

**Regenerated Power  
Absorbing Controller**

**MEIDEN**  
Quality connecting the next

# KAISEIPLUS

For 750V DC Transit System

*For safe and comfortable ride  
of electric train*



## KAISEI PLUS for Safe and Comfort Ride

KAISEI in Japanese language means the regeneration. KAISEI PLUS is the latest regenerated power absorbing system for railway featuring the PWM control system and various useful functions. KAISEI also means the cloudless sky which represents the comfortable and pleasant ride of transit system.

The regenerative electric braking mode is getting popular as the optimum control system. In order to fully utilize this technology, the regenerated power shall be effectively absorbed, otherwise the excess energy may cause the excessive traction voltage, regeneration failure and discomfort ride etc. The wayside regenerative system is therefore proposed to eliminate these problems.

KAISEI PLUS is the simple and economical solution realizing the optimum dissipation of excess power, and it fit to;

- The lightweight rolling stock without the onboard resistor
- The light system with single or a few coach(es) operation
- The light system with long headway
- The transit system receiving the power supply from power electric company, and reverse power is not accepted by the power electric company.

## Product Features

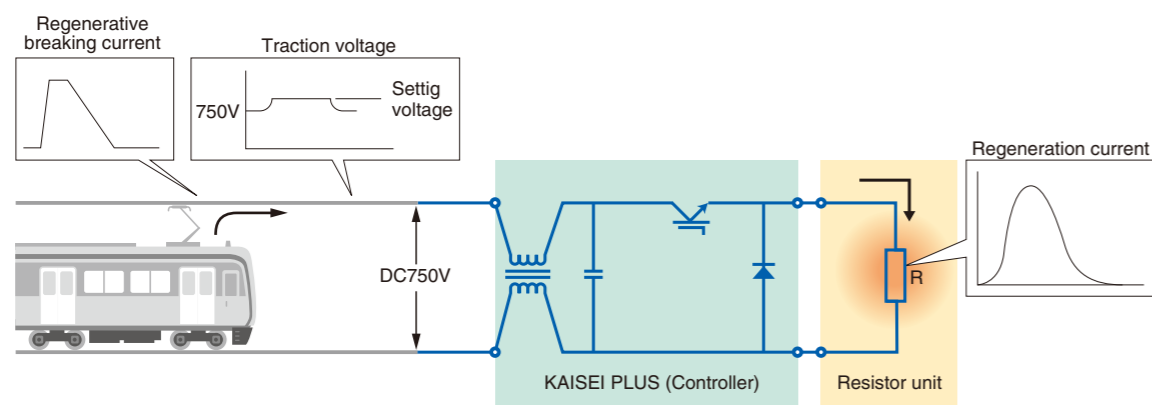
KAISEI PLUS line up provides following features.

- The standardization and unitization design policy realized simple, reliable and superior cost performance.
- The compact design.
- Harmonic free
- Minimize heat dissipation by PWM constant voltage control
- Variable carrier frequency
- Variable operational voltage

## Principle of Operation

The main dc input terminals of KAISEI PLUS are connected across the positive and negative traction system and its output is connected to the regenerative resistor unit.

The PWM chopper control circuit will be triggered when the braking train(s) regenerates the excess energy and boost the traction line voltage up to the preset value. KAISEI PLUS regulates the traction voltage to setting voltage by means of dissipate the energy at the resistor unit. Its concept is shown as Fig.1.

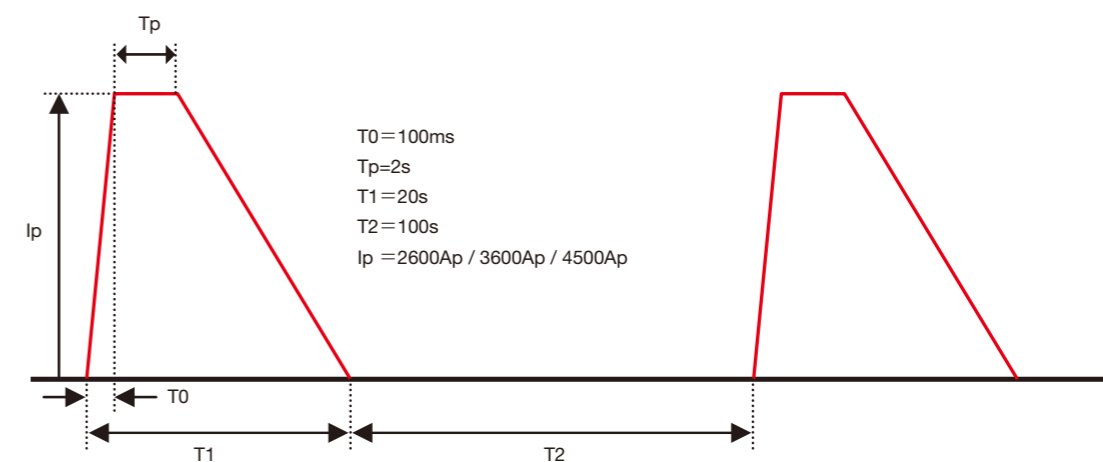


## Rating and Specification

The standard rating and specification of KAISEI PLUS are shown in Table 1.

**Table 1 Rating and Specification**

Description		Rating and specification				Notes
Series		KAISEI PLUS				
Applicable standard		IEC60146				
Capacity		Ipeak	2600A	3600A	4500A	Based on current characteristics shown in Fig.1
		Irms	671A	930A	1162A	
Control method	Control	PWM chopper control				
	Carrier frequency	3kHz				Variable in 16steps
Rated class		Class S				Based on current characteristics shown in Fig.1
System voltage		750V				
Setting voltage		770V to 850V				Variable in 1V step
Maximum voltage		900V				
Operation time		200times per day (rated operation)				
Noise level		60dB at stand-by mode, Max 75dB at operation				Excluding resistor unit
Insulation		Main circuit - Earth: AC 2300V 1min Control circuit - Earth : AC 1500V 1min				The control circuit to be tested is 60V or above.
Ambient temperature		-5degC to 40degC				Average 35degC
Humidity		15% to 95%				No freezing No condensation
Altitude		1000m and under				
Degree of Protection		IP30				



**Fig.1 Typical regenerative braking current characteristics**

## Control Diagram and Characteristics

The basic control block diagram is shown in Fig.2.

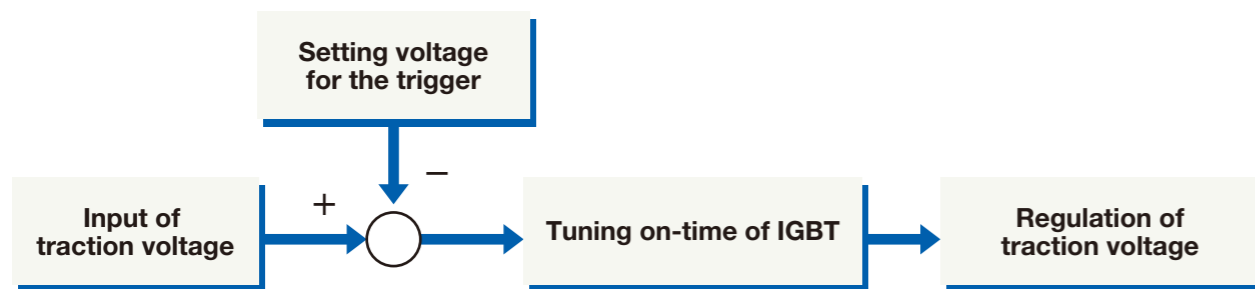


Fig.2 Control Block Diagram

KAISEI PLUS chopper controller with IGBT performs high speed PWM switching of 3kHz (variable). The pulse width is controlled in response to traction voltage. The higher the traction voltage increased, the longer the pulse width regulated. The lower the traction voltage decreased, the shorter the pulse width regulated. The traction voltage is then constantly regulated as shown in Fig.3.

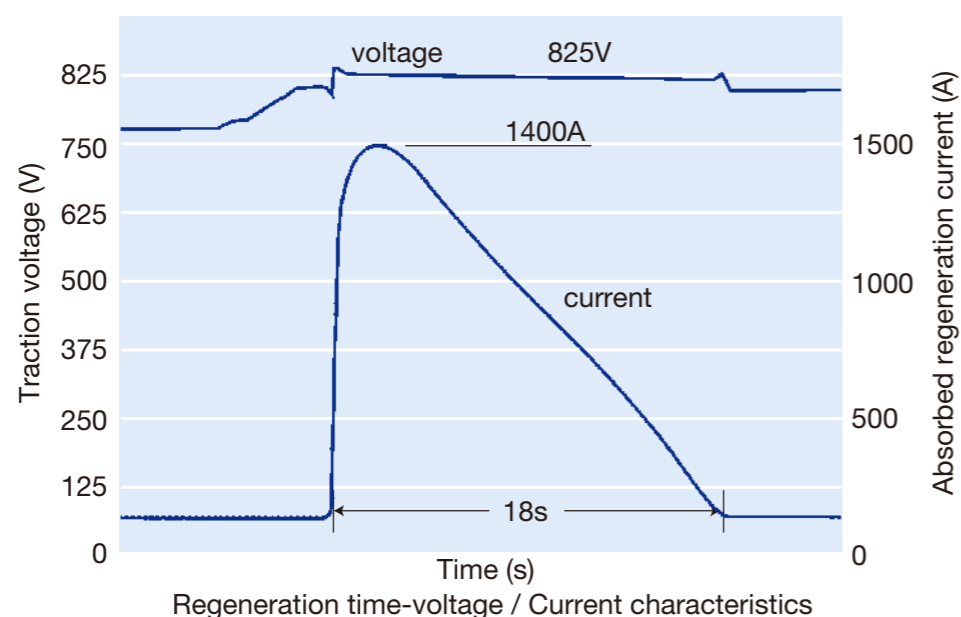


Fig.3 Regenerative Characteristics

Fig.4 illustrates the circuit diagram of KAISEI PLUS controller unit.

KAISEI PLUS provides the standard design and standard unit assembly method. The rating current capacity can be chosen from 2600A, 3600A and 4500A and they equip the difference nos. of standard chopper controller as shown as Fig.5. Each chopper controller is designed to share and balance the current. Employing the high switching frequency of 3kHz ease to filter the electromagnetic noise and down size the filter unit of reactors and capacitors.

The control compartment is the standard for all the ratings.

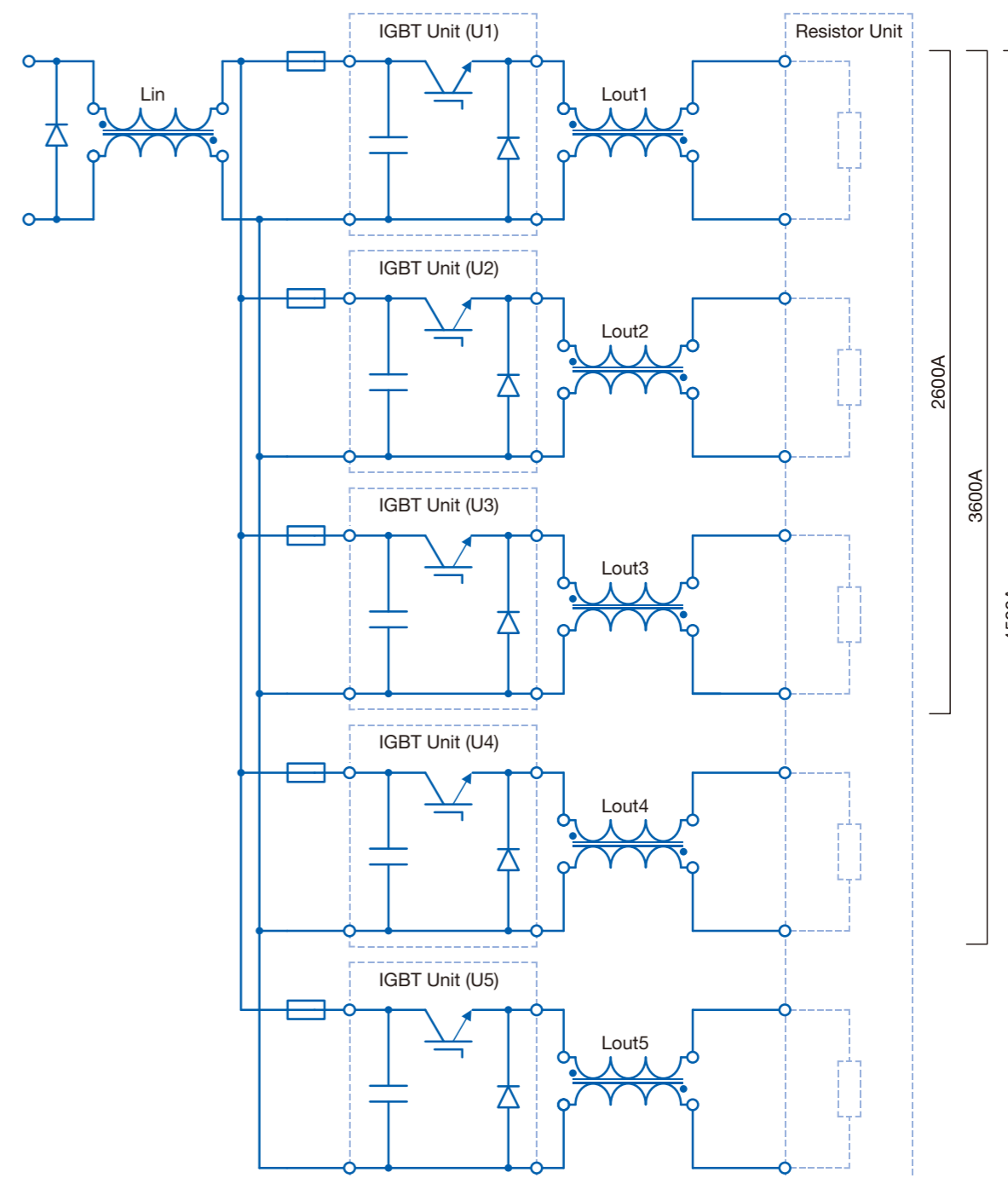


Fig.4 Circuit Diagram of KAISEI PLUS (Controller)

## Standard Indication Windows

The standard indication windows for operation mode and protection device are shown as Fig.5.

RUN (W)	8VD FAILURE (A)	CHOPPER OVER TEMP. (1st) (A)	RESISTOR OVER TEMP. (1st) (A)	CHOPPER FRAME LEAKAGE (1st) (R)	CONTROL P. S. FAILURE 1 (R)	UNDER VOLTAGE (R)	OVER VOLTAGE (R)	OVER CURRENT (R)	CHOPPER CONTROL FAILURE (R)
READY (W)	PRE. CHARGE (W)	CHOPPER OVER TEMP. (2nd) (R)	RESISTOR OVER TEMP. (2nd) (R)	RESISTOR FRAME LEAKAGE (1st) (R)	CONTROL P. S. FAILURE 2 (R)	CHOPPER FUSE BLOWN (R)	CHOPPER VENT. FAN FAILURE (R)	STARTUP FAILURE (R)	

Legend : Indication color (W): Status (R): Heavy fault (A): Light fault

Fig.5 Standard Indication Window

## Standard Operation Mode

The standard cycle of operation mode is shown as Fig.6.

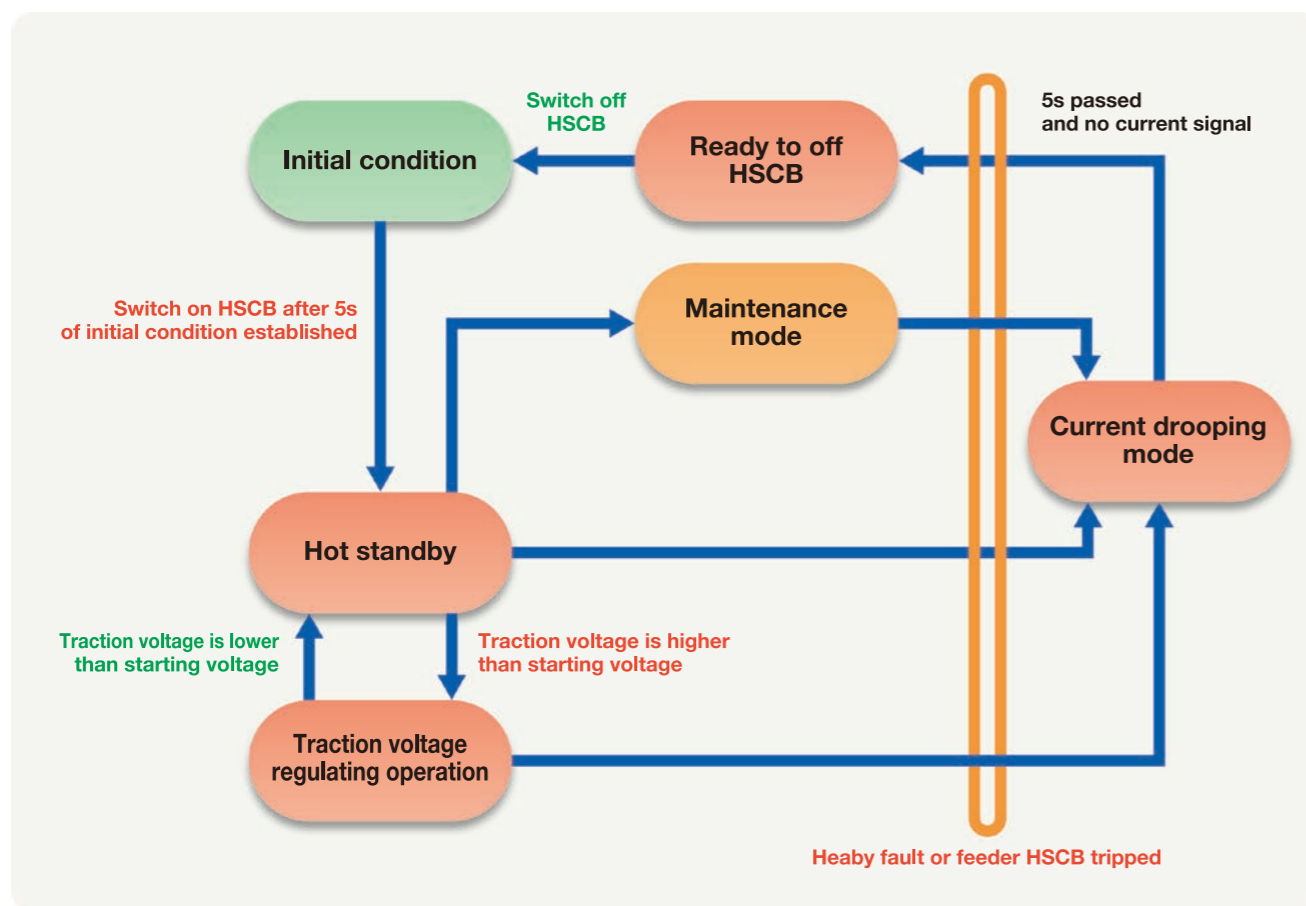


Fig.6 Standard Operation Mode

## Variable Settings

KAISEI PLUS has following variable setting function.

(1) Carrier frequency

The 16steps of variable carrier frequency are provided covering from 2.57kHz to 3.43kHz which can customize the frequency interface to avoid the electromagnetic interference with other system. The default set frequency is 3kHz.

(2) Nos. of operation unit

Numbers of operation unit of 3, 4 and 5 can be selected by the dip switch.

(3) Various compensation function

The following various function can be selected by the dip switch.

- AC primary voltage compensation function:  
The output is compensated following the AC primary voltage of traction substation.
- Traction line impedance compensation function (optional):  
The voltage drop due to traction line impedance is calculated based on input current and preset impedance value, and compensate the output.
- Distance traction voltage compensation function (optional):  
The starting voltage is compensated for the train at remote location.

(4) Variable starting voltage

The starting voltage can be set at the multi digital switch. The setting range is between 770V and 850V. (1V step)

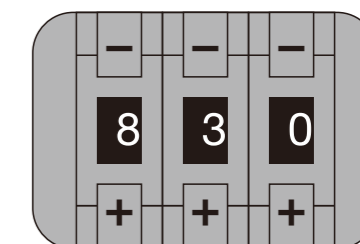


Fig.7 Multi Digital Switch

## Dimensions

The dimension of each ratings are shown in Fig.8.

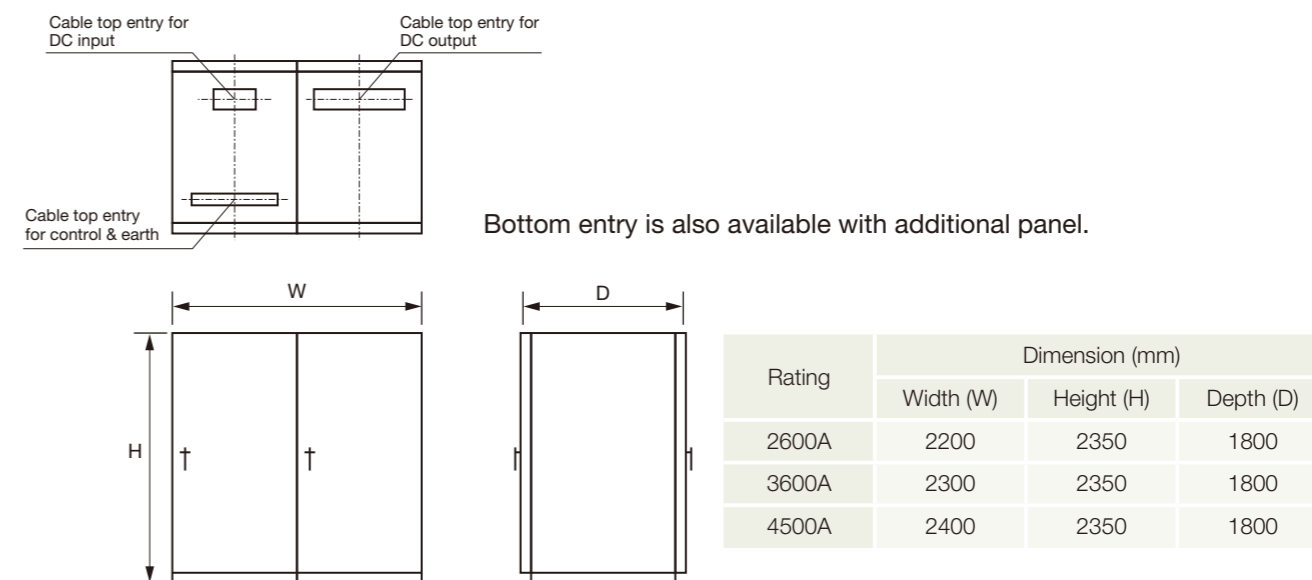


Fig.8 Dimension of KAISEI PLUS (excluding regulator unit)

Dimension and components may be changed according to the specifications.



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MEIDEN HANGZHOU DRIVE SYSTEMS CO., LTD.  
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