

minun

### ThermaCAM<sup>™</sup> EX300

User's manual – Benutzerhandbuch – Manual dei usuano – Manuel de l'utilisateur – Manuale dell'utente – Manual do utilizador – Felhas-I – Benutzerhandbuch – Manual dei usuano – Manuel de l'utilisateur – Manuale dell'utente – Manual do utilizador – Felhasználól kézikönyv – Käyttäjän opas – Betjeningsvejledning – Brukerveiledning – Instrukcja obslugi – BruksanVISning – Kullanim ING – Brukerveiledning – Instrukcja obslugi – BruksanVISNING – Kullanim Kilavuzu – Uzivatelská pliručka – Gebruikershandleiding

### User's manual

Publ. No.	1558439
Revision	a156
Language	English (EN)
Issue date	February 28, 2006

Warnings & cautions	1
Important note about this manual	2
Welcome!	3
Packing list	4
System overview	5
Connecting system components	6
Introduction to thermographic inspections of electrical installations	7
Tutorials	8
Camera overview	9
Camera program	10
Electrical power system	11
Maintenance & cleaning	12
Troubleshooting	13
Technical specifications & dimensional drawings	14
Glossary	15

Thermographic measurement techniques	16
History of infrared technology	17
Theory of thermography	18
Emissivity tables	19

# ThermaCAM<sup>™</sup> EX300

User's manual





#### Legal disclaimer

All products manufactured by FLIR Systems are warranted against defective materials and workmanship for a period of one (1) year from the delivery date of the original purchase, provided such products have been under normal storage, use and service, and in accordance with FLIR Systems instruction.

All products not manufactured by FLIR Systems included in systems delivered by FLIR Systems to the original purchaser carry the warranty, if any, of the particular supplier only and FLIR Systems has no responsibility whatsoever for such products.

The warranty extends only to the original purchaser and is not transferable. It is not applicable to any product which has been subjected to misuse, neglect, accident or abnormal conditions of operation. Expendable parts are excluded from the warranty.

In the case of a defect in a product covered by this warranty the product must not be further used in order to prevent additional damage. The purchaser shall promptly report any defect to FLIR Systems or this warranty will not apply.

FLIR Systems will, at its option, repair or replace any such defective product free of charge if, upon inspection, it proves to be defective in material or workmanship and provided that it is returned to FLIR Systems within the said one-year period.

FLIR Systems has no other obligation or liability for defects than those set forth above.

No other warranty is expressed or implied. FLIR Systems specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

FLIR Systems shall not be liable for any direct, indirect, special, incidental or consequential loss or damage, whether based on contract, tort or any other legal theory.

#### Copyright

© FLIR Systems, 2006. All rights reserved worldwide. No parts of the software including source code may be reproduced, transmitted, transcribed or translated into any language or computer language in any form or by any means, electronic, magnetic, optical, manual or otherwise, without the prior written permission of FLIR Systems.

This manual must not, in whole or part, be copied, photocopied, reproduced, translated or transmitted to any electronic medium or machine readable form without prior consent, in writing, from FLIR Systems.

Names and marks appearing on the products herein are either registered trademarks or trademarks of FLIR Systems and/or its subsidiaries. All other trademarks, trade names or company names referenced herein are used for identification only and are the property of their respective owners.

#### Quality assurance

The Quality Management System under which these products are developed and manufactured has been certified in accordance with the ISO 9001 standard.

FLIR Systems is committed to a policy of continuous development; therefore we reserve the right to make changes and improvements on any of the products described in this manual without prior notice.

#### Patents

This product is protected by patents, design patents, patents pending, or design patents pending.

One or several of the following patents, design patents, patents pending, or design patents pending apply to the products and/or features described in this manual:

Designation	Status	Reg. No.	
China	Application	00809178.1	
China	Application	01823221.3	
China	Application	01823226.4	
China	Design Patent	235308	
China	Design Patent	ZL02331553.9	
China	Design Patent	ZL02331554.7	
China	Pending	200530018812.0	
EPC	Patent	1188086	
EPO	Application	01930377.5	
EPO	Application	01934715.2	
EPO	Application	27282912	
EU	Design Patent	000279476-0001	
France	Patent	1188086	

Designation	Status	Reg. No.	
Germany	Patent	60004227.8	
Great Britain	Design Patent	106017	
Great Britain	Design Patent	3006596	
Great Britain	Design Patent	3006597	
Great Britain	Patent	1188086	
International	Design Patent	DM/057692	
International	Design Patent	DM/061609	
Japan	Application	2000-620406	
Japan	Application	2002-588123	
Japan	Application	2002-588070	
Japan	Design Patent	1144833	
Japan	Design Patent	1182246	
Japan	Design Patent	1182620	
Japan	Pending	2005-020460	
PCT	Application	PCT/SE01/00983	
PCT	Application	PCT/SE01/00984	
PCT	Application	PCT/SE02/00857	
PCT	Application	PCT/SE03/00307	
PCT	Application	PCT/SE/00/00739	
Sweden	Application	0302837-0	
Sweden	Design Patent	68657	
Sweden	Design Patent	75530	
Sweden	Patent	518836	
Sweden	Patent	522971	
Sweden	Patent	524024	
U.S.	Application	09/576266	
U.S.	Application	10/476,217	
U.S.	Application	10/476,760	
U.S.	Design Patent	466540	
U.S.	Design Patent	483782	
U.S.	Design Patent	484155	
U.S.	Patent	5,386,117	
U.S.	Patent	5,637,871	
U.S.	Patent	5,756,999	
U.S.	Patent	6,028,309	
U.S.	Patent	6,707,044	
U.S.	Patent	6,812,465	

Designation	Status	Reg. No.	
U.S.	Pending	29/233,400	

### Table of contents

1	Warnings & cautions				
2	about this manual	3			
3	Welco	ome!		5	
	3.1		IR Systems	6	
		3.1.1	A few images from our facilities	8	
	3.2	Commer	nts & questions		
_					
4	Packi	ng list		11	
5	Syste	m overvie	3W	13	
6	Conne	ecting sys	stem components	15	
7	Introd	luction to	thermographic inspections of electrical installations	17	
	7.1		it note		
	7.2	General	information	17	
		7.2.1	Introduction	17	
		7.2.2	General equipment data	18	
		7.2.3	Inspection	19	
		7.2.4	Classification & reporting	19	
		7.2.5	Priority	20	
		7.2.6	Repair	20	
		7.2.7	Control	21	
	7.3	Measure	ment technique for thermographic inspection of electrical installations	22	
		7.3.1	How to correctly set the equipment	22	
		7.3.2	Temperature measurement	22	
		7.3.3	Comparative measurement	24	
		7.3.4	Normal operating temperature		
		7.3.5	Classification of faults		
	7.4	•	g		
	7.5	Different	types of hot spots in electrical installations	30	
		7.5.1	Reflections		
		7.5.2	Solar heating		
		7.5.3	Inductive heating		
		7.5.4	Load variations		
		7.5.5	Varying cooling conditions		
		7.5.6	Resistance variations		
		7.5.7	Overheating in one part as a result of a fault in another		
	7.6		nce factors at thermographic inspection of electrical installations		
		7.6.1	Wind		
		7.6.2	Rain and snow		
		7.6.3	Distance to object		
	77	7.6.4	Object size		
	7.7		advice for the thermographer		
		7.7.1	From cold to hot		
		7.7.2	Rain showers		
		7.7.3	Emissivity		
		7.7.4	Reflected apparent temperature		
		7.7.5	Object too far away	40	

8	Tutori	als			41
	8.1	Switching	on & switching off the came	a	41
		8.1.1	-		
		8.1.2	-		
	8.2	Working	•		
	0.2	8.2.1			
		8.2.2			
		8.2.3			
			0 0		
		8.2.4		es	
		8.2.5			
	8.3				
		8.3.1			44
		8.3.2	_aying out a measurement a	ea	
	8.4	Working	vith alarms		45
		8.4.1	Setting up a color alarm		45
			3.4.1.1 Setting a color al	arm using the menu system	45
			-	arm without using the menu system	
	8.5	Changin	0		
	0.0	8.5.1			
		8.5.2			
	8.6				
	0.0	•	, ,		
		8.6.1			
		8.6.2			
		8.6.3			
		8.6.4			
		8.6.5	Changing date & time		48
	8.7	Working	vith the camera		49
		8.7.1	Removing the lens		49
		8.7.2	Adjusting the focus		50
		8.7.3	nserting & removing the bat	ery	50
			<b>v v</b>	ery	
			v	ttery	
				,	
9	Came	ra overvi	<b>N</b>		53
	9.1	Camera	arts		53
	9.2	Keypad I	uttons & functions		57
	9.3	Laser Lo	atIR		59
	9.4	LED indi	ator on keypad		60
10	Came	ra progra	۱		61
	10.1	Result ta	le		61
	10.2	System	essages		62
		10.2.1	Status messages		62
		10.2.2	Narning messages		62
	10.3	Selecting	0 0		
		10.3.1	,		
		10.3.2		objects	
	10.4		•	•	
	10.4				
		10.4.1			
		10.4.2			
		10.4.3		ust	
		10.4.4	•		
		10.4.5	Palette		67

		10.4.6 10.4.7	•	ra option) ics / Show graphics		
		10.4.8	• •			
		10.4.9	Setup		6	69
			10.4.9.1	Settings		;9
			10.4.9.2	Date/time	7	0
			10.4.9.3	Local settings	7	'1
			10.4.9.4	Camera info	7	'1
			10.4.9.5	Factory default	7	'1
11	Electri	cal powe	er svstem			'3
	11.1	•		ging		
	11.2		•	rging		
	11.3			ngs		
12	Mainte		olooning		7	70
12	12.1			s & accessories		
	12.2					
13	Troub	eshootin	ng		8	51
14	Techni	ical spec	ifications &	dimensional drawings	8	33
	14.1	Imaging	performanc	e	8	33
	14.2	Image p	resentation .		8	3
	14.3	•	0			
	14.4	8				
	14.5	8				
	14.6		•	fications		
	14.7	,	•	ns		
	14.8			erfaces		
	14.9		0			
		14.9.1 14.9.2		B connector		
		14.9.2		nector		
	1/ 10			n fields of view and distance		
			•	al drawings		
				nensional drawing		
			•	al drawing		
	01				0	~
15	Gloss	ary				9
16				ent techniques		
	16.1					
	16.2					
		16.2.1	•	e emissivity of a sample		
			16.2.1.1	Step 1: Determining reflected apparent temperature		
	16.3	Pofloato	16.2.1.2 d apparant t	Step 2: Determining the emissivity emperature		
	10.5	nellecter	u apparent t			''
17	Histor	y of infra	ared technol	logy	10	9
18	Theory	y of ther	mography			3
	18.1	-				
	18.2			spectrum		
	18.3	Blackbo	dy radiation		11	4

		18.3.1	Planck's law	
		18.3.2	Wien's displacement law	
		18.3.3	Stefan-Boltzmann's law	
		18.3.4	Non-blackbody emitters	
	18.4	Infrared	I semi-transparent materials	
19	Emis	sivitv tab	les	
	19.1		nces	
	19.2	Importa	ant note about the emissivity tables	
	19.3	Tables .		
	Index	x		139

### Warnings & cautions

10474103;a1



- This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.
- An infrared camera is a precision instrument and uses a very sensitive IR detector. Pointing the camera towards highly intensive energy sources – such as devices emitting laser radiation, or reflections from such devices – may affect the accuracy of the camera readings, or even harm – or irreparably damage – the detector. Note that this sensitivity is also present when the camera is switched off and the lens cap is mounted on the lens.
- Each camera from FLIR Systems is calibrated prior to shipping. It is advisable that the camera is sent in for calibration once a year.
- For protective reasons, the LCD (where applicable) will be switched off if the detector temperature exceeds +60 °C (+149 °F) and the camera will be switched off if the detector temperature exceeds +68 °C (+154.4 °F).
- The camera requires a warm-up time of 5 minutes before accurate measurements (where applicable) can be expected.

### INTENTIONALLY LEFT BLANK

## 2 Important note about this manual

As far as it is practically possible, FLIR Systems configures each manual to reflect each customer's particular camera configuration. However, please note the following exceptions:

- The packing list is subject to specific customer configuration and may contain more or less items
- FLIR Systems reserves the right to discontinue models, parts and accessories, and other items, or change specifications at any time without prior notice
- In some cases, the manual may describe features that are not available in your particular camera configuration



205 Westwood Ave Long Branch, NJ 07740 1-877-742-TEST (8378) Fax: (732) 222-7088 salesteam@Tequipment.NET



