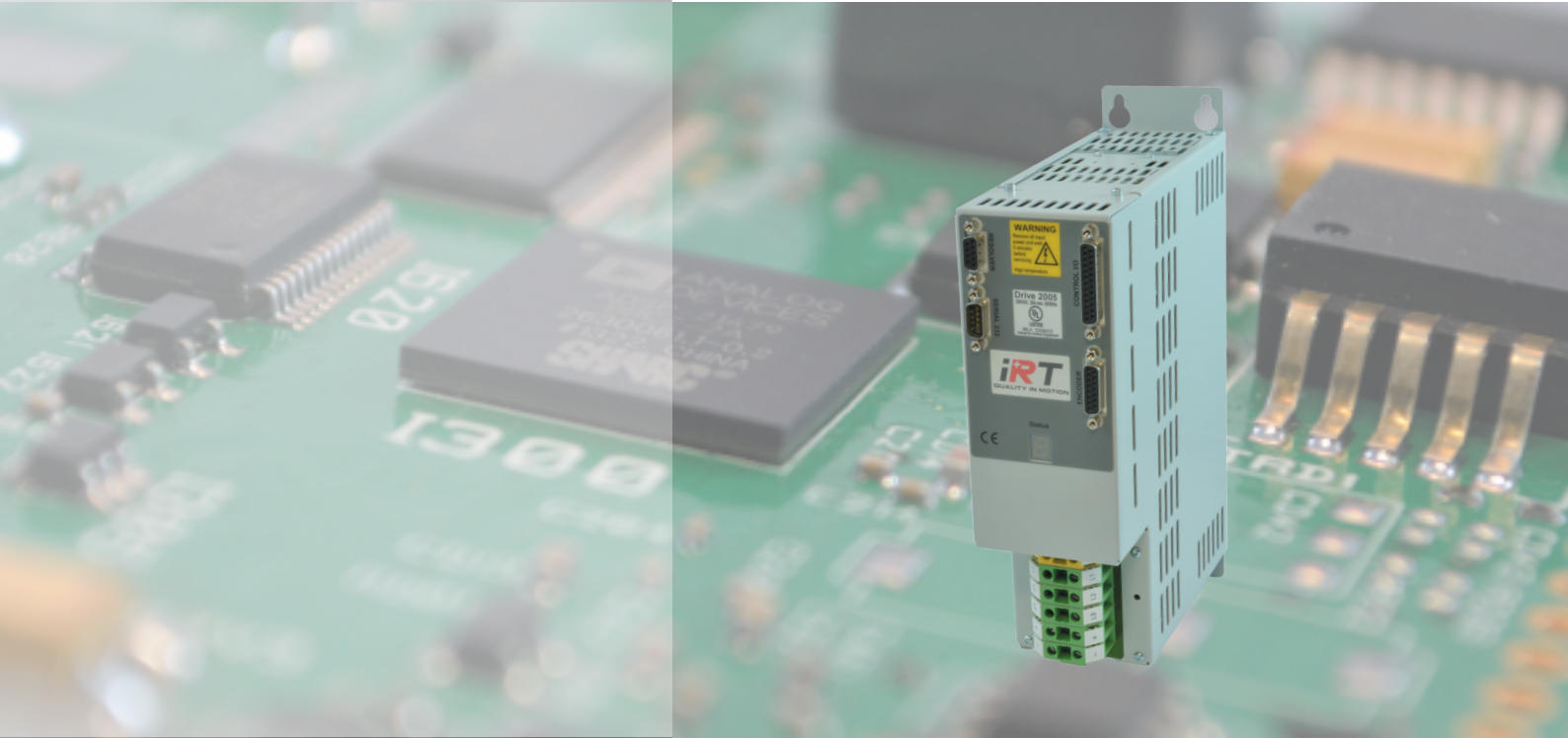


## 2000 AT-Small



## Technical Manual





**UL Requirements Drives Series 2000 / 4000 AT**

1. Field wiring terminal to use 60/75 or 75°C copper (CU) wire only.
2. Input power terminal tightening torque = 1.2 Nm
3. Motor terminal tightening torque = 0.5 Nm
4. No overspeed protection incorporated
5. Degree of overload protection provided internally by the drive, in percent of full load current or current value.
6. Open chassis to be installed in an enclosure that protects the drive from conductive dust and condensation (pollution degree 2 environment).
7. Maximum surrounding air temperature = 40 degree C.
8. These devices are not provided with motor overtemperature sensing.
9. Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
10. Suitable for use on A circuit capable of delivering not more than 5000 rms - symmetrical amperes, 230 (2000 Serie) and 400 (4000 Serie) Volts maximum. The short circuit ampere rating and the fuse ampere rating shall be in accordance with the following rating table :

Drive Model	Branch Fuses	
	Ratings	Reference
4003	30A – 690V (rated I <sup>2</sup> t 815)	Ferraz Shawmut, JFHR2 – type A070GRB 30E113, 10,3 x 38 (reference M330015)
4005		
4009		
2005		
2010		
2020	50A – 690V (rated I <sup>2</sup> t 2250)	Ferraz Shawmut, JFHR2 – type 6.900 CP gRC, 14.51 x 50 (reference L220902)
4015		
4025		
4050	100A / 690V (rated I <sup>2</sup> t 11950)	Ferraz Shawmut, JFHR2 – type 6.900 CP gRC, 22.58 x 100 (reference W220911)

UL listed drives : 2000 S-AT 4000 S-AT 4000 M-AT 4000 L-AT

## Contents

<b>1. INTRODUCTION</b>	<b>4</b>
<b>2. DESCRIPTION</b>	<b>5</b>
<b>3. TECHNICAL DATA</b>	<b>7</b>
<b>3.1 GENERAL DATA FOR ALL TYPES</b>	<b>7</b>
<b>3.2 ELECTRICAL DATA</b>	<b>8</b>
<b>3.3 SMALL DRIVE OUTLINES</b>	<b>10</b>
<b>3.4 MOTORS</b>	<b>12</b>
<b>3.5 POSITION FEEDBACK</b>	<b>12</b>
<b>4. FUSES</b>	<b>13</b>
<b>5. OPTION LIST</b>	<b>13</b>
<b>6. ADD-ON BOARDS</b>	<b>14</b>

## 1. Introduction

The servo-amplifiers series 2000 are intended for the control of 3 phases brushless servo-motors and asynchronous servo-motors.

The motors regulated by the series 2000 servo-amplifiers should have the following characteristics:

- Rotor constructed with permanent magnets or winding cage arranged in 1, 2, 3, 4, 5 or 6 pole pairs, without commutator.
- Stator constructed with 3 windings connected in star or delta.
- Brushless motors : electronic commutation is performed by means of a feedback type :
  - **Speed one resolver**
  - **Absolute encoder SinCos Hiperface compatible**
  - **Incremental encoder with U, V and W signals**
  - **EnDat.**
- Asynchronous motors : electronic commutation is only performed by means of a feedback type :
  - **Speed one resolver**
  - **Incremental encoder.**
- Motors with Hall effect sensors and tachogenerator are not suitable.

The servo-amplifier series 2000 Small are fully digital. High-performance torque, speed and positioning control fulfils all requirements for rapid response and control accuracy.

Digital control allows comprehensive diagnostics, motor parameters tuning, data and fault logging, etc.. using a PC based user program.

A wide range of firmware assures to meet the requirements of practically any application.

## 2. Description

The particular features of the servo-amplifiers series 2000 Small are described thereunder:

### Power supply

- Single-Axis unit incorporating braking module for connection to 3 phases power supply. Possibility to connect the drives to a common DC-bus voltage.
- 230V three-phase power source
- Option: Internal filters in power source reducing noise emission.

### Power driver

- Galvanic isolation between control and power electronics.
- IGBT output stage.
- Digital PWM current loop providing very low ripple motor currents and high motor efficiency.

### Digital controller

- Full-digital servo-amplifier for Brushless motor with resolver.
- Easy software update and fully programmable through serial link RS232 or RS485.
- Possibility to integrate a customised *INTERFACE* board.
- Energy managing system for fan-cooling.
- Multi loops control (torque and speed).
- Sinusoidal current output ensures smooth torque and optimal performance at low speed.
- 7 segment status indicator for diagnostic display.

### User's inputs

- Analogue speed or current input command +/- 10V or digital input command.
- RS232 serial port and RS485 serial port for multi axis controller system.
- Limit switches for overrun protection in both directions.
- External power supply to the Control and Interface boards to keep position data and alarms in case of main power supply interruption.

**User's outputs**

- Incremental encoder output simulation with adjustable resolution from 1 to 1024 ppr and adjustable marker pulse. Differential line driver outputs.
- Ready relay contact.

**Protections**

- Protection and rugged construction for use in adverse conditions.
- Power stage fully protected against short-circuit and over-temperature.
- Motor protection by  $I^2t$  limitation.
- Detection of resolver fault, motor wiring failure, motor overheating.

### 3. Technical data

#### 3.1 General data for all types

Description		Unit	Series 2000 Small
Supply frequency		Hz	45 to 65
Operating temperature range		° C	0 to 60
Operating temperature range at full power (from 45°C, reduce output current by 2%/°C to 60°C)		° C	0 to 45
Storage temperature range		°C	-25 to +55
PWM chopper frequency		kHz	7.5
Differential input reference		V	+ 10 to -10
Speed control range			1/32768
Speed loop bandwidth		Hz	max. 150
Current loop bandwidth		Hz	max. 2000
Output frequency to motor		Hz	0 to 500
Incremental encoder simulation		ppr	1 to 1024 (2048)
Theoretical max. speed for motor with resolver "speed one"		rpm	7500 or 12000 depending on firmware version
Serial link	Standard baud rate	Bd.	9600
	Transmission		Full duplex
	Format		1 START bit, 8 DATAS bit, no parity, 1 STOP bit
Time between power on and enable drive		sec	Max. 3
International Protection			IP20
Supply Voltage		VAC	3x230 +10% -20%
Max. output voltage to motor		V	3x220
ON-Switching threshold of brake module		VDC	385
OFF-Switching threshold of brake module		VDC	380
ON-Trip threshold of overvoltage		VDC	410
OFF-Trip threshold of overvoltage		VDC	400
OFF-Trip threshold of undervoltage		VDC	230
ON-Trip threshold of undervoltage		VDC	220
Cooling			Air fan forced above 40°C
Indicative weight		kg	3.2



### 3.2 Electrical data

Drive AT Type	Rated rms current	Rated pk. current	Max. rms current	Max. peak current	Rated power	Max. power
	( $I_{rms \text{ rated}}$ )	( $I_{peak \text{ rated}}$ )	( $I_{rms \text{ max}}$ )	( $I_{peak \text{ max}}$ )	( $P_{rated}$ )	( $P_{max}$ )
	(A)	(A)	(A)	(A)	(kW)	(kW)
2005	5	7	10	14	2	4
2010	10	14	20	28	4	8
2020	20	28	40	56	7.5	15

**Note:**  $I_{rms} = I_{peak} / 1,41$   $V_{rms} = 220V$   
 $P = 1,73 \times I_{rms} \times V_{rms}$  or  $P = 3 \times I_{rms/phase} \times V_{rms/phase}$

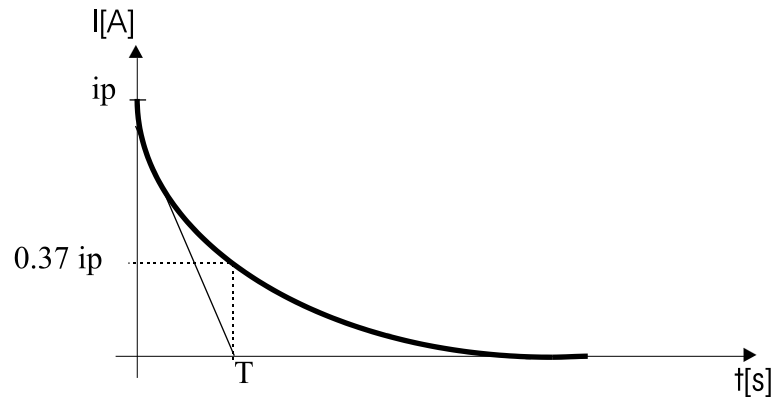
**Braking power :**

Drive AT Type	Rbraking	Peak braking power	Max. continuous braking power	Surge energy ( $\Delta T=300K$ )
	( $\Omega$ )	(W)	(W)	(kJ)
2005 2010 2020	33	4500	250	5

The surge energy rating is the maximum permitted dynamic brake application from cold. To a first approximation, heat is then removed at the rate given by the continuous power figure: thus about 20 seconds interval must be allowed between full energy stops.

**3.2.1 Inrush current**

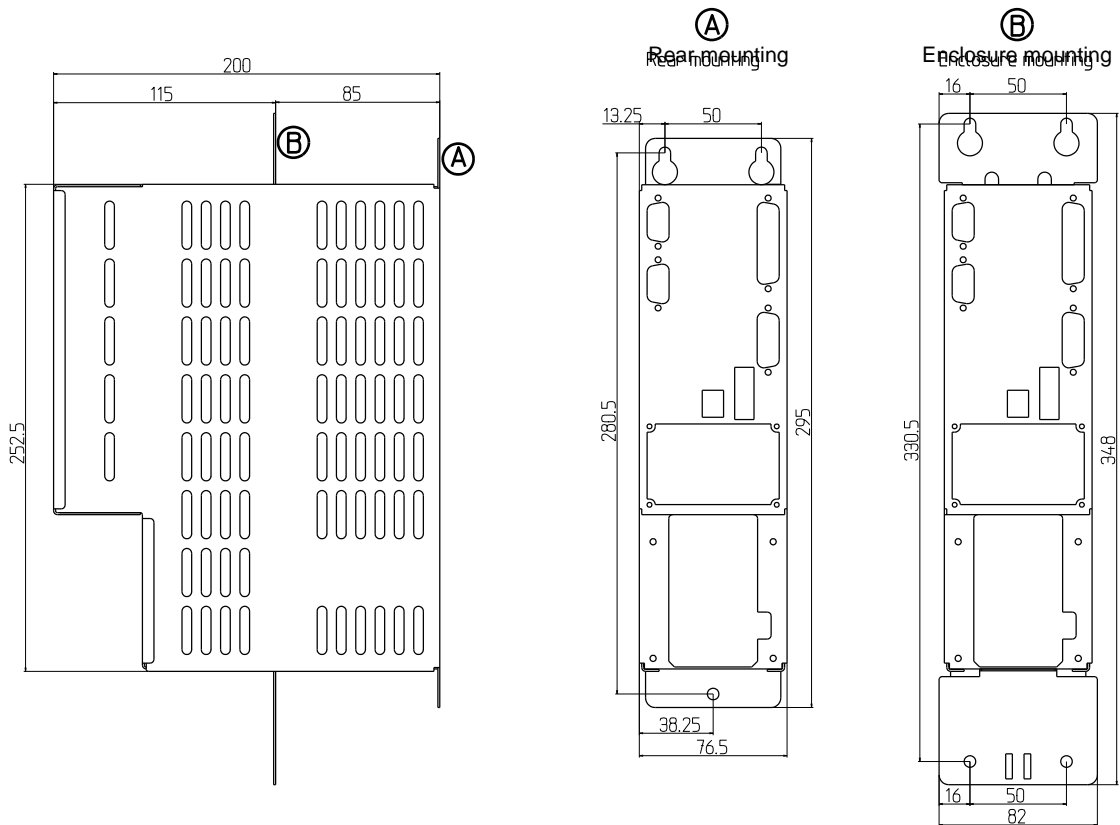
Wave shape for the nominal values



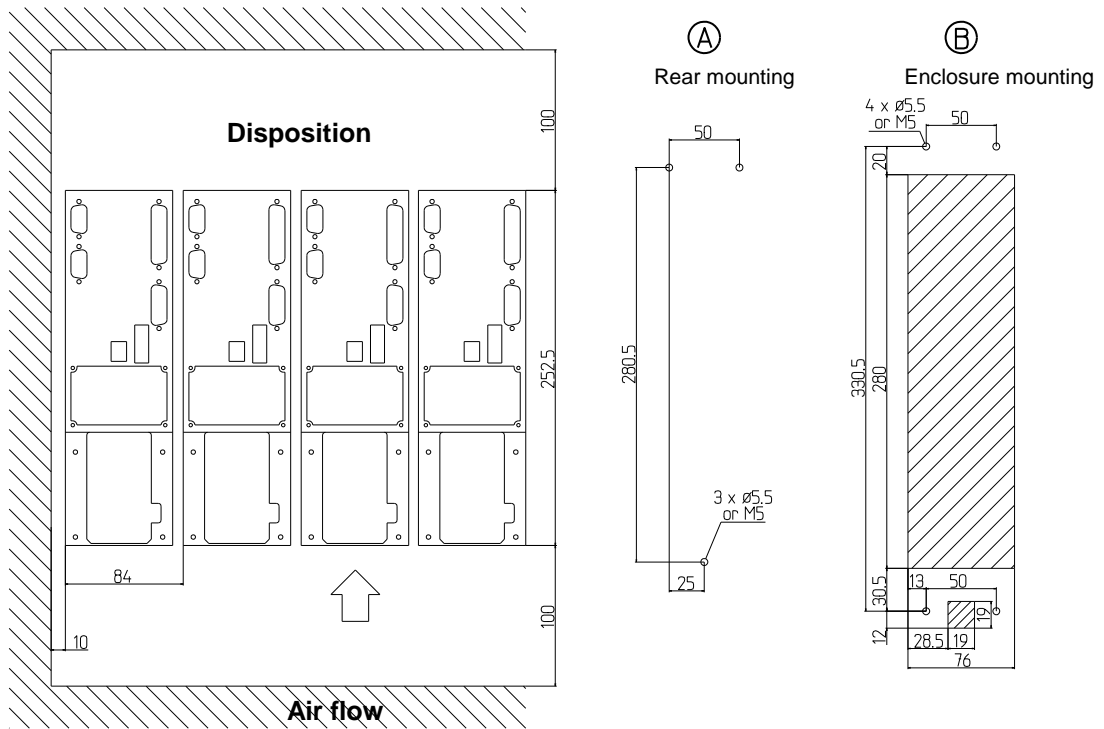
$$i(t) = i_p \cdot e^{-t/T} \quad \Rightarrow \quad i^2 \cdot t = \frac{1}{2} \cdot i_p^2 \cdot T$$

2000 AT Small:                       $i_p = 7 \text{ A}$                       and                       $T = 31 \text{ ms}$                        $\Rightarrow$                        $i^2 t = 1.5 \text{ A}^2 \text{ s}$

**3.3 Small drive outlines**

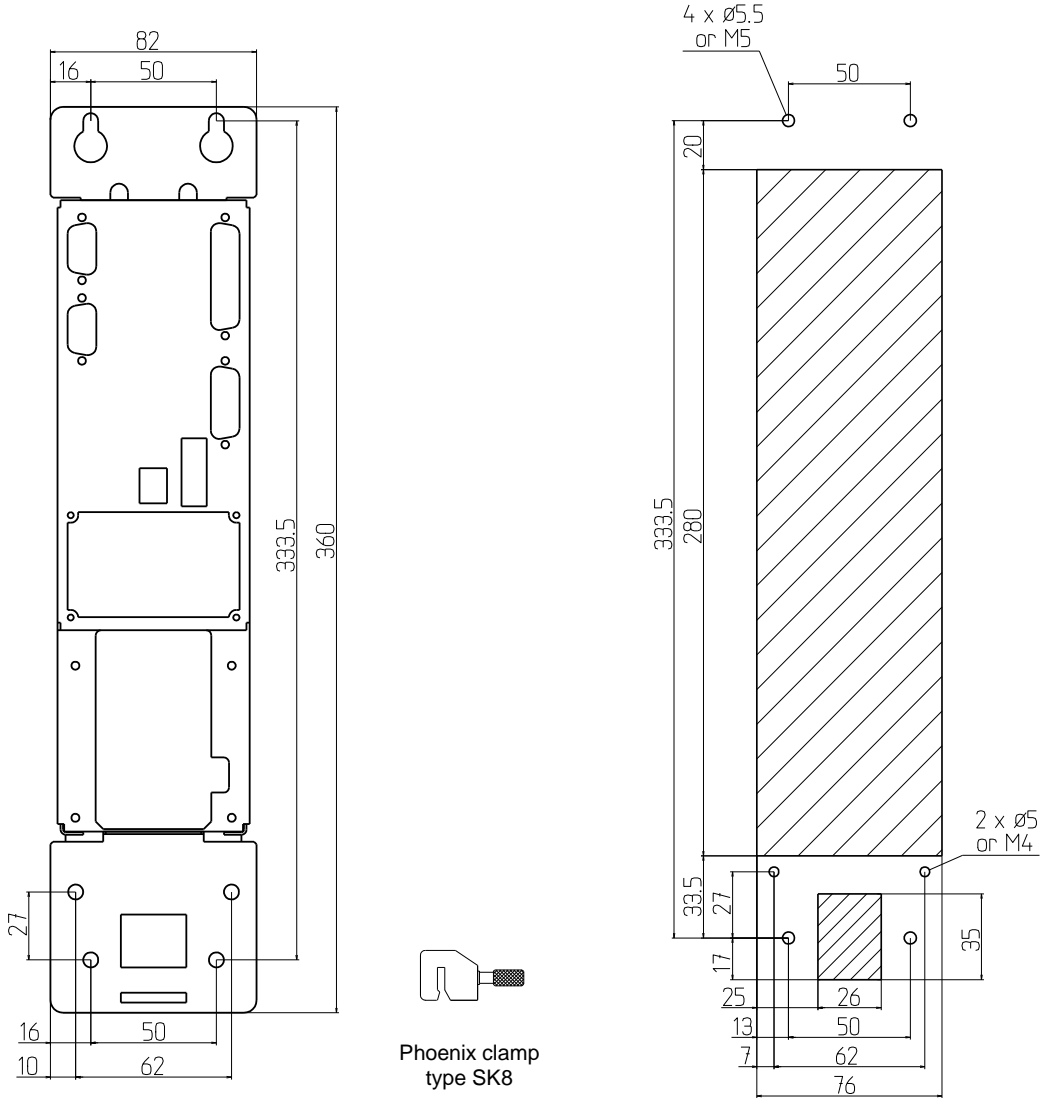


**Installation, drill and cutout plan :**



**3.3.1 Small with special clamp type Phoenix (option)**

**Drill and cutout plan for enclosure mounting :**



### 3.4 Motors

- Brushless 3 phases servo-motors
- Asynchronous, 3 phases motors

### 3.5 Position feedback

- Resolver :

**Characteristics :**

- Speed One (1 sine period and 1 cosine period per revolution)
- Ratio  $0.5 \pm 10\%$
- Reference frequency : 5..10 kHz
- $Z_{RO} > 95\Omega$  @ 7,5 kHz (Input impedance)
- $Z_{SO} < 1000\Omega$  @ 7,5 kHz (Output impedance)

- Incremental encoder for asynchronous motor only.
- Absolute encoder Stegmann SinCos Multi and Single turn SRS/M 50/60(HIPERFACE compatible).
- Incremental encoder with U, V and W signals for synchronous motor.
- EnDat encoder.

## 4. Fuses

Drive 2000 AT Small	DC-BUS (FBUS)
2005 2010 2020	<b>30A gRB/690V</b> 10.3x38 Ferraz, art. A070 gRB 30T13 <i>UL: E76491</i> Art. IRT: 2410.159.30

**NB:** No replacement of any fuse should be carried out until the reason for it's blowing has been rectified.

## 5. Option list

1. EMC FILTER ON 3 PHASES INPUT SUPPLY (Small AT only)
2. MECHANICAL MOTOR BRAKE RELAY
3. RS485 BUS
4. AUXILIARY 24V SUPPLY

## 6. Add-on boards

Add-on boards compatible with series 2000 Small drives

### IRT PROFILE

**Add-on board to perform simple movements and interfacing with 24V systems (PLS).**

**Main characteristics :**

- 24 V powered.
- DC-DC conversion for drive power back-up (the position value is kept when main supply of the drive is switched off).
- 14 Outputs potential free (24V 100 mA).
- 16 Inputs 24V potential free.
- Windows Profile User software for easy setting.

To obtain more information about Profile board, contact your IRT distributor.

**Distributed by :**

Official IRT distributors.

### UVW ENCODER FEEDBACK

**See Special functions specification.**

**Distributed by :**

Official IRT distributors.

### Dual analogic bipolar output

**Outputs range :** +/- 10V

**Output SPEED :** 1V corresponds to 1000 RPM

**Output CURRENT :** 10V corresponds to  $I_{MAX DRIVE}$

**Distributed by :**

Official IRT distributors.

## Add-on boards compatible with series 2000 Small drives

**☐ MKS IR115 / IR116 / IR117**

**Synchro-Control, positioning and CANopen interface module for IRT Series 2000 Small drives.**

**Manufacturer :**

MKS Mashinen-Kontroll-System Gmbh  
Zwischen den Wegen 32  
D-78239 Rielasingen 2 - Germany  
Tel. +49 (0)7731-9332-0  
Fax +49 (0)7731-9332-30  
E-Mail info@mks-sys.com  
Internet www.mks-sys.com

**Distributed by :**

MKS.  
Official IRT distributors.

**☐ QUIN SERVOnet**

**Positioning control and SERVOnet (CAN-BUS type) interfacing module for IRT series 2000 Small drives.**

**Manufacturer :**

Quin Systems limited  
Oakland business Centre  
Oakland Park  
Wokingham  
Berkshire RG41 2FD  
Tel 0118 977 1077  
Fax 0118 977 6728  
E-Mail : sales@quin.co.uk  
Internet : www.quin.co.uk

**Distributed by :**

Quin System.



**DRIVE SERIES 2000 SMALL, TECHNICAL MANUAL EVOLUTION**

CHAPTER	PAGE (OLD VERSION)	PAGE	REVISION	DESCRIPTION
				Manual reduced to Technical manual for drives 2000 Small
		1	2	Drive picture
	2	2	3	UL Requirements
3	10	10	3	Drives outlines, Motor + Feedback
	2	2	4	UL Requirements

**Last modification : September 2013**