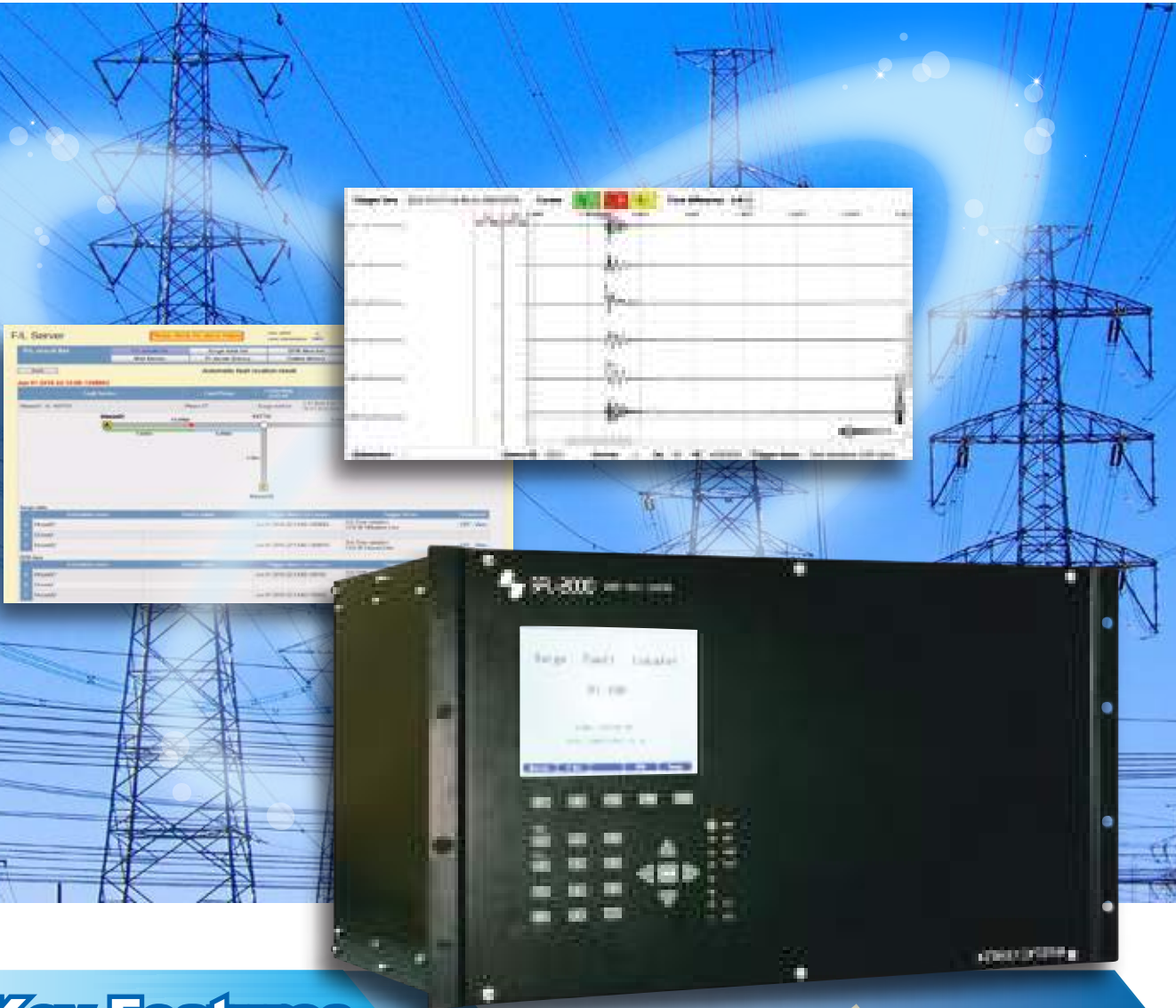


SFL-2000 and F/L server

Surge Type Fault Locator System



Key Features

Calculates accurate fault location of transmission lines

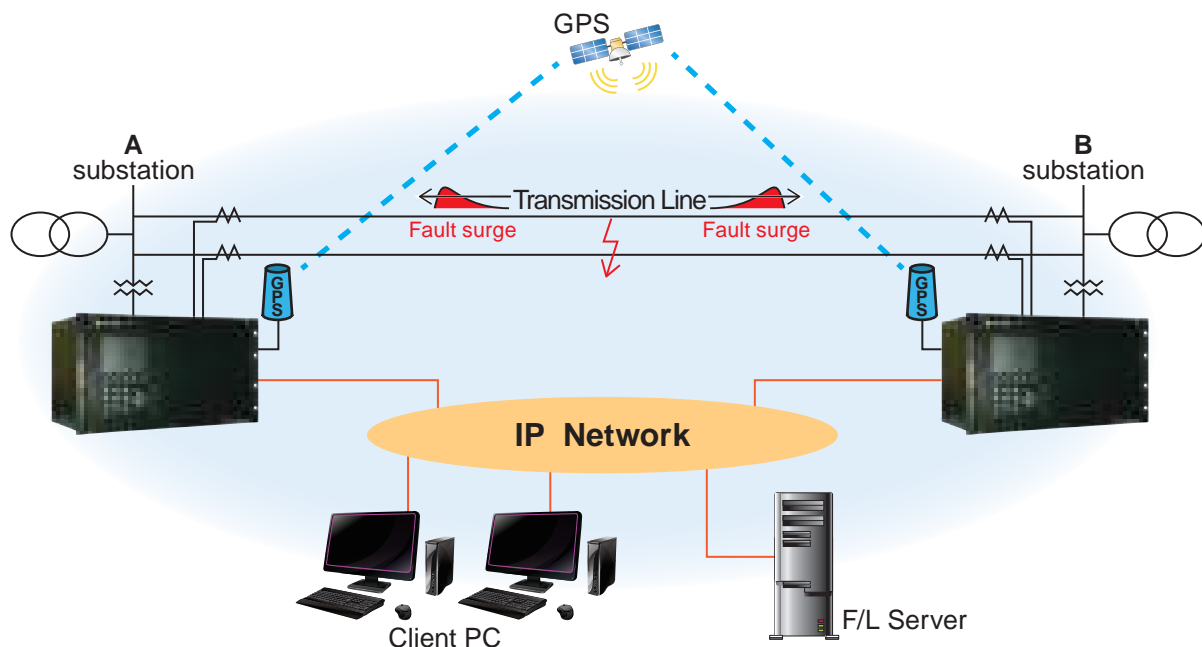
- High accuracy
- Reliable trigger
- Easy to operate
- Down time reduction
- Operating cost reduction
- Customer satisfaction



■ Descriptions

- Surge type fault locator system consists of Surge Type Fault Locators (SFL-2000) installed in the terminals of transmission lines and a Fault Locator Server (F/L Server) which performs fault locating calculation.
- SFL-2000 performs monitoring and recording with high-speed sampling of 10MHz and a low-speed sampling of 12.8kHz (or 15.36kHz) which synchronized with internal GPS clock. SFL-2000 detects transmission line fault and records the waveforms.
- F/L Server receives waveforms from SFL-2000, calculates the fault location accurately based on the fault surges arrival time difference at the substations.
- E-mail is automatically sent to the people who are registered as receivers to notify the occurrence of the fault.
- One can access the F/L server by web browser to browse the details of the fault location results.
- One can also access SFL-2000 by web browser.

■ System Configuration



■ Functional Specifications (Total system)

Item		Specification
Locating accuracy		±200m (best ±48m)
Applicable systems (Neutral grounding method)		Solid (directly) grounding system, Resistance grounding system (Please contact KINKEI if you want to apply a non-grounding system or a direct current (HVDC) transmission system.)
Applicable transmission lines		Overhead line, Underground cable
Maximum length of a target transmission line		600km
Maximum number of target transmission lines		100 lines (* able to be extended)
Maximum number of stored location results		10,000 items (* able to be extended)
Maximum number of terminals per one transmission line		4 terminals per line (the main line with 2 terminals and 2 branch lines with 1 terminal each)
Fault detection methods	Surge trigger	10MHz high speed sampling (current, voltage)
	DFR trigger (deviation)	12.80kHz/15.36kHz low speed sampling (current, voltage)
	DFR trigger (variation)	
	Digital Input trigger	110 -220 Vdc, ON/OFF
Properties of a fault location results		Fault occurrence time / Line name Fault phase / Locating result (Distance from the substation [km])
Backup fault locating methods		Current division ratio method / Impedance method

Highly accurate 10MHz (1 sample = 100ns) fault locating

- Location accuracy : $\pm 200\text{m}$ (best $\pm 48\text{m}$)
- Time synchronization accuracy : 160ns (GPS)
- Sampling frequency : 10MHz (1sample = 100ns)

Examples of Actual Fault Location result

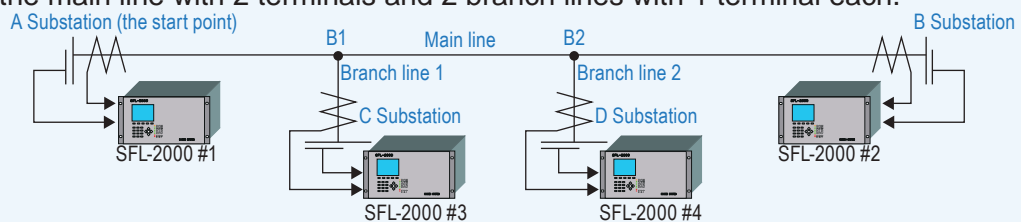
Voltage Level	Line Length	Real Fault Location	F/L Calculation Result	error of measurement
500[kV]	229,950m	110,700m	110,540m	160m
220[kV]	267,390m	260,580m	260,650m	70m
70[kV]	11,800m	4,050m	4,240m	190m

Reliable Fault Detection

- Four types of trigger are available to detect transmission line fault certainly.
 - (1) Surge trigger: 10MHz high speed sampling
 - Triggered when current variation or voltage variation exceeds the setting value.
 - (2) DFR trigger (deviation): 12.80kHz/15.36kHz low speed sampling
 - Triggered when voltage RMS is lower than the threshold level.
 - Triggered when current RMS is larger than the threshold level.
 - (3) DFR trigger (variation): 12.80kHz/15.36kHz low speed sampling
 - Triggered when current variation or voltage variation exceeds the setting value.
 - (4) Digital Input Trigger
 - Protection relay tripping or Circuit breaker status.
- Voltage elements are used for fault locating
Not only current elements but also voltage elements are used for fault locating.
- Backup Fault Location functions
Even when the fault surge is very small and it cannot be detected, KINKEI fault locating system is able to locate the fault point by the Current Division Ratio Method or the Impedance Method.

Be able to manage up to 4 terminals per one transmission line

the main line with 2 terminals and 2 branch lines with 1 terminal each.

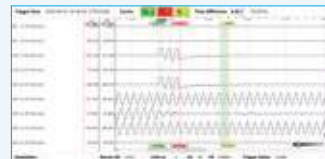


Highly operable human machine interface

Not only F/L server but also surge recorder is equipped with a web server. One can access the F/L server and SFL-2000 from one's client PC by web browser.



F/L result list screen



Waveform display screen



Displaying automatic fault location result

LCD Display on SFL-2000

SFL-2000 has color Liquid Crystal Display and operating switches on the front panel. On the display you can perform basic operations such as confirming the activating information, displaying waveform and setting parameters of the equipment.



F/L result list screen on LCD operation screen



Surge waveform display on LCD operation screen

■ SFL-2000 Specifications

Item		Specification		
Sampling frequency	High speed sampling	10MHz	A/D resolution	12bits
	Low Speed sampling	12.80kHz@50Hz,15.36kHz@60Hz		16bits
Time synchronization accuracy		±160ns (GPS Receiver : ±60ns)		
Input Elements Configuration	The number of channels per DSU		Max. DSUs	
	Current + Digital	Current 16ch: 4 circuits of current ((3 phases + Io) × 4) Digital 16contacts: 4 contacts x 4 circuits	Max 3 DSUs:12 circuit	
	Current + Voltage + Digital	Current 8ch: 2 circuits of voltage ((3 phases + Vo) × 2) Voltage 8ch: 2 circuits of current ((3 phases + Io) × 2) Digital 16 contacts: 4 contacts x 4 circuits	Max 3 DSUs: 6 circuit	
Current element	Current + Voltage	Current 8ch: 2 circuits of voltage ((3 phases + Vo) × 2) Voltage 8ch: 2 circuits of current ((3 phases + Io) × 2)	Max 4 DSUs: 8 circuit	
	1A rated	High speed:Ip-p=±2.896A	Burden	approx. 1mVA (at 5A)
	5A rated	High speed:Ip-p=±14.48A		
Monitoring accuracy		±0.5% of full scale(±0.10Arms@FS20.48A rms)		
Voltage element	110V√3 rated	Vp-p=±231.78V(163.84V rms)	Burden	approx. 1mVA (at 5A)
	Monitoring accuracy			
Digital element	Rated	110Vdc to 220Vdc		
	ON/OFF level	ON ≥80Vdc, OFF ≤30Vdc		
Alarm contact		Power supply failure, GPS asynchronous		
Storage		4GB(CF card) (8GB Option)		
HMI	LCD	5.7type TFT(640×480)		
	Key input	(×22):10key,F key(F1-F5),Cursor key		
	LED	(×8)for status display		
	Web Server	Embedded web server		
Communication I/F		Ethernet LAN: RJ-45		
Communication protocol		TCP/IP,HTTP,IEC61850(GOOSE Publisher,File Transfer)		
Power supply	Input range	DC:110V-220V(-20%~30%:88V~286V) AC:100V-240V(-15%~15%:85V~276V)		
	Power consumption	Maximum 125W/300VA		
Environmental	Temperature	Operating:-10°C to +55°C,Storage: -25°C to +70°C		
	Humidity	0% to 95% RH(Non-condensing)		
Immunity		Conforms to IEC60255-26		
Mechanical(Vibration,Shock,Bump,Seismic)		Conforms to IEC60255-21		
Safety related electrical		Confirms to IEC60255-27		
External dimensions		482.5(W)×266(H)(EIA:6U)×302(D)mm		
Weight		Max 12kg		
Country of Origin		Japan		

■ F/L Server & Client PC or F/L Application Specifications

	F/L Server	F/L Application (Single user only)
OS	Red Hat Enterprise Linux (64bit)	Windows 11 Pro
Memory	Minimum 16GB of RAM	Minimum 32GB of RAM
CPU	Minimum Xeon® 2GHz	Minimum Intel Corei7-11700 with 6 cores or equivalent
Storage	4TB or more for free space (RAID LEVEL 1)	C drive(OS): 500GB or more SSD and D drive(DATA): 4TB or more SSD
LAN I/F	RJ-45	RJ-45
Display	1920 × 1080 or more	1920 × 1080 or more
Web browser		Microsoft Edge(Chromium)
	Client PC	
Display	1920 × 1080 or more	
Web browser	Microsoft Edge(Chromium)	

■ SFL-2000 external view

