/W | Manual power of output 2 phase L3 | 0...100% | | | 0 |
| 148 | **M.P.L3.3** | R/W | Manual power of output 3 phase L3 | 0...100% | | | 0 |
| 149 | **M.P.L3.4** | R/W | Manual power of output 4 phase L3 | 0...100% | | | 0 |
| 150 | **M.P.L3.5** | R/W | Manual power of output 5 phase L3 | 0...100% | | | 0 |
| 151 | **M.P.L3.6** | R/W | Manual power of output 6 phase L3 | 0...100% | | | 0 |
| 152 | **M.P.L3.7** | R/W | Manual power of output 7 phase L3 | 0...100% | | | 0 |
| 153 | **M.P.L3.8** | R/W | Manual power of output 8 phase L3 | 0...100% | | | 0 |

## Reading status

| | | | |
|---|---|---|---|
| 0 | **Out.P.L1.1** | R | Percentage of modulation of output 1 phase L1 |
| 1 | **Out.P.L1.2** | R | Percentage of modulation of output 2 phase L1 |
| 2 | **Out.P.L1.3** | R | Percentage of modulation of output 3 phase L1 |
| 3 | **Out.P.L1.4** | R | Percentage of modulation of output 4 phase L1 |
| 4 | **Out.P.L1.5** | R | Percentage of modulation of output 5 phase L1 |
| 5 | **Out.P.L1.6** | R | Percentage of modulation of output 6 phase L1 |
| 6 | **Out.P.L1.7** | R | Percentage of modulation of output 7 phase L1 |
| 7 | **Out.P.L1.8** | R | Percentage of modulation of output 8 phase L1 |
| 8 | **Out.P.L2.1** | R | Percentage of modulation of output 1 phase L2 |
| 9 | **Out.P.L2.2** | R | Percentage of modulation of output 2 phase L2 |
| 10 | **Out.P.L2.3** | R | Percentage of modulation of output 3 phase L2 |
| 11 | **Out.P.L2.4** | R | Percentage of modulation of output 4 phase L2 |
| 12 | **Out.P.L2.5** | R | Percentage of modulation of output 5 phase L2 |
| 13 | **Out.P.L2.6** | R | Percentage of modulation of output 6 phase L2 |
| 14 | **Out.P.L2.7** | R | Percentage of modulation of output 7 phase L2 |
| 15 | **Out.P.L2.8** | R | Percentage of modulation of output 8 phase L2 |
| 16 | **Out.P.L3.1** | R | Percentage of modulation of output 1 phase L3 |
| 17 | **Out.P.L3.2** | R | Percentage of modulation of output 2 phase L3 |
| 18 | **Out.P.L3.3** | R | Percentage of modulation of output 3 phase L3 |
| 19 | **Out.P.L3.4** | R | Percentage of modulation of output 4 phase L3 |
| 20 | **Out.P.L3.5** | R | Percentage of modulation of output 5 phase L3 |
| 21 | **Out.P.L3.6** | R | Percentage of modulation of output 6 phase L3 |
| 22 | **Out.P.L3.7** | R | Percentage of modulation of output 7 phase L3 |
| 23 | **Out.P.L3.8** | R | Percentage of modulation of output 8 phase L3 |

| | | | |
|---|---|---|---|
| 50 | **Pw.L1.1** | R | Power setpoint % of output 1 phase L1 |
| 51 | **Pw.L1.2** | R | Power setpoint % of output 2 phase L1 |
| 52 | **Pw.L1.3** | R | Power setpoint % of output 3 phase L1 |
| 53 | **Pw.L1.4** | R | Power setpoint % of output 4 phase L1 |
| 54 | **Pw.L1.5** | R | Power setpoint % of output 5 phase L1 |
| 55 | **Pw.L1.6** | R | Power setpoint % of output 6 phase L1 |
| 56 | **Pw.L1.7** | R | Power setpoint % of output 7 phase L1 |
| 57 | **Pw.L1.8** | R | Power setpoint % of output 8 phase L1 |
| 58 | **Pw.L2.1** | R | Power setpoint % of output 1 phase L2 |
| 59 | **Pw.L2.2** | R | Power setpoint % of output 2 phase L2 |
| 60 | **Pw.L2.3** | R | Power setpoint % of output 3 phase L2 |
| 61 | **Pw.L2.4** | R | Power setpoint % of output 4 phase L2 |
| 62 | **Pw.L2.5** | R | Power setpoint % of output 5 phase L2 |
| 63 | **Pw.L2.6** | R | Power setpoint % of output 6 phase L2 |
| 64 | **Pw.L2.7** | R | Power setpoint % of output 7 phase L2 |
| 65 | **Pw.L2.8** | R | Power setpoint % of output 8 phase L2 |
| 66 | **Pw.L3.1** | R | Power setpoint % of output 1 phase L3 |
| 67 | **Pw.L3.2** | R | Power setpoint % of output 2 phaseL3 |
| 68 | **Pw.L3.3** | R | Power setpoint % of output 3 phase L3 |
| 69 | **Pw.L3.4** | R | Power setpoint % of output 4 phase L3 |
| 70 | **Pw.L3.5** | R | Power setpoint % of output 5 phase L3 |
| 71 | **Pw.L3.6** | R | Power setpoint % of output 6 phase L3 |
| 72 | **Pw.L3.7** | R | Power setpoint % of output 7 phase L3 |
| 73 | **Pw.L3.8** | R | Power setpoint % of output 8 phase L3 |

## COMPENSATION OF LINE VOLTAGE

This function lets you correct supplied power based on reference line voltage **Volt.Nom.Lp** (with p = phase from 1 to 3).
The function can be activated / deactivated with the **Option** parameter.
Correct compensation status is shown in the status of each **S.Out.Lp.o** (with p = phase from 1 to 3, o = output from 1 to 8).

### Settings

| | | | | | | |
|---|---|---|---|---|---|---|
| 37 | **Volt.Nom.L1** | R/W | Rated voltage phase L1 | 0.0...270.0V | | 230.0 |
| 38 | **Volt.Nom.L2** | R/W | Rated voltage phase L2 | 0.0...270.0V | | 230.0 |
| 39 | **Volt.Nom.L3** | R/W | Rated voltage phase L3 | 0.0...270.0V | | 230.0 |
| 43 | **Option** | R/W | Device options | Bit | *Device options table* | 42 |

| | |
|---|---|
| 1 | Disables saving of parameters En.Lp in eeprom (with p = phase from 1 to 3) |
| 3 | Disables saving of parameters M.P.Lp.o in eeprom (with p = phase from 1 to 3, o = output from 1 to 8) |
| 5 | Disables compensation of line voltage |

| | | | |
|---|---|---|---|
| 80 | **S.Out.L1.1** | R | Status of output 1 phase L1 |
| 81 | **S.Out.L1.2** | R | Status of output 2 phase L1 |
| 82 | **S.Out.L1.3** | R | Status of output 3 phase L1 |
| 83 | **S.Out.L1.4** | R | Status of output 4 phase L1 |
| 84 | **S.Out.L1.5** | R | Status of output 5 phase L1 |
| 85 | **S.Out.L1.6** | R | Status of output 6 phase L1 |
| 86 | **S.Out.L1.7** | R | Status of output 7 phase L1 |
| 87 | **S.Out.L1.8** | R | Status of output 8 phase L1 |
| 88 | **S.Out.L2.1** | R | Status of output 1 phase L2 |
| 89 | **S.Out.L2.2** | R | Status of output 2 phase L2 |
| 90 | **S.Out.L2.3** | R | Status of output 3 phase L2 |
| 91 | **S.Out.L2.4** | R | Status of output 4 phase L2 |
| 92 | **S.Out.L2.5** | R | Status of output 5 phase L2 |
| 93 | **S.Out.L2.6** | R | Status of output 6 phase L2 |
| 94 | **S.Out.L2.7** | R | Status of output 7 phase L2 |
| 95 | **S.Out.L2.8** | R | Status of output 8 phase L2 |
| 96 | **S.Out.L3.1** | R | Status of output 1 phase L3 |
| 97 | **S.Out.L3.2** | R | Status of output 2 phase L3 |
| 98 | **S.Out.L3.3** | R | Status of output 3 phase L3 |
| 99 | **S.Out.L3.4** | R | Status of output 4 phase L3 |
| 100 | **S.Out.L3.5** | R | Status of output 5 phase L3 |
| 101 | **S.Out.L3.6** | R | Status of output 6 phase L3 |
| 102 | **S.Out.L3.7** | R | Status of output 7 phase L3 |
| 103 | **S.Out.L3.8** | R | Status of output 8 phase L3 |

*Table of output states*

| bit | |
|---|---|
| 0 | = 0: output OFF;<br>= 1: output ON |
| 1 | = 0: correct compensation;<br>= 1: output saturated (compensation is not correct) |
| 2 | |
| 3 | |
| 4 | Status output: channel power interrupted (fuse or relay) |
| 5 | Status output: load interrupted or disconnected |
| 6 | Output State: SSR short-circuit |

## SSR COMMAND MODE

The following power control modes are settable with the **Firing.t** parameter:

- **Optimized BF**:
modulation by means of changing the number of conduction cycles with zero crossing firing at each full wave with optimum distribution of active channels (refresh time equals 100 half waves: 2.00 s at 50Hz, 1.66 s at 60Hz) to minimize current draw peaks
- **BF** modulation by means of changing the number of conduction cycles with zero crossing firing at full wave
- **HSC** modulation by means of changing the number of conduction cycles with zero crossing firing at half wave

**BF burst firing**: this mode controls power on the load by means of a series of conduction cycles (ON) and non conduction cycles (OFF). The ratio of the number of ON cycle to the number of OFF cycles is proportional to the value of power to be supplied to the load. The period of repetition or cycle time is kept to a minimum for each power value.
The **BF.Cycles** parameter defines the minimum number of conduction cycles, settable from 1 to 20
**HSC Half Single Cycle**: this mode corresponds to a BF that includes half cycles of ON and OFF.
Used to reduce the flicker loads with short-wave infrared.

### Settings

| | | | | | | |
|---|---|---|---|---|---|---|
| 41 | **Firing.t** | R/W | Firing type | *Firing type table* | | 0 |

| | |
|---|---|
| 0 | Optimized Burst Firing |
| 1 | Burst Firing |
| 2 | Half Single Cycle |
| 4 | Phase Angle |

| | | | | | | |
|---|---|---|---|---|---|---|
| 35 | **BF.Cycles** | R/W | Minimum number of cycles of BF mode | 1...20 | | 0 |

## LOAD TYPE

Load type can be set with the **Load.t** parameter

### Settings

| | | | | | | |
|---|---|---|---|---|---|---|
| 42 | **Load.t** | R/W | **Load type** | *Load type table* | | 0 |

| | |
|---|---|
| 0 | Infrared lamps |
| 1 | Resistances |

# HW/SW INFORMATION

You can identify the HW/SW on the controller and check their operation by means of the following information registers

| | | | | | |
|---|---|---|---|---|---|
| 122 | **Upd** | R | Software version code | | |
| 120 | **mtmID** | R | Manufact - Trade Mark (Gefran) | Manufacturer's name | 5000 |
| 121 | **deviceID** | R | Device ID (IR-12/IR-24 module) | Device product | 215 |
| 48 | **Model** | R | Hardware configuration code | *Table of hardware configuration codes* | |

| bit | |
|---|---|
| 0 | = 0: 12 channels<br>= 1: 24 channels |

| | | | | |
|---|---|---|---|---|
| 30 | **S.General** | R | General status | *General status table* |

| bit | |
|---|---|
| 0 | Frequency: 0=50Hz, 1=60Hz |
| 1 | Line voltage off spec. |
| 2 | Alarm minimum voltage phase L1 |
| 3 | Alarm minimum voltage phase L2 |
| 4 | Alarm minimum voltage phase L3 |
| 5 | Alarm maximum voltage phase L1 |
| 6 | Alarm maximum voltage phase L2 |
| 7 | Alarm maximum voltage phase L3 |

| | | | | |
|---|---|---|---|---|
| 31 | **S.Alarm** | R | Alarms status | *Alarms status table* |

| bit | |
|---|---|
| 0 | General alarm (OR all alarms) |
| 1 | |
| 2 | Alarm max. temp. exceeded heat sink 1 |
| 3 | Alarm max. temp. exceeded heat sink 2 |
| 4 | |
| 5 | |
| 6 | Warning first temp. threshold exceeded heat sink 1 |
| 7 | Warning first temp. threshold exceeded heat sink 2 |
| 8 | Alarm phase of synchronism L1 |
| 9 | Alarm phase of synchronism L2 |
| 10 | Alarm phase of synchronism L3 |
| 11 | Alarm no 24V power supply digital outputs |
| 12 | Generic alarm digital output in short circuit |
| 13 | Generic alarm power channel interrupted (FUSE_OPEN) |
| 14 | Generic alarm load interrupted or disconnected (LOAD_OPEN) |
| 15 | Generic alarm solid status relay in short circuit (SSR_SHORT) |

| | | | | |
|---|---|---|---|---|
| 29 | **S.IO** | R | Digital I/O states | *Digital I/O states table* |

| bit | |
|---|---|
| 0 | Input State 1 |
| 1 | Input State 2 |
| 2 | Input State 3 |
| 3 | Input State 4 |
| 4 | Output State 1 |
| 5 | Output State 2 |
| 6 | Output State 3 |
| 7 | Output State 4 |

# APPENDIX

## PARAMETERS

| Parameter definition | | | | Notes | Assigned value |
|---|---|---|---|---|---|
| **CONTROLLING THE DEVICE VIA SERIAL** | | | | | |
| 45 | **Baud** | R/W | Select baud rate | | |
| 47 | **Par** | R/W | Select parity | | |
| 46 | **Cod** | R | Device identification code | Value acquired by rotary switches (tens+units) | |
| **LINE VOLTAGE VALUE** | | | | | |
| 24 | **Volt.L1** | R | Voltmeter input value phase L1 | | |
| 25 | **Volt.L2** | R | Voltmeter input value phase L2 | | |
| 26 | **Volt.L3** | R | Voltmeter input value phase L3 | | |
| 30 | **S.General** | R | General status | | |
| 31 | **S.Alarm** | R | Alarms status | | |
| **DIGITAL INPUTS** | | | | | |
| 74 | **In.1** | R/W | Digital input 1 function | | |
| 75 | **In.2** | R/W | Digital input 2 function | | |
| 76 | **In.3** | R/W | Digital input 3 function | | |
| 77 | **In.4** | R/W | Digital input 4 function | | |
| 29 | **S.IO** | R | Digital I/O states | | |
| **ALARM: THERMAL PROTECTION** | | | | | |
| 27 | **Temp.1** | R | Temperature of heatsink 1 | | |
| 28 | **Temp.2** | R | Temperature of heatsink 2 | | |
| 31 | **S.Alarm** | R | Alarms status | | |

ALARM: FUSE_OPEN, SSR_SHORT and LOAD _OPEN

| | | | |
|---|---|---|---|
| 31 | **S.Alarm** | R | Alarms status |
| 80 | **S.Out.L1.1** | R | Status of output 1 phase L1 |
| 81 | **S.Out.L1.2** | R | Status of output 2 phase L1 |
| 82 | **S.Out.L1.3** | R | Status of output 3 phase L1 |
| 83 | **S.Out.L1.4** | R | Status of output 4 phase L1 |
| 84 | **S.Out.L1.5** | R | Status of output 5 phase L1 |
| 85 | **S.Out.L1.6** | R | Status of output 6 phase L1 |
| 86 | **S.Out.L1.7** | R | Status of output 7 phase L1 |
| 87 | **S.Out.L1.8** | R | Status of output 8 phase L1 |
| 88 | **S.Out.L2.1** | R | Status of output 1 phase L2 |
| 89 | **S.Out.L2.2** | R | Status of output 2 phase L2 |
| 90 | **S.Out.L2.3** | R | Status of output 3 phase L2 |
| 91 | **S.Out.L2.4** | R | Status of output 4 phase L2 |
| 92 | **S.Out.L2.5** | R | Status of output 5 phase L2 |
| 93 | **S.Out.L2.6** | R | Status of output 6 phase L2 |
| 94 | **S.Out.L2.7** | R | Status of output 7 phase L2 |
| 95 | **S.Out.L2.8** | R | Status of output 8 phase L2 |
| 96 | **S.Out.L3.1** | R | Status of output 1 phase L3 |
| 97 | **S.Out.L3.2** | R | Status of output 2 phase L3 |
| 98 | **S.Out.L3.3** | R | Status of output 3 phase L3 |
| 99 | **S.Out.L3.4** | R | Status of output 4 phase L3 |
| 100 | **S.Out.L3.5** | R | Status of output 5 phase L3 |
| 101 | **S.Out.L3.6** | R | Status of output 6 phase L3 |
| 102 | **S.Out.L3.7** | R | Status of output 7 phase L3 |
| 103 | **S.Out.L3.8** | R | Status of output 8 phase L3 |

ENABLING SSR OUTPUT CHANNELS

| | | | | | |
|---|---|---|---|---|---|
| 32 | **En.L1** | R/W | Enabling output channels phase L1 | | |
| 33 | **En.L2** | R/W | Enabling output channels phase L2 | | |
| 34 | **En.L3** | R/W | Enabling output channels phase L3 | | |
| 43 | **Option** | R/W | Device option | | |

## ASSIGNMENT OF DIGITAL OUTPUTS

| | | | | | |
|---|---|---|---|---|---|
| 125 | **Out.1** | R/W | Assignment digital output OUT 1 | | |
| 126 | **Out.2** | R/W | Assignment digital output OUT 2 | | |
| 127 | **Out.3** | R/W | Assignment digital output OUT 3 | | |
| 128 | **Out.4** | R/W | Assignment digital output OUT 4 | | |
| 29 | **S.IO** | R | Digital I/O states | | |

## CONTROL

| | | | | | |
|---|---|---|---|---|---|
| 43 | **Option** | R/W | Device option | | |
| 44 | **M.Ramp.tm** | R/W | Length of softstart ramp in manual mode | | |
| 130 | **M.P.L1.1** | R/W | Manual power of output 1 phase L1 | | |
| 131 | **M.P.L1.2** | R/W | Manual power of output 2 phase L1 | | |
| 132 | **M.P.L1.3** | R/W | Manual power of output 3 phase L1 | | |
| 133 | **M.P.L1.4** | R/W | Manual power of output 4 phase L1 | | |
| 134 | **M.P.L1.5** | R/W | Manual power of output 5 phase L1 | | |
| 135 | **M.P.L1.6** | R/W | Manual power of output 6 phase L1 | | |
| 136 | **M.P.L1.7** | R/W | Manual power of output 7 phase L1 | | |
| 137 | **M.P.L1.8** | R/W | Manual power of output 8 phase L1 | | |
| 138 | **M.P.L2.1** | R/W | Manual power of output 1 phase L2 | | |
| 139 | **M.P.L2.2** | R/W | Manual power of output 2 phase L2 | | |
| 140 | **M.P.L2.3** | R/W | Manual power of output 3 phase L2 | | |
| 141 | **M.P.L2.4** | R/W | Manual power of output 4 phase L2 | | |
| 142 | **M.P.L2.5** | R/W | Manual power of output 5 phase L2 | | |
| 143 | **M.P.L2.6** | R/W | Manual power of output 6 phase L2 | | |
| 144 | **M.P.L2.7** | R/W | Manual power of output 7 phase L2 | | |
| 145 | **M.P.L2.8** | R/W | Manual power of output 8 phase L2 | | |
| 146 | **M.P.L3.1** | R/W | Manual power of output 1 phase L3 | | |
| 147 | **M.P.L3.2** | R/W | Manual power of output 2 phase L3 | | |
| 148 | **M.P.L3.3** | R/W | Manual power of output 3 phase L3 | | |
| 149 | **M.P.L3.4** | R/W | Manual power of output 4 phase L3 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 150 | **M.P.L3.5** | R/W | Manual power of output 5 phase L3 | | | |
| 151 | **M.P.L3.6** | R/W | Manual power of output 6 phase L3 | | | |
| 152 | **M.P.L3.7** | R/W | Manual power of output 7 phase L3 | | | |
| 153 | **M.P.L3.8** | R/W | Manual power of output 8 phase L3 | | | |

COMPENSATION OF LINE VOLTAGE

| | | | | | | |
|---|---|---|---|---|---|---|
| 37 | **Volt.Nom.L1** | R/W | Rated voltage phase L1 | | | |
| 38 | **Volt.Nom.L2** | R/W | Rated voltage phase L2 | | | |
| 39 | **Volt.Nom.L3** | R/W | Rated voltage phase L3 | | | |
| 43 | **Option** | R/W | Device option | | | |
| 80 | **S.Out.L1.1** | R | Status of output 1 phase L1 | | | |
| 81 | **S.Out.L1.2** | R | Status of output 2 phase L1 | | | |
| 82 | **S.Out.L1.3** | R | Status of output 3 phase L1 | | | |
| 83 | **S.Out.L1.4** | R | Status of output 4 phase L1 | | | |
| 84 | **S.Out.L1.5** | R | Status of output 5 phase L1 | | | |
| 85 | **S.Out.L1.6** | R | Status of output 6 phase L1 | | | |
| 86 | **S.Out.L1.7** | R | Status of output 7 phase L1 | | | |
| 87 | **S.Out.L1.8** | R | Status of output 8 phase L1 | | | |
| 88 | **S.Out.L2.1** | R | Status of output 1 phase L2 | | | |
| 89 | **S.Out.L2.2** | R | Status of output 2 phase L2 | | | |
| 90 | **S.Out.L2.3** | R | Status of output 3 phase L2 | | | |
| 91 | **S.Out.L2.4** | R | Status of output 4 phase L2 | | | |
| 92 | **S.Out.L2.5** | R | Status of output 5 phase L2 | | | |
| 93 | **S.Out.L2.6** | R | Status of output 6 phase L2 | | | |
| 94 | **S.Out.L2.7** | R | Status of output 7 phase L2 | | | |
| 95 | **S.Out.L2.8** | R | Status of output 8 phase L2 | | | |
| 96 | **S.Out.L3.1** | R | Status of output 1 phase L3 | | | |
| 97 | **S.Out.L3.2** | R | Status of output 2 phase L3 | | | |
| 98 | **S.Out.L3.3** | R | Status of output 3 phase L3 | | | |
| 99 | **S.Out.L3.4** | R | Status of output 4 phase L3 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 100 | **S.Out.L3.5** | R | Status of output 5 phase L3 | | | |
| 101 | **S.Out.L3.6** | R | Status of output 6 phase L3 | | | |
| 102 | **S.Out.L3.7** | R | Status of output 7 phase L3 | | | |
| 103 | **S.Out.L3.8** | R | Status of output 8 phase L3 | | | |

SSR COMMAND MODE

| | | | | | | |
|---|---|---|---|---|---|---|
| 41 | **Firing.t** | R/W | Trigger type | | | |
| 35 | **BF.Cycles** | R/W | Minimum number of cycles of BF mode | | | |

LOAD TYPE

| | | | | | | |
|---|---|---|---|---|---|---|
| 42 | **Load.t** | R/W | Load type | | | |

HW/SW INFORMATION

| | | | | | | |
|---|---|---|---|---|---|---|
| 122 | **Upd** | R | Software version code | | | |
| 120 | **mtmID** | R | Manufact - Trade Mark (Gefran) | | | |
| 121 | **deviceID** | R | Device ID (IR-12/IR-24 Module) | | | |
| 48 | **Model** | R | Hardware configuration code | | | |
| 30 | **S.General** | R | General status | | | |
| 31 | **S.Alarm** | R | Alarms status | | | |
| 29 | **S.IO** | R | Digital I/O states | | | |

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