

VIPA FM355 / R355

4/8-Channel Controller Module for Siemens S7-300
and Vipa System 300V

3-349-355-29
6/10.09



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1 Safety Precautions

The controller is manufactured and tested in accordance with safety regulations IEC 61010-1 / EN 61010-1 / VDE 0411, part 1.

If used for its intended purpose, safety of the user and of the device is assured.



Attention!

Check the specified nominal voltage **before placing the instrument into service**. When wiring the instrument, make sure the connector cables are not damaged, and that they are voltage-free.

If it can be assumed that safe operation is no longer possible, the instrument must be immediately removed from service (disconnect auxiliary voltage!). Safe operation can no longer be relied upon if the instrument demonstrates visible damage.

The device may not be placed back into operation until troubleshooting and repair have been performed, and calibration and dielectric strength have been tested and approved at our factory or an authorized service center.

Work on live, open instruments may only be carried out by trained personnel who are familiar with the dangers involved.

Requirements set forth in VDE 0100 must be observed during the performance of all work.

Safety clearances to neighboring electrical circuits with dangerous voltages must be maintained during installation.

Meanings of Symbols on the Instrument



Warning concerning a point of danger
(Attention: observe documentation!)



Indicates EC conformity



This device may not be disposed of with the trash. Further information regarding the WEEE mark can be accessed on the Internet at www.gossenmetrawatt.com under the search term 'WEEE'.

2 Identification by Means of Serial Plate

The serial plate is located on the right-hand side of the module. The device type is also shown at the bottom of the front panel on the left-hand side.

4-Channel Temperature Control Module		
Article Number	Measurement Inputs	Binary I/Os
VIPA FM355-3SD00 / R355A	Current / voltage	None
VIPA FM355-3SD10 / R355B	Thermocouple / Pt100	None
VIPA FM355-4SD00 / R355E	Current / voltage	8
VIPA FM355-4SD10 / R355F	Thermocouple / Pt100	8

8-Channel Temperature Control Module		
Article Number	Measurement Inputs	Binary I/Os
VIPA FM355-3SF00 / R355C	Current / voltage	None
VIPA FM355-3SF10 / R355D	Thermocouple / Pt100	None
VIPA FM355-4SF00 / R355G	Current / voltage	24
VIPA FM355-4SF10 / R355H	Thermocouple / Pt100	24

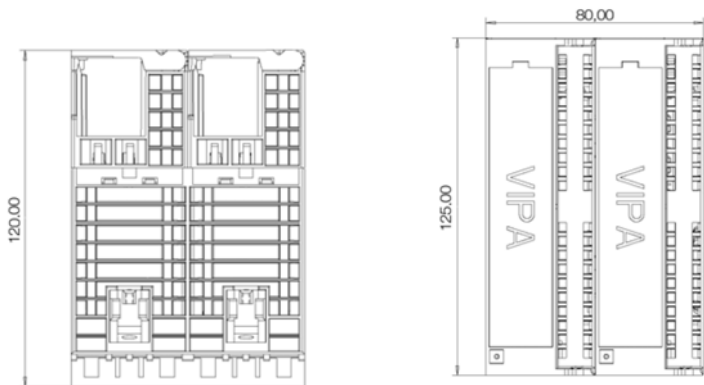
3 Mounting, Setup and Installation Instructions

Safety clearances to neighboring electrical circuits with dangerous voltages must be maintained during installation.

In general, unobstructed air circulation must be assured when one or several devices are installed. The ambient temperature underneath the devices may not exceed 50° C.

Aggressive vapors shorten the service life of the controller.

3.1 Dimensional Drawing



4 Electrical Connection



Attention!

Observe the **terminal assignments** on the inside of the front doors!

Mismatching of the front plugs may result in damage to the controller or interconnected components.

EN 55022 requires the following warning as regards electromagnetic compatibility:

Warning

This is a class A device. This device may cause radio interference in residential areas. If this is the case, the owner may be required to implement appropriate corrective measures.

4.1 Terminal Assignments, 4-Channel Module

Front Plug Pin Assignments, 4 Thermocouples / Pt100 Sensors

For connection of:				For connection of:
	1	L+	21	24 V supply power
1 A heating current transformer Phase 1	2 1k	2k	22	1 A heating current transfor. Phase 2
	3 1l	2l	23	
1 A heating current transformer Phase 3	4 3k	u	24	Heating voltage transformer (transformer, approx. 30 V)
	5 3l	v	25	
Temperature sensor Channel 1 1)	6 +	+	26	Temperature sensor Channel 2 1)
	7 -1	2-	27	
	8 ⊥	⊥	28	
Z355 reference junction	9 C1	+	29	Temperature Sensor Channel 4 1)
	10 C2	4-	30	
Temperature Sensor Channel 3 1)	12 +	⊥	31	Digital input/output 1 ²⁾
	12 -3	I01	32	Digital input/output 2 ²⁾
	14 ⊥	I02	33	Digital input/output 3 ²⁾
Analog output 1 (+10V/+20mA)	15 AO1	I03	34	Digital input/output 4 ²⁾
Analog output 2 (+10V/+20mA)	15 AO2	I04	35	Digital input/output 5 ²⁾
Analog output ground (M)	16 AGND	I05	36	Digital input/output 6 ²⁾
RS 232 (pin 3)	17 Rx	I06	37	Digital input/output 7 ²⁾
service (pin 2)	18 Tx	I07	38	Digital input/output 8 ²⁾
interface (pin 5)	19 GND	I08	39	
	20	M	40	Power supply ground

¹⁾ See terminal assignments in chapter 4.5.

²⁾ Only for variant with binary I/Os


Front Plug Pin Assignments, 4 ea. 10 V / 20 mA

For connection of:			For connection of:
	1	L+	21
1 A heating current transformer Phase 1	2 1k	2k	22
	3 1l	2l	23
1 A heating current transformer Phase 3	4 3k	u	24
+ 0 to 10 V	5 3l	v	25
Controlled variable, channel 1 +0/4 to 20 mA	6 U	U	26
	7 \perp 1	2 \perp	27
	8 I	I	28
	9	U	29
	10	4 \perp	30
+ 0 to 10 V Controlled variable, channel 3 +0/4 to 20 mA	12 U	I	31
	12 \perp 3	101	32
Analog output 1 (+10V/+20mA)	14 I	102	33
Analog output 2 (+10V/+20mA)	15 AO1	103	34
Analog output ground (M)	15 AO2	104	35
RS 232 (pin 3) service (pin 2) interface (pin 5)	16 AGND	105	36
	17 Rx	106	37
	18 Tx	107	38
	19 GND	108	39
	20	M	40
			24 V supply power
			1 A heating current transf. Phase 2
			Heating voltage transformer (transformer, approx. 30 V)
			+ 0 to 10 V
			Controlled variable, channel 2 +0/4 to 20 mA
			+ 0 to 10 V
			Controlled variable, channel 4 +0/4 to 20 mA
			Digital input/output 1 ^{*)}
			Digital input/output 2 ^{*)}
			Digital input/output 3 ^{*)}
			Digital input/output 4 ^{*)}
			Digital input/output 5 ^{*)}
			Digital input/output 6 ^{*)}
			Digital input/output 7 ^{*)}
			Digital input/output 8 ^{*)}
			Power supply ground

^{*)} Only for variant with binary I/Os

4.2 Terminal Assignments, 8-Channel Module

Pin Assignments, Left Front Plugs, AI, 8 ea. Thermocouple7/Pt100

For connection of:				For connection of:
	1	L+	21	24 V supply power
1 A heating current transformer Phase 1	2 1k	2k	22	1 A heating current transfor. Phase 2
	3 1l	2l	23	
1 A heating current transformer Phase 3	4 3k	u	24	Heating voltage transformer (transformer, approx. 30 V)
	5 3l	v	25	
	6		26	
Temperature Sensor Channel 1 1)	7 +	+	27	Temperature Sensor Channel 2 1)
	8 -1	2-	28	
	9 ⊥	⊥	29	
Z355 reference junction	10 C1	C 2	30	Z355 reference junction
				
Temperature Sensor Channel 3 1)	12 +	+	31	Temperature Sensor Channel 4 1)
	12 -3	4-	32	
	14 ⊥	⊥	33	
Temperature Sensor Channel 5 1)	15 +	+	34	Temperature Sensor Channel 6 1)
	15 -5	6-	35	
	16 ⊥	⊥	36	
Temperature Sensor Channel 7 1)	17 +	+	37	Temperature Sensor Channel 8 1)
	18 -7	8-	38	
	19 ⊥	⊥	39	
	20	M	40	Power supply ground

1) See terminal assignments in chapter 4.5.

Pin Assignments, Left Front Plug, AI, 8 ea. U/I

For connection of:				For connection of:	
	1		L+	21	24 V supply power
1 A heating current transformer Phase 1	2	1k	2k	22	1 A heating current transfor. Phase 2
	3	1l	2l	23	
1 A heating current transformer Phase 3	4	3k	u	24	Heating voltage transformer (transformer, approx. 30 V)
	5	3l	v	25	
	6			26	
+ 0 to 10 V Controlled variable, channel 1 +0/4 to 20 mA	7	U	U	27	+ 0 to 10 V
	8	⊥ 1	2 ⊥	28	Controlled variable, channel 2 +0/4 to 20 mA
	9	I	I	29	
	10			30	
+ 0 to 10 V Controlled variable, channel 3 +0/4 to 20 mA	12	U	U	31	+ 0 to 10 V
	12	⊥ 3	4 ⊥	32	Controlled variable, channel 4 +0/4 to 20 mA
	14	I	I	33	
+ 0 to 10 V Controlled variable, channel 5 +0/4 to 20 mA	15	U	U	34	+ 0 to 10 V
	15	⊥ 5	6 ⊥	35	Controlled variable, channel 6 +0/4 to 20 mA
	16	I	I	36	
+ 0 to 10 V Controlled variable, channel 7 +0/4 to 20 mA	17	U	U	37	+ 0 to 10 V
	18	⊥ 7	8 ⊥	38	Controlled variable, channel 8 +0/4 to 20 mA
	19	I	I	39	
	20		M	40	Power supply ground

Pin Assignments, Right Front Plugs, DIO, 24 ea. 24 V DC

For connection of:				For connection of:	
Supply power, 24 V, IO17-24 ²⁾	1	1L+	2L+	21	Supply power, 24 V, IO1-8 ²⁾
Digital input/output 17 ²⁾	2	IO17	IO1	22	Digital input/output 1 ²⁾
Digital input/output 18 ²⁾	3	IO18	IO2	23	Digital input/output 2 ²⁾
Digital input/output 19 ²⁾	4	IO19	IO3	24	Digital input/output 3 ²⁾
Digital input/output 20 ²⁾	5	IO20	IO4	25	Digital input/output 4 ²⁾
Digital input/output 21 ²⁾	6	IO21	IO5	26	Digital input/output 5 ²⁾
Digital input/output 22 ²⁾	7	IO22	IO6	27	Digital input/output 6 ²⁾
Digital input/output 23 ²⁾	8	IO23	IO7	28	Digital input/output 7 ²⁾
Digital input/output 24 ²⁾	9	IO24	IO8	29	Digital input/output 8 ²⁾
Power supply ground ²⁾	10	1M	2M	30	Power supply ground ²⁾
	12		3L+	31	Supply power, 24 V, IO9-16 ¹⁾
Analog output 1 (+10 V / +20 mA)	12	AO1	IO09	32	Digital input/output 9 ²⁾
Analog output 2 (+10 V / +20 mA)	14	AO2	IO10	33	Digital input/output 10 ²⁾
Analog output 3 (+10 V / +20 mA)	15	AO3	IO11	34	Digital input/output 11 ²⁾
Analog output 4 (+10 V / +20 mA)	15	AO4	IO12	35	Digital input/output 12 ²⁾
Analog output ground (3M)	16	AGND	IO13	36	Digital input/output 13 ²⁾
RS 232 (pin 3)	17	Rx	IO14	37	Digital input/output 14 ²⁾
service (pin 2)	18	Tx	IO15	38	Digital input/output 15 ²⁾
interface (pin 5)	19	GND	IO16	39	Digital input/output 16 ²⁾
	20		3M	40	Power supply ground

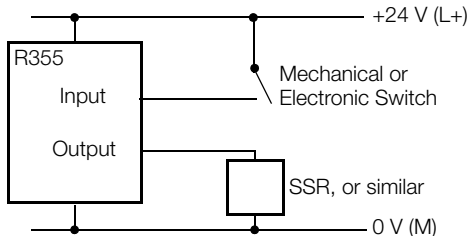
¹⁾ Is also required for supplying power to the analog outputs and the service interface.

²⁾ Only for variant with binary I/Os

4.3 Auxiliary Voltage

Auxiliary voltage is 24 V DC. A fully isolated safety power supply must be used to operate the device.

4.4 Binary Inputs / Outputs (I/O)



Binary I/Os which are configured as **outputs** connect the auxiliary voltage positive pole by means of a semiconductor switch. The load (SSR, controller input etc.) is connected to the auxiliary voltage negative pole.

Three SSRs can be connected in series for controlling 3-phase heaters. Maximum load for each individual output is 100 mA.

If the I/Os are used as **inputs**, control is accomplished either by means of an active positive signal at the auxiliary voltage negative pole, or with a floating contact which switches the auxiliary voltage positive pole to the input.

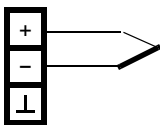
The assignment of I/Os to channels and functions can be freely configured via the interface.



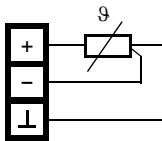
Attention!

Before I/Os used as inputs are configured as such, an active output signal can be read out depending upon configuration. **The output of the connected device may thus be damaged as a result.**

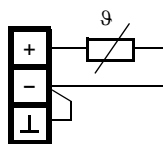
4.5 Measurement Inputs for Thermocouples and Pt100



Thermo-
couple



Pt100
3 or 4-wire



Pt100
2-wire

Thermocouples are connected to the positive and negative terminals. No connections may be made to the \perp terminal.

If impermissible measured values should occur when using insulated thermocouples, all negative legs at the insulated thermocouples should be connected to each other. If necessary they can be connected to the switch cabinet ground terminal.



Attention!

Due to the front plug and housing design it is inevitable for the thermocouple terminals to adopt different temperatures. This results in measuring errors which, depending on the heat development in the module installed on the left side of the R355 module, may amount to ± 5 K. We therefore recommend you to terminate the thermocouple and/or the equalizing lead at a terminal strip, to establish a copper wire connection to the R355 module and to place the reference junction at the thermocouple terminals.

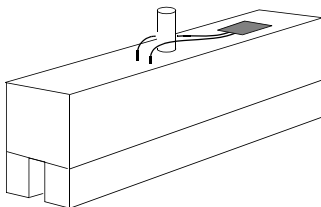
3-wire connection is used for **Pt100 sensors**. In the event of 2-wire connection, the negative terminal must be connected to the \perp terminal at the controller. If Pt100 sensors with 4-wire connection are used, the fourth wire may not be connected at all.



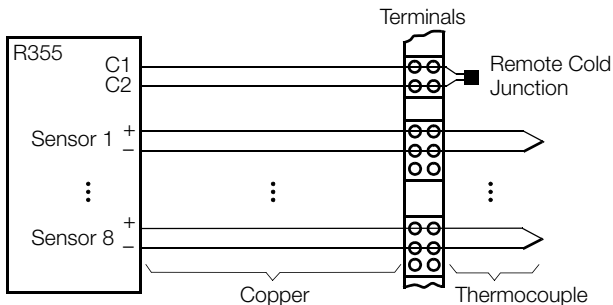
Attention!

The \perp terminals are connected with each other internally and may not be grounded.

4.6 Remote Cold Junction



The reference junction must be mounted such that it has best possible thermal contact with the front plug if the thermocouples are laid all the way up to the front plug.



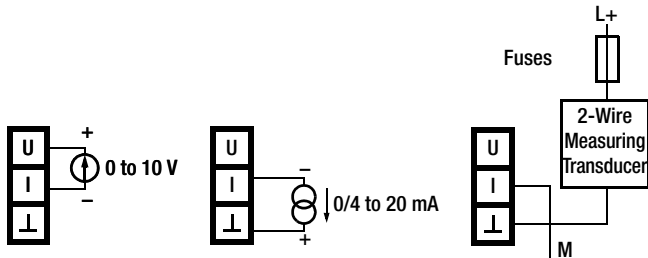
If the equalizing leads for the thermocouple are not laid all the way up to the controller, the accessory Z355A or Z355B (remote cold junctions) are attached to the transition from the thermocouple or the equalizing lead to the copper conductor.



Attention!

The Z355B reference junction must be mounted such that it has best possible thermal contact with the terminals and is not located in the air flow of any control cabinet cooler that may be provided for.

4.7 10 V / 20 mA Measurement Inputs



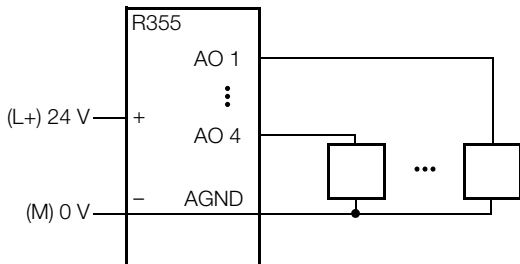
Voltage simulators (0 to 10 V) are connected to terminals U and L.

Current simulators (0/4 to 20 mA) are connected to terminals I and L. An internal load impedance of 44.6Ω is included, so that voltage drop does not exceed 0.9 V. In the event that interference or potential shifting results in unreliable measured values, the L terminals can be grounded.

4.8 Continuous Outputs (AO)

The device is equipped with four (or two) continuous outputs for controlling proportional actuators.

The negative terminals at the actuators are all connected to the AGND terminal.

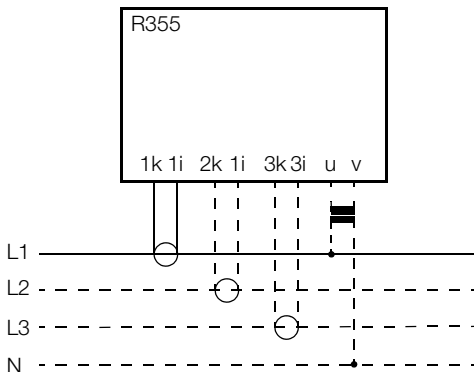


4.9 Heating Current Monitoring (HC 1 ... 3, HV)

Commercially available current transformers with max. 1 A secondary current are connected to terminals k and l. Compliance voltage is max. 2 V.

Three inputs are provided for monitoring 3-phase current.

Several control loops are monitored by means of the summation current principle.



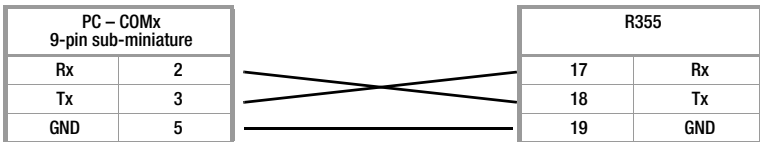
Attention!

If the front plug is removed during operation, excessive voltage occurs at the secondary side of the current transformer.

In order to enable more accurate current monitoring, current fluctuations which result from line voltage fluctuations can be compensated. A voltage transformer with a secondary open-circuit voltage of 12 to 40 V is connected to terminals u and v to this end. A representative phase voltage from the heater power supply is used at the primary side.

All interconnected transformers must assure safe electrical separation, and may not be connected to each other at the secondary side.

4.10 RS 232 Service Interface



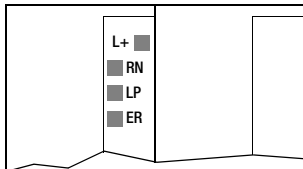
All data can be accessed with a PC via service interface independent of the CPU. Auxiliary voltage must be connected to 3L+ and 3M for interface operation with the 8-channel module.

5 LED Functions

LEDs provide information regarding the status of the device, as well as the controller's switching outputs and switching inputs.

Status Displays

Power on (L+)	Green	Auxiliary voltage on
Run (RN)	Green	Processor on
Controller active, loop (LP)	Green	Controller autonomously configured or CPU not in STOP
Error (ER)	Red	Hardware error, see operating instructions
Active binary input/output	Green	Status of binary I/Os



6 Initial Start-Up

6.1 Controller Configuration

All settings are either configured via the interfaces of the CPU (Ethernet TCP/IP, MPI, Profibus DP) with the 355Remote remote maintenance tool or via the service interface at the controller with the 355config configuration tool. The tools can be downloaded at www.gossenmetrawatt.com. The data handling blocks are available directly from the customer service center, from your sales representative or from product support.

6.2 Performance after Connecting Auxiliary Voltage

- As soon as auxiliary voltage is connected, the green “Power” LED lights up.
- Shortly thereafter, the green “Run” LED lights up, and the red “Error” LED blinks twice briefly.
- The green “Loop” lights up when the controller is configured “autonomously”, or when the CPU is not in “Stop”.
- The binary output LEDs then light up in accordance with control loop settings. The binary output LEDs light up even if auxiliary voltage has not been connected, if the inputs are driven actively.

6.3 Possible Errors

Error	Possible Cause
Power LED does not light up	No auxiliary voltage or reversed polarity
Run LED does not light up or blinks	Defective processor or data error
Error LED lights up	Defective hardware
Binary output LEDs do not light up	Short-circuit at output
Binary I/O LEDs continuously illuminated	No connection between negative pole at the actuators and auxiliary voltage

7 Parameters Configuration and Operation

Information regarding parameters configuration and operation of the controller is included in the comprehensive operating instructions. These are available from the Internet at www.gossenmetrawatt.com.

Read these operating instructions completely and carefully before using the device, Follow all instructions contained therein. Make sure that the operating instructions are available to all users of the instrument.

8 Technical Data

Inputs / Outputs

Sampling rate 10 ms per channel

Thermocouple Measurement Input

Thermocouples per IEC 60584 / EN 60584 / DIN 43710

Measuring range 0 to 50 mV

Accuracy / error ± 0.3 mV

Resolution 0.1 K

Cont. overload	AC	50 / 60 Hz sinusoidal,	50 V AC
	DC		1 V DC

Input impedance Approx. 50 k Ω

Error message In event of broken sensor or sensor polarity reversal, or temperature outside of the measuring range

Reference Junction Measurement Input

Nominal input range 0 to 70 °C

Accuracy ± 2 K

Remote cold junction Available as accessory

Measurement Input for Pt100 Resistance Thermometer with 2 or 3-Wire Connection

Pt100 per IEC 60751 / DIN EN 60751

Measuring range 60 to 280 Ω

Nominal input range -200 to 850 °C

Sensor current < 0.2 mA

Accuracy / error < 0.5% of measuring range

Resolution 0.1 K

Cont. overload	AC	50 / 60 Hz sinusoidal,	50 V AC
	DC		1 V DC

Input impedance 18 k Ω

Cable resistance
(both directions) 2-wire connection: 0 to 30 Ω , adjustable

3-wire connection: 0 to 30 Ω , compensated

Error message In event of broken sensor or sensor short-circuit, or temperature outside of the measuring range

Measurement Input: Direct Voltage, Direct Current

	Direct Voltage	Direct Current
Measuring range	0 / 2 to 10 V, configurable	0 / 4 to 20 mA, configurable
Continuous overload	100 V	60 mA DC
Input impedance / load	Approx. 84 k Ω	Approx. 45 Ω
Error message	Measured quantities more than 10% outside the measuring range	
Accuracy	< 0.7% of measuring range	
Resolution	< 0.1% of upper range value	

Heating Current Monitoring Input

Measuring range	1 A AC (direct connection of a commercially available measuring transducer)
Resolution	< 0.1% of upper range limit
Accuracy	< 5% of upper range limit

Heating Voltage Monitoring Input

Measuring Range	10 to 50 V AC (direct connection of a commercially available measuring transducer)
Resolution	< 0.1% of upper range limit
Accuracy	< 5% of upper range limit

Binary Inputs / Outputs

Unused I/Os are freely available to the CPU

Output function	Active switching outputs, power supply directly from auxiliary voltage
Function	Manipulated variable output / alarm output
Read-out cycle	Adjustable within a range of 0.1 to 300 s
Nominal Range of Use	H signal: $U \geq$ auxiliary voltage -0.5 V $I \leq 100$ mA L signal: < 0.1 mA e.g. for controlling up to 3 commercially available semiconductor relays (SSR) in series
Input Function	Read back output status, external control of PLC etc.
Nominal Range of Use	H signal: > 14 V / 8 to 16 mA at 24 V L signal: < 7 V / < 0.2 mA
Overload limit, H and L signals	Continuous short-circuit, interruption

Continuous Outputs

Output function	Actuator output for proportional actuator
Output quantity	0 to 10 V at > 1 k Ω load, 0 to 20 mA at < 300 Ω load
Resolution	0.1% of upper range limit
Accuracy	< 3% of upper range limit

Auxiliary Voltage

A fully isolated safety power supply must be used to operate the device.

Nominal value	24 V DC
Nominal range of use	18 to 30 V DC
Power consumption	Max. 10 W, typically 6 W (without load)

RS 232 Service Interface

Maximum number of devices	1
Transmission Speed	19.2 kBaud
Protocol per	EN 60870

Electrical Safety

Attention: The device is not equipped with its own mains switch.

Variant	IEC 61010-1 / EN 61010-1 / VDE 0411, part 1
Safety class	II
Measurement category	CAT I
Pollution Degree	2
Protection	IEC 60529 / EN 60529 / VDE 0470, part 1
Housing, connections	IP 20

Electromagnetic Compatibility

Product standard EN 61326:2002

EMC interference emission		Class		Class	
EN 55022	Radio interference characteristics	A			
EMC interference immunity			EN 61000-4-5	Surge voltages	A
EN 61000-4-2	Discharge of static electricity	A	EN 61000-4-6	Mains-borne injection	A
EN 61000-4-3	Electromagnetic fields	A	EN 61000-4-8	Magnetic field at line frequency	A
EN 61000-4-4	Fast transient interferences	A	EN 61000-4-11	Voltage dip	A

Ambient Conditions

Annual mean relative humidity, no condensation	75%
Ambient temperature	
– Nominal range of use	0 to + 50° C
– Operating range	0 to + 50° C
– Storage range	– 25 to + 70° C

Mechanical Design

Basic housing dimensions

Single width (W x H x D) in mm: 40 x 125 x 120

Double width (W x H x D) in mm: 80 x 125 x 120

Weight

4-channel module: approx. 250 g
8-channel module: approx. 500 g

Connectors

40-pin front plug

Mounting

To S7-300 mounting rails

9 Maintenance – Device Return and Environmentally Sound Disposal

Maintenance

The controller does not require maintenance at regular intervals.

Device Return and Environmentally Sound Disposal

The VIPA FM355 / R355 is a category 9 product (monitoring and control instrument) in accordance with ElektroG (German electrical and electronic device law). This device is not subject to the RoHS directive.

We identify our electrical and electronic devices (as of August 2005) in accordance with WEEE 2002/96/EC and ElektroG with the symbol shown to the right per DIN EN 50419.

These devices may not be disposed of with the trash. Please contact our service department regarding the return of old devices (see chapter 10).



10 Repair and Replacement Parts Service, Rental Instrument Service

If required please contact:

GMC-I Service GmbH

Service Center

Thomas-Mann-Str. 20

90471 Nürnberg • Germany

Phone: +49 911 817718-0

Fax: +49 911 817718-253

E-mail service@gossenmetrawatt.com

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