

Event and Fault records in SIPROTEC COMPACT and SIPROTEC 4 relays

This document describes the important Event, Trip and Oscillographic (Waveform) records available in SIPROTEC COMPACT and SIPROTEC 4 devices. The options for saving, printing and deleting log files are then discussed.

Event log

The Event Log (also referred to as the Operational Indication Buffer) operates continuously and records status changes of all the information items that are set to be monitored. The time resolution of the log is 1 ms. Up to 200 Events can be stored in the cyclic buffer, when then the oldest Event is overwritten as new Events occur.

Number	Indication	Value	Date and time	Initiator	Cause
00284	Set Point I< alarm	ON	30.10.2013 14:39:24.044	Com.Issued=AutoLocal	Spontaneous
00068	Clock Synchronization Error	OFF	30.10.2013 14:39:25.005	Com.Issued=AutoLocal	Spontaneous
009.0100.01	Failure EN100 Modul	OFF	30.10.2013 14:39:41.128	Com.Issued=AutoLocal	Spontaneous
00301	Power System fault	1-0N	30.10.2013 14:44:44.696	Com.Issued=AutoLocal	Spontaneous
01761	Time Overcurrent picked up	ON	30.10.2013 14:44:44.696	Com.Issued=AutoLocal	Spontaneous
01791	Time Overcurrent TRIP	ON	30.10.2013 14:44:47.695	Com.Issued=AutoLocal	Spontaneous
01761	Time Overcurrent picked up	OFF	30.10.2013 14:44:47.816	Com.Issued=AutoLocal	Spontaneous
01791	Time Overcurrent TRIP	OFF	30.10.2013 14:44:47.845	Com.Issued=AutoLocal	Spontaneous
00301	Power System fault	1 - OFF	30.10.2013 14:44:48.099	Com.Issued=AutoLocal	Spontaneous

Figure 1. An Event Log showing 1ms time-stamping

The maximum number of Events that can be stored varies per device. The buffer memory is battery backed in case of loss of DC supply to the device.

To map an item to the Event Log, map its destination in the Configuration Matrix to the Operational Indication Buffer. Events can be mapped to be recorded at Incoming (rising edge) or both Incoming and **O**utgoing (rising and falling edge).

	Information			Source Destination																	
Number	Display text	Long text	Туре	ы	F	5	С	20	1.50		Buffe	a.	5	×	С	D	1	DM			
								50	LEU	0	S	T	1			CI	D				
04602	>Brk Aux NC	>Breaker contact(OPEN, if bkr is closed)	SP							10			X								
00126	ProtON/OFF	Protection DN/OFF (via system port)	IntSP							10											
01761	Overcurrent PU	Time Dvercurrent picked up	OUT							10-	1	10	X								
01791	OvercurrentTRIP	Time Overcurrent TRIP	OUT							IC		10	Íncoi	min	ig =	ON))				
01704	>BLK Phase O/C	>BLOCK Phase time overcurrent	SP									10.4			Ξ.	.	-	- 01	LODED.		
01721	>BLOCK I>>	>BLOCK I>>	SP									10 (inco	m	ngy	Outg	oing	g = 01	(OFF)		
01722	>BLOCK I>	>BLOCK I>	SP									_ (N	lot c	onf	figu	red)					
01751	0/C Phase OFF	Time Overcurrent Phase is OFF	OUT							10	-	-	101		-	-	-	-	_	-	
01752	D/C Phase BLK	Time Overcurrent Phase is BLOCKED	OUT							1D		10	X								
01753	D/C Phase ACT	Time Overcurrent Phase is ACTIVE	OUT							10			X								
01762	0/CPhL1PU	Time Overcurrent Phase L1 picked up	OUT									10	X								

Figure 2. Mapping an information item to be recorded in the Event Log (Operational Indication Buffer)

Each information item in the matrix has both a Short Text and a Long Text description – the short text is used when the log is viewed on the relay front-display, the long text is used when viewed in DIGSI.

Internal items also have an associated Number. This reference number is given in the Configuration Matrix and is useful when searching for the item in the relay manual. Numbers are consistent across the SIPROTEC range.

To view the Event Log via the relay front-panel, select Annunciation->Event Log from the menu.

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Figure 3. Access to the Event Log via the menu

It is also possible to map a Function Key to allow direct access to the Event Log. This is done via the Set Function Keys menu, available from the Configuration Matrix.

🗰 File Edit Ins	ert Device	View Options Win	dow Help					
	6 F & !	월 🚺 Customi	te	Ctrl+Alt	+E	No filte	,	- D - 1 0 10 N?
	Number	Primary V • Seconda	/alues y Values			7 8	Source Set function keys	
Device		Parton	Antoned Values				Function key 01	
P.System Data 1	05145 05147 05148	Rot Chatter B	locking				B- Main Menu	
Osc. Fault Rec.		Set Punct	ion neys	Contraction of the local division of the loc	-		E Annunciation	
P.System Data 2	00356 02720 00533 00534 00535 00501 00511	>M. Display a >Er IL1 IL2 Translate IL2 Translate IL3 Rel	iter fault user texts ate into Cyrillic g Operations				Trip Log Statistics Statistics D Statistics D Control Control Settings	
	00561	Man Clos Detect	OUT					
	04601	>Brk Aux NO	SP		H			
	04602	>Brk Aux NC	SP	H				
	00126	PiotON/OFF	IntSP				a film 1	
5 I	01761	Overcurrent PU	OUT	10 0.1			* Latter	
	01791	OvercurrentTRIP	OUT					
	01704	>BLK Phase 0/C	SP					i i i i i i i i i i i i i i i i i i i
	01721	SBLOCK ISS	SP	н		+	OK	Cancel Help
	01722	SBLUCKIS	SP					

Figure 4. To set Function Key 1 to display the event log, use the Set Function Keys menu item available when viewing the Configuration Matrix

To view the event-log in DIGSI when connected on-line to the relay, select Event Log from the Annunciation group. When connected on-line to the device, only the log file stored in the device is available. When the setting file is opened off-line any previously saved versions of the event log will also be visible.



Figure 5. Viewing event logs in DIGSI. When online, the version of the log in the relay is viewable. When connected offline, all previously saved versions of the log are available.

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Trip Log

A Trip log is started when a protection element picks-up and remains active (recording) until the fault condition disappears. Any items that are mapped to the Trip Log and change status while the fault is active will be recorded.

A maximum of eight separate Trip Logs can be held in the relay. These are held in a cyclic buffer with oldest Trip Log being automatically over-written when a new fault occurs.

The first item in the fault log has the absolute time-stamp of the beginning of the fault. The time recorded for each subsequent item is the number of milliseconds since this fault-trigger time.

Number	Indication	Value	Date and time
00301	Power System fault	5-0N	30.10.2013 15:06:27.202
00302	Fault Event	5-0N	30.10.2013 15:06:27.202
00501	Relay PICKUP	ON	0 ms
01761	Time Overcurrent picked up	ON	0 ms
01762	Time Overcurrent Phase L1 picked up	ON	0 ms
01810	I> picked up	ON	0 ms
00511	Relay GENERAL TRIP command	ON	2996 ms
01791	Time Overcurrent TRIP	ON	2996 ms
01815	I> TRIP	ON	2996 ms
00533	Primary fault current IL1	0.24 kA	3027 ms
00534	Primary fault current IL2	0.00 kA	3027 ms
00535	Primary fault current IL3	0.00 kA	3027 ms
01762	Time Overcurrent Phase L1 picked up	OFF	3119 ms
01810	l> picked up	OFF	3119 ms
01761	Time Overcurrent picked up	OFF	3119 ms
00545	Time from Pickup to drop out	3122 ms	3122 ms
00546	Time from Pickup to TRIP	2996 ms	3122 ms
01791	Time Overcurrent TRIP	OFF	3146 ms
01123	Fault Locator Loop L1E	ON	3015 ms
01118	Flt Locator: secondary REACTANCE	0.02 Ohm	3015 ms
01115	Flt Locator: primary REACTANCE	0.00 Ohm	3015 ms
01117	Fit Locator: secondary RESISTANCE	0.06 Ohm	3015 ms
01114	Flt Locator: primary RESISTANCE	0.01 Ohm	3015 ms
01119	Flt Locator: Distance to fault	0.7 km	3015 ms
00301	Power System fault	5 - OFF	30.10.2013 15:06:30.567

Figure 6. A fault log showing event time-tagging as milliseconds since event trigger time

Selection of items to be recorded in the fault log is similar to mapping to the event log – the abbreviation for trip log column is T.

🗱 Settings - Masking	g I/O (Configur	ation Matrix) - EventLogT	esting / Folder / 7SJ632 V4.6 2/7SJ632																
		Information							Destination										
	Number Display text Long text Type						S	С,		1	Buff	SI .	S	X	С	D	CM		
					BI			E		0	S	Ť				CD	7		
P.System Data 1										×									
Osc. Fault Rec.													х.		•		M		
P.System Data 2										×		×	×		2				
	01761	Overcurrent PU	Time Overcurrent picked up	OUT				Т				10	X						
	01791	OvercurrentTRIP	Time Overcurrent TRIP	OUT				Т		Т		Ι	X						
	01704	>BLK Phase O/C	>BLOCK Phase time overcurrent	SP															
	01721	>BLOCK I>>	>BLOCK I>>	SP															

Figure 7. Mapping the overcurrent pickup and trip to the Trip Log. In this example the pickup is set to be recorded at both Incoming and Outgoing (rising and falling-edge) while the Trip is set to record only on Incoming.

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Deleting all mapping in a matrix column

The default setting file from DIGSI contains a number of points already mapped to the Event Log and Trip Log. To clear these, right-click on the abbreviation letter at the top of the column and select 'Delete configurations at Operational Indication Buffer'. Before using this option, it is recommended to check what items have been mapped – some items can be useful for later diagnostics. Some pre-defined items can't be deleted. DIGSI will provide a message indicating how many can and can't be deleted.



Access to the Trip Log from the relay front panel uses a similar method as shown for the Event Log in Figure 3. Once the Event Log menu is accessed, a list of the last 8 trip logs is available (using the down-arrow to scroll if necessary). Pressing the right-arrow key (or Enter) allows viewing any individual Trip Log.



Figure 9. Access to a Trip Log via the front display

Within DIGSI access to the Trip Log is via the Annunciation group (Figure 10). When connected on-line to the relay the last 8 events stored in the relay memory will be available for display. Double-clicking on any of these allows detailed view of the log. When the setting file is opened off-line, any previously saved Trip Logs will be available.



Figure 10. Viewing the available Trip Logs in DIGSI

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Oscillographic Fault Records (Waveform Capture)

Up to 8 Oscillographic (waveform) Fault Records can be captured stored in each relay. The records can be then saved to DIGSI for later viewing in SIGRA or any software compatible with the COMTRADE standard format.

To enable the Fault Recorder it must be enabled in the Device Configuration (Figure 11).

Masking I/O (Configuration M	Availabl	e functions:		
Centrel Display	No.	Function	Scope	
CEC Control Display	0103	Setting Group Change Option	Disabled	
Deven Centere Dete 1	0104	Oscillographic Fault Records	Enabled	•
Power System Data 1	0112	DMT / IDMT Phase	Definite Time only	_
Setting Group A	0113	DMT / IDMT Earth	Definite Time only	

Figure 11. Enabling Oscillographic Fault Records in the Device Configuration

The analogues channels that are sampled are pre-defined and vary depending on the relay model. The total recording time and sampling rate of some commonly used relays is shown in table 1. Binary signals can also be recorded with each Oscillographic fault record and viewed in SIGRA. The binary signals recorded can be selected using DIGSI "Properties" tab for each item in the Configuration Matrix (Figure 12).

Relay	Sampling rate	Total recording
Model	(Hz)	time (s)
7SJ80	1000	18
7SD80	1000	18
7RW80	1000	18
7SJ61	800	20
7SJ62	800	20
7SJ63	800	5
7SJ64	800	20
7SD610	1000	15
7SA522	1000	15
7UT612	600	5
7UT613	800	5

Table 1. Waveform sampling rate and total recording time capability of some commonly used relays

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				nformation		S											
	Number	Display text		Long text	Туре											BI	
						1	2	3	4	5	6	7	8	9	10	11 1	2 13
P.System Data 1																	
Osc. Fault Rec.																	
P.System Data 2									×	×							
	01761	Overcurrent PU	Ti	e Overcurrent picked up	OUT							Τ					
	01791	OvercurrentTRIP	Ti	e Overcurrent TRIP	OUT												
	01704	>BLK Phase O/C	>6	OCK Diseas View and and and a	icn.		_		_	-		-	-	_		-	
	01721	>BLOCK I>>	>E	Object properties - Overcurrent PU - OUT												_ X	
	01722	>BLOCK I>	>6														
	01751	0/C Phase OFF	Ti	Select in fault record Fast Indication IEC	61850												
	01752	0/C Phase BLK	Ti	1													
	01753	0/C Phase ACT	Ti	Mark message												_	
	01762	0/C Ph L1 PU	Ti														
	01763	0/C Ph L2 PU	Ti	Select message in fault record													
	01764	0/C PhL3 PU	Ti														
	01800	I>> picked up	1>														
	01805	I>> TRIP															

Figure 12. Select an information-item from the matrix to be recorded in the Oscillographic Fault Record by right clicking on the item and selecting 'Select message in fault record'

Waveform capture is usually set to begin at the pickup of an enabled protection element. This behaviour can be modified via the 'Waveform Capture' setting in the Oscillographic Fault Records tab in DIGSI (Figure 13).



Figure 13. Settings for wave-form capture times and recording options

The setting options are:

- Save-With-Pickup (Recording starts and records are saved every time a protection element picks-up)
- Save-With-Trip (Recording starts on pickup but the event is only saved if the pickup leads to a trip)
- Start-With-Trip (Recording only begins when a trip is issued).

The maximum length of an individual fault record and pre-trigger and post-fault recording times are also set in this tab – the effects of these settings can be seen in Figure 14.

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Figure 14. An Oscillographic Fault Record showing Pre-trigger and Post-fault recording times

Oscillographic Fault Records can't be directly viewed from the relay front panel, but they are associated with Trip Log entries by a common Network Fault Number. This is an automatically assigned number that increments with each fault record capture. A Trip Log and an Oscillographic Waveform record with the same Network Fault Number refer to the same event.

In DIGSI, records can be viewed via the Oscillographic Records item. Selecting this when connected online to a relay shows the records saved within the relay. Selecting an individual record will display the record using SIGRA. When a setting file is opened off-line, any previously saved events are visible.

Waveform captures can be manually triggered when connected on-line in DIGSI by the Test menu (Figure 15). This is a handy commissioning and test feature.



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Figure 15. Manually triggering an Oscillographic Fault Record using the DIGSI Test Menu

It is also possible to set the relay so that an event record is triggered when a specified binary input is activated. This is done by mapping the input to the *>Trig. Wave.Cap* item in the Configuration Matrix.

10	E.System Data i										
I		00004	>Trig.Wave.Cap.	SP							
-		00203	Wave, deleted	OUT_Ev							
	USC, Fault Nec.		FltRecSta	IntSP							
I		30053	Fault rec. run.	OUT							
	P Sustem Data 2					×	×				

Figure 16.	Triggering	Event	Record	from	binary	input
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Retrieving and saving Fault Records

The simplest way to save all the event logs available in the relay is to connect to it via the front port via a 'Plug and Play' connection. From DIGSI Manager the 'Device->DIGSI (plug and play)' is reached via the Device menu. Once DIGSI is connected to the relay, when the setting file is saved (via the Save icon in the top-left corner), DIGSI prompts with 'Do you also want to save process data'. If 'Yes' is selected then DIGSI will download and save the Event Log, Trip Log and Oscillographic Fault records. It will also save a snapshot of all the available metering values in the "setting file". For a post event forensic analysis, it is very valuable to have the fault records and relay settings.



Figure 17. The prompt that appears when saving a setting file retrieved using the Plug and Play connection option. Selecting yes causes DIGSI to retrieve and save the Event Log, Trip Logs and Oscillographic Records as well as snapshots of the metering data of the device

An alternative method is available if the setting file for the device is already available in DIGSI – this option works either via a local or remote serial connection or via an Ethernet connection. The command to use is 'Read Out Process Data', available by right-clicking on the setting file (Figure 18) from within DIGSI Manager.

After saving the process data, a prompt asks if you wish to save setting data also. Selecting yes to this will retrieve the settings out of the physical relay device and save them to this DIGSI setting file. If select 'no' then the settings in the existing file remain and only the process data is updated in DIGSI.

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By EventLogTesting	75J632 V	💶 👔 7SJ632 V4.6 1	🗎 7SJ632 V4.6 Va	
Folder		Open Object	Ctrl+Alt+O	
		Cut	Ctrl+X	
		Сору	Ctrl+C	
		Paste	Ctrl+V	
		Delete	Del	
		Configure DIGSI 4		
		Start Reydisp Evolution		
		Start Reydisp Manager		
		Initialize device		
		DIGSI -> Device		
		Read out process data		
		Create variant		
		Export device		
		Import Device		
		Update parameter set		
		Update process bus data		
		Import USB flash drive		
		Object Properties	Alt+Return	

Figure 18. Reading and saving all the 'Process Data' from a device. This includes the Event Log, Trip Logs and Oscillographic Records as well as snapshots of the metering data of the device

When connected on-line to the relay, it is also possible to save an individual Event or Oscillographic record to the PC copy of the setting file by right-clicking and selecting 'Save' (Figure 19). This record will then be added to those already saved and will be available for viewing when the setting file is ______ opened

viewing when the setting file is Offline.

Number	Indication	V.	alue	Date and time
009.0100.01	Failure EN100 Modul	0	N	30.10.2013 15
05147	Phase Rotation L1L2L3	0	N	30.10.2013 15
01756	Time Overcurrent Earth is OFF	0	N	30.10.2013 15
02651	Dir. time overcurrent PHASE is OFF	0	N	30.10.2013 15
02656	Dir. time overcurrent EARTH is OFF	0	N	30.10.2013 15
00055	Reset Device	Refresh	F5	30.10.2013 15
00056	Initial Start of Device			30.10.2013 15
	>CB waiting for Spring charged	Save	Ctrl+S	30.10.2013 15
	>Cabinet door open			30.10.2013 15
00051	Device is Operational and Protecting	Print		30.10.2013 15
009.0101.01	Failure EN100 Link Channel 1 (Ch1)			30.10.2013 15
009.0102.01	Failure EN100 Link Channel 2 (Ch2)	Set		30.10.2013 15
01753	Time Overcurrent Phase is ACTIVE	Jet		30.10.2013 15
00052	At Least 1 Protection Funct. is Active	Split		30.10.2013 15
00284	Set Point I< alarm			30.10.2013 15
00068	Clock Synchronization Error	0	FF	30.10.2013 15
009.0100.01	Failure EN100 Modul	0	FF	30.10.2013 16
31000	Q0 operationcounter=	0		30.10.2013 16
31001	Q1 operationcounter=	0		30.10.2013 16

Figure 19. Saving an event Log to the off-line DIGSI file

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Exporting and printing fault records

Oscillographic records can be saved external to DIGSI native file format, via the 'Export' option in the context-menu accessed by right-clicking on a record. The record is exported in COMTRADE format as three separate files.



Figure 20. Exporting an Oscillographic Fault Record in COMTRADE format

To print out or save Event or Trip logs, select File-Print. This brings up a Dialog to select the type of data to print – either from the currently open window, or other data from the presently open setting-file. From within this dialog, records can either printed or saved to .pdf or other formats.



Figure 21. To print Event log data, select Print from the File menu. Clicking on the Annunciation option brings up a list of the type of event data for printing

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Copying fault records between setting files

DIGSI allows copying Event and fault data between setting files so that all data associated with a relay can be stored in one central setting file. This is done by opening both setting files off-line and opening the same view in each file. Event Logs, Trip Logs and Oscillographic records can be copied by drag-and-drop between the two open windows.

EventLogTesting / Folder / Relay 1	Copy/7SJ632		7		1
🖻 🕄, Offline	Network fault number	Date and time	ing / Folder / Relay 1/75J632		
🕒 🖉 Settings	4 000012	3:29:20.692 p.m.	- 0	Network fault number	Date and time
Annunciation	\$ 000011	30/10/2013 3:000	qs	\$ 000011	30/10/2013 3:23:32.230 p.m.
- O Event Log			lictore		
- 🛃 Trip Log			ent Log		
			ip Log		
Spontaneous Annuncia			eneral Interrogation		
⊕ Statistics			ontaneous Annuncia		
Measurement			atistics		
🖻 🛃 Oscillographic Records			urement		

Figure 22. To copy a Trip Log between setting files, open both setting files off-line to the Trip Log view. Log files can be copied between devices by drag-and-drop.

Deleting fault records

Event and Trip logs can be cleared from the relay by using the menu option: *Annunciation-> Set/Reset Event Log*. The password will need to be entered before the logs are cleared. From DIGSI, right-click on the log to clear and select Delete. This will delete the event log both from the relay memory and the setting file. Note that deleting the Trip Logs also deletes any Oscillographic Fault records and will reset the Network Fault Number.



Figure 23. Deleting the Event Log from a relay using DIGSI

Event and fault data is also lost when a relay is "initialised" or the internal backup-battery is replaced.

More Information:

For further information on event and fault recording refer to sections 6.1 and 6.2 of the SIPROTEC 4 System Manual.

Other information on SIPROTEC devices can be found at http://www.hvpower.co.nz/TechnicalLibrary/LineProtection.html

or by contacting HV Power.

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