HVAC ORIENTED AC DRIVE

# H100

H100

Background

Increased interest on environmental concern and energy demand worldwide

→ Needs for energy saving and efficient process.

→ Government support to save energy and energy related restrictions leads to increased demand on inverters.

Support of various customer's needs

→ Features and product diversification are needed to respond to various applications and markets

→ Strengthening the responsiveness to high value-added fields

Emerging need of customized product for HVAC market

→ Energy saving effects on large fans, pumps, blowers, etc.
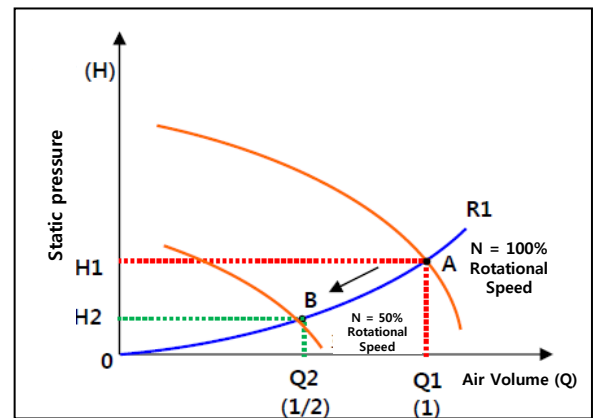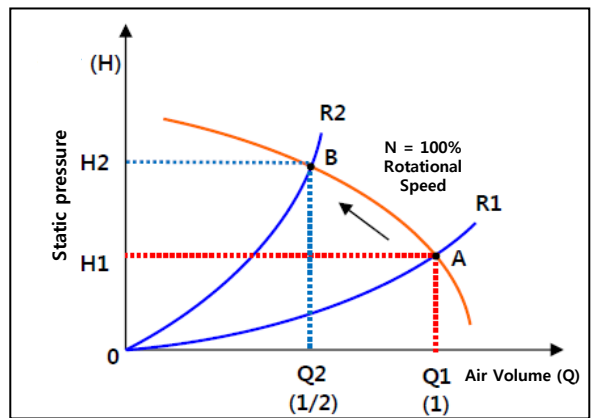
→ To strengthen and expand its position in the market

Field	Main Market	Other approachable Market	Unapproachable market
Energy / Environment	HVAC Fan Water supply and drainage Pump Incinerator/Boiler Fan Cooling tower	Big size Fan, Pump Water and wastewater treatment	Turbo Blower (Application for PMSM)

H100

Target Market
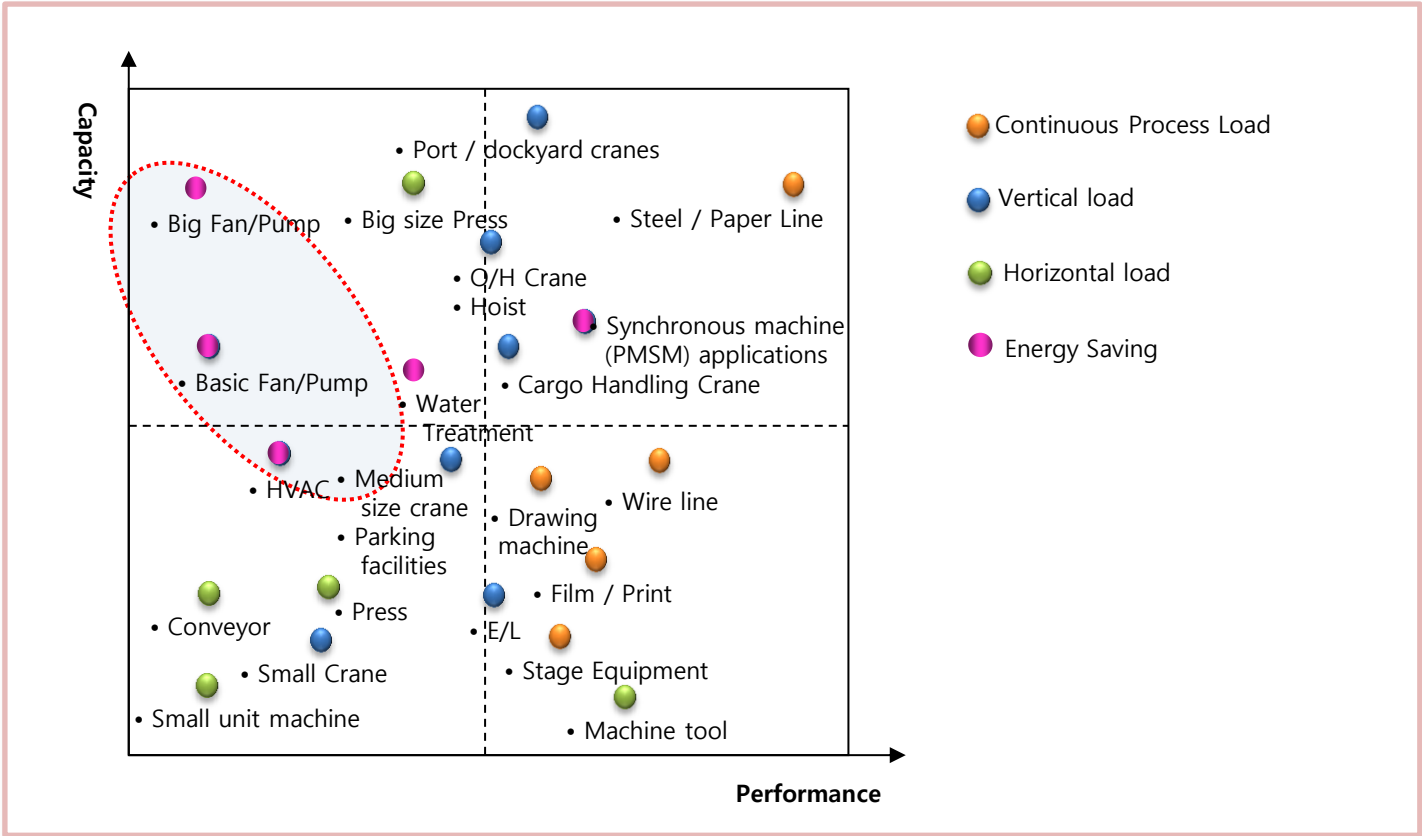
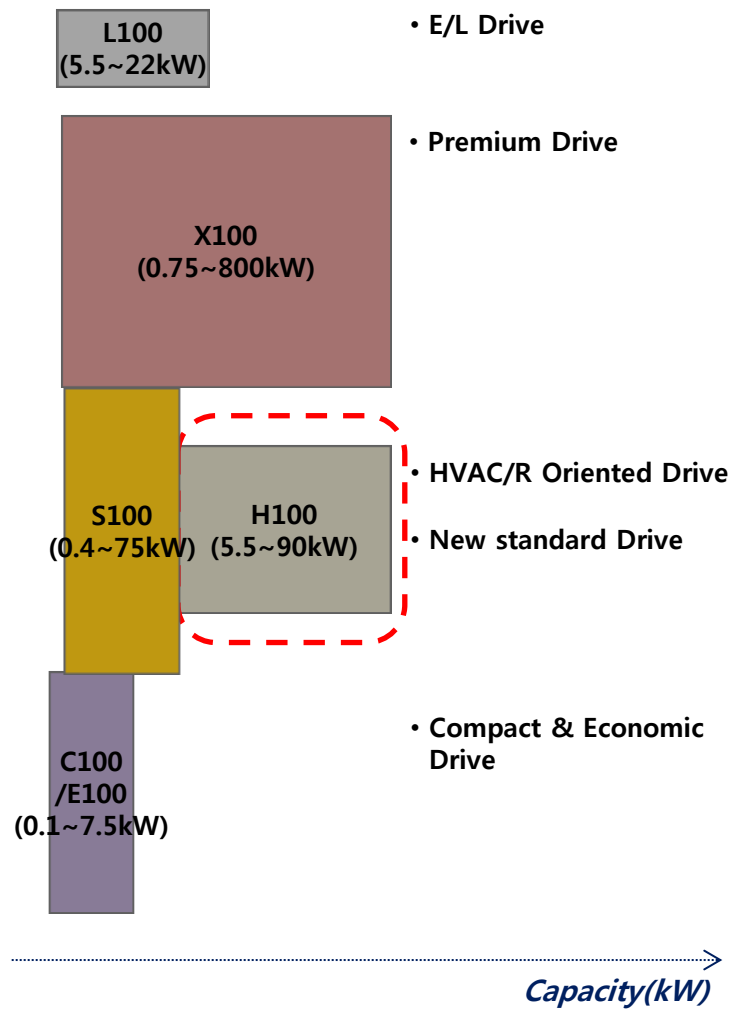|	Commercial HVAC	• Ventilation Fan, Boost Pump, Cooling Tower, Circulation pump
Energy Saving	**Industrial HVAC**	• Painting Equipment, Dust Collector, Boiler, Cooling Tower, Agricultural Pumps
	Water Treatment	• Water and wastewater, Wastewater treatment, SOC(Rail / Tunnel), Incineration plant, Power station

H100

LV Drive Line-up

Current LV Drive Line-up

- iV5 (2.2~800kW) — • System Drive
- iS7 (0.75~375kW) — • High Performance Drive
- iP5A (5.5~450kW) — • FAN/Pump Drive
- iG5A (0.4~22kW) — • Compact High-performance Drive
- iC5 /iE5 (0.1~2.2kW) — • Economy Class Drive

Future LV Drive Line-up

- L100 (5.5~22kW) — • E/L Drive
- X100 (0.75~800kW) — • Premium Drive
- S100 (0.4~75kW)
- H100 (5.5~90kW) — • HVAC/R Oriented Drive • New standard Drive
- C100 /E100 (0.1~7.5kW) — • Compact & Economic Drive

Capacity(kW)

H100

Line-Up

400V / 5.5~90kW

200V / 5.5~18.5kW

5.5 7.5 11 15 18.5 22 30 37 45 55 75 90 kW
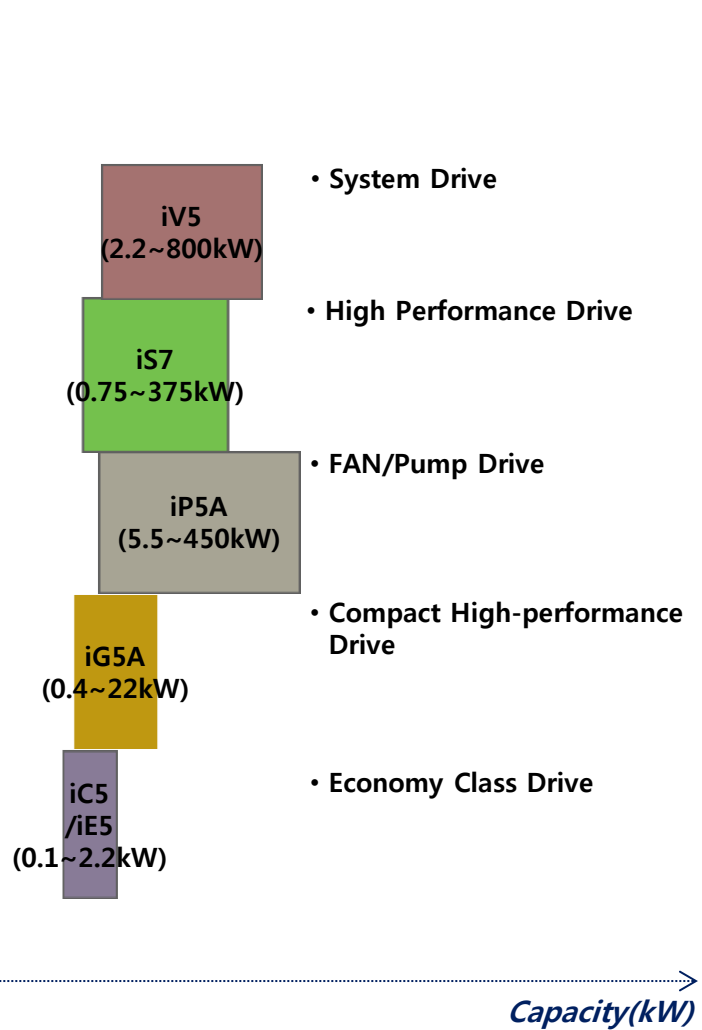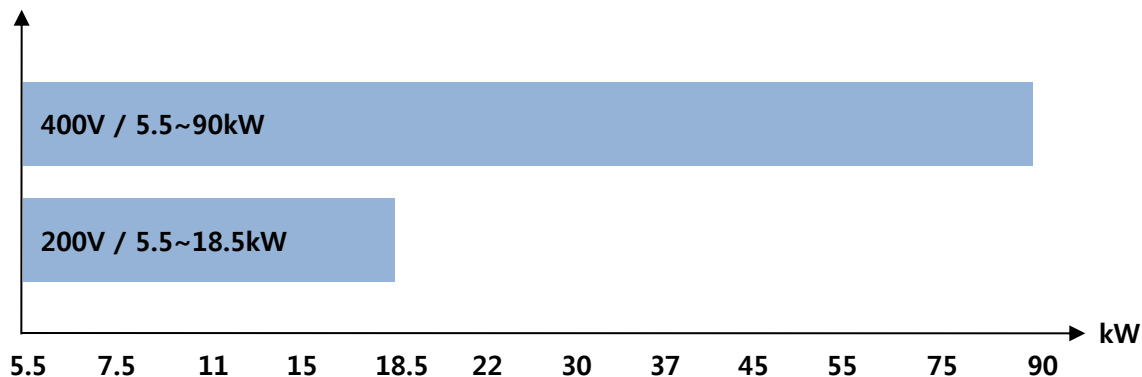
General specifications

- Drive capacity (Normal Duty)
  - 200V, Three-phase, 5.5~18.5kW(22~69A)
  - 400V, Three-phase, 5.5~90kW(12~152A)
- Overload capacity : 120% for 60sec
- Input voltage range
  - 200~240V Three-phase (-15%/+10%)
  - 380~480V Three-phase (-15%/+10%)
- Control Method : V/f control, Slip compensation
- Output frequency : 0 ~400Hz
- LCD Keypad (HVAC customized Keypad)
- Enclosure: IP20 (UL Enclosed type1 as optional)
- Carrier Frequency: 3kHz
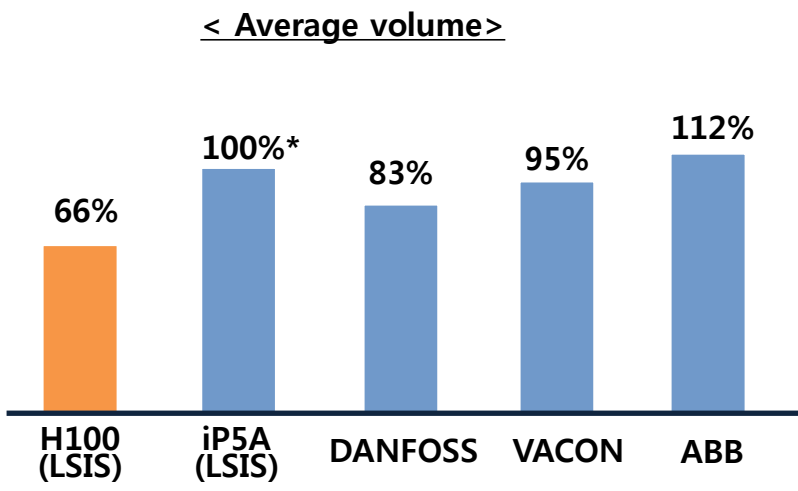- Global Certificated : CE, UL, cUL, RoHS

H100

Frame & Size

Frame	iP5A	H100
1	150 x 284 x156.5	160 x 232 x 181
2	200 x 284 x 182	180 x 290 x 205
3	250 x 385 x 201	220 x 350 x 223
4	304 x 460 x 234	275 x 450 x 284
5	300 x 534 x 265.6	325 x 510 x 284
6	370 x 610 x 337.6	325 x 550 x 309

* Red is smaller than iP5A   * * Blue is bigger than iP5A

< Average volume>

H100 (LSIS)	iP5A (LSIS)	DANFOSS	VACON	ABB
66%	100%*	83%	95%	112%

* Compare average volume based on iP5A(100%) (400V)

H100

Frame & Size
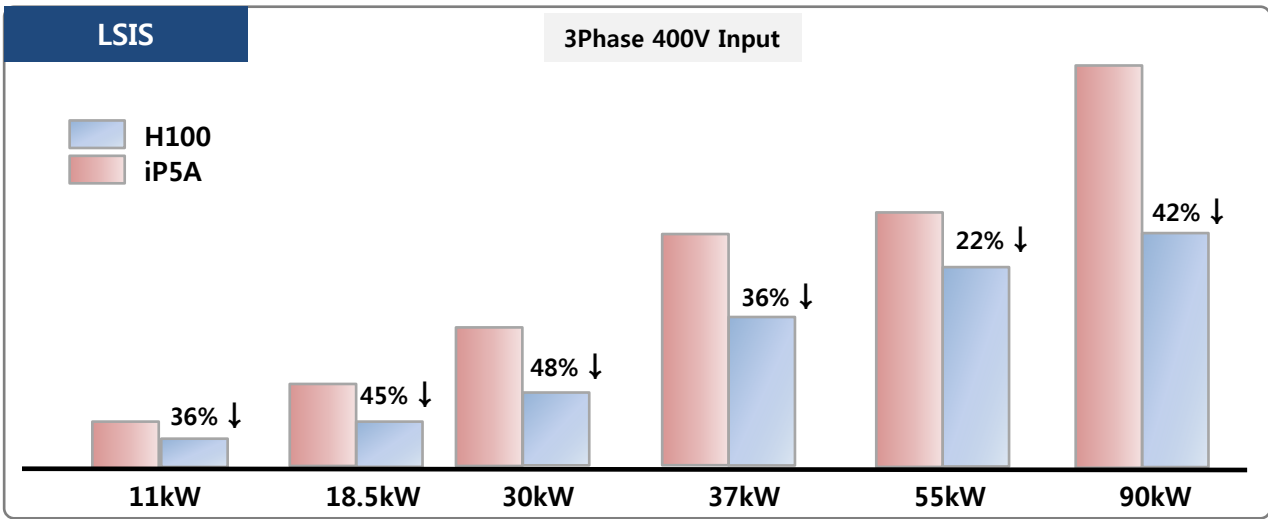
Compared to LSISiP5A series, H100's size is only 66%, the average reduction in size is 34%
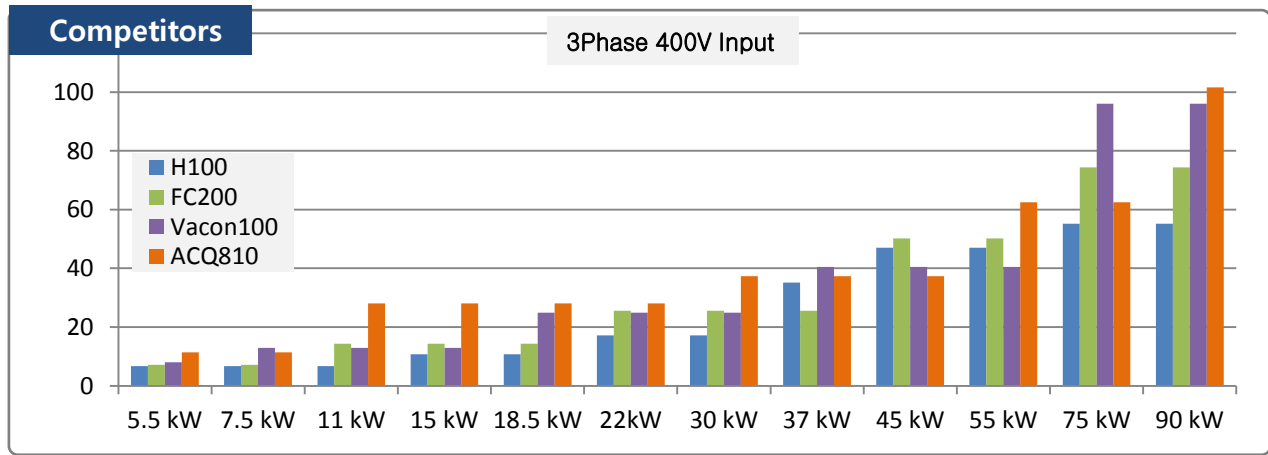
Compared to Danfoss FC200 series, the average reduction in size is 17%.

Compared to Vacon's 100 series, the average reduction in size is 26%

Compared to ABB's ACQ 810 series, the average reduction in size is 31%

H100

General specifications

Control Method		V/F control, Slip compensation
Frequency Setting Resolution		Digital Reference : 0.01Hz Analog Reference : 0.06Hz (max. freq. : 60Hz)
Frequency Accuracy		Digital : 0.01Hz Analog : 1% of max. frequency
V/F Pattern		Linear (default), Squared Pattern-1, Squared Pattern-2, Customized V/F
Torque Boost		Auto Torque Boost-1, **Auto Torque Boost-2*** / Manual Torque Boost
Operation Method		I/O keypad / Terminal / Built-in Communication / External communication
Frequency Setting		Analog : -10 ~ 10[V], 0 ~ 20[mA] Digital : I/O keypad, Pulse Train input, Step Frequency input
Input	**Multi-function Terminal**	NPN(Sink) / PNP(Source) Digital input : P1 ~ P7 (7 Points)
	Pulse Train Input	0 Hz ~ 32 kHz, Low Level : 0 ~ 0.8V, High Level : 3.5 ~ 12V
	Analog Input	V/Thermal (0 ~ 10V, -10V ~ 10V / PTC) optional 1 Point I/V(0 ~ 20mA / 0 ~ 10V) optional 1 Point
Output	**Multi-function Open Collector Output**	OC Output 1point DC 24V / 100mA or less, Pulse output terminal (Maximum 32kHz)
	Multi-relay Output	Fault signal output 1 Point (N.O. AC250V 2A or less, DC 30V 3A or less, N.C. AC250V 1A or less, DC 30V 1A or less) Multi-Function Relay 4Point (AC 250V 5A or less, DC 30V 5A or less)
	Analog Output	V/I (0 ~ 10V / 0 ~ 20mA) 1point, V (0 ~ 10V) 1point

* A new function to compensate loads that Auto Torque Boost-1 could not cover.

General specifications

Communication method		RS-485
Protocol		LS Bus, Modbus-RTU, BACnet(MS/TP, B-ASC), Metasys N2
Communication Speed [bps]	**Modbus/LS Bus**	1,200/2,400/4,800/9,600/19,200/38,400/56,000/115,200bps
	BACnet	9600/19200/38400/76800bps
	Metasys N2	9,600bps
Number of connected inverters		16 inverters
Instantaneous Power Interruptions		Designed to withstand instantaneous power interruptions within 8ms and maintain normal operation
Macro Function Setting		Basic/Compressor/Supply Fan/Exhaust Fan/Cooling Tower/Circular Pump/Vacuum Pump/Constant Torque
EMC Filter		Certification : EN61800-3(2004) - 200V Class : 5.5 ~ 18.5kW (Non EMC) - 400V Class : 5.5 ~ 30kW (Built-in basic C3) 37 ~ 90kW (Non EMC, **C3 applicable without EMC**)
DC Reactor		200V : 5.5 ~ 18.5kW (Non DCL) 400V : 5.5 ~ 30kW (Non DCL), 37 ~ 90kW (DCL Built-in Basic)
DB Chopper		200V : 5.5 ~ 18.5kW : Built-in 400V : 5.5 ~ 30kW : Built-in, 37 ~ 90kW : Option
Protection Structure		IP20 (UL Open Basic) Option : UL Enclosed Type 1
Carrier Frequency		Default 3kHz, 1~15kHz(Carrier Frequency is different per capacity)
RTC		Built-in RTC (Remove the protective film before installation)
USB		Drive View 7 (Do not support lower version than 7)

H100

General specifications

Built-in USB Port

Easy DriveView7 connection through USB to USB port
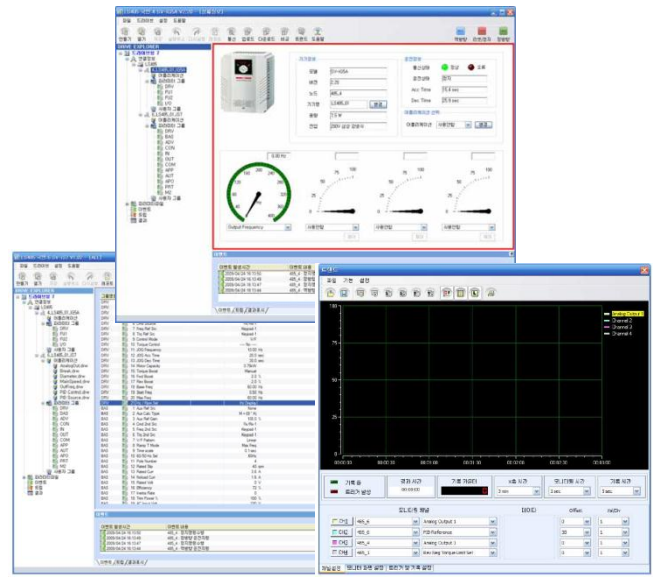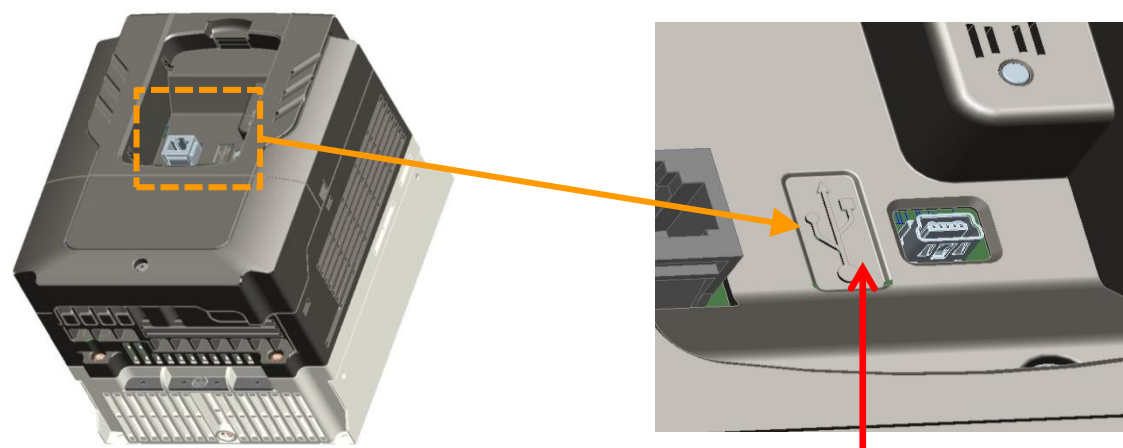
USB to USB

Drive View 7

H100

General specifications

Enhanced RS485 communication

Inbuilt RS485 communication (Modbus RTU & LS Bus) is faster than the previous models (Max. speed 115kbps) and its reliability has be improved.
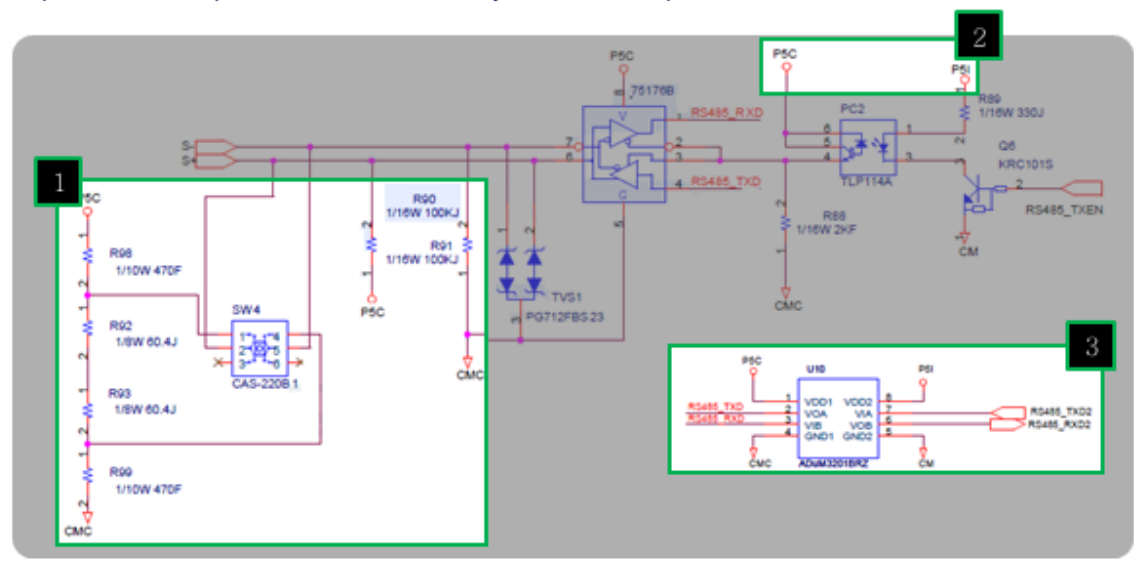
1 Stable communication signal levels
- through improvement in the terminal resistor circuit even if several stations are communicated

2 Independent power source for RS485 communication
- Not affected by electromagnetic noises from the drive or its surrounding environment

3 High communication speed
- Approximately 6 times faster than previous model (IG5A: 19kbps → H100: 115kbps)
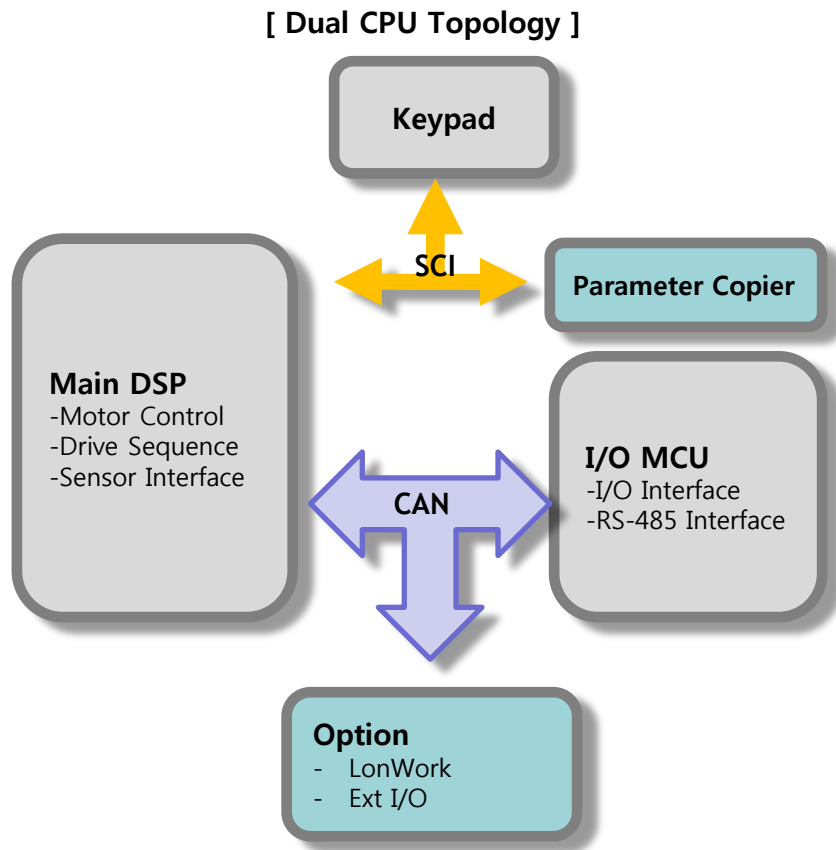
Effect of Terminal resistor
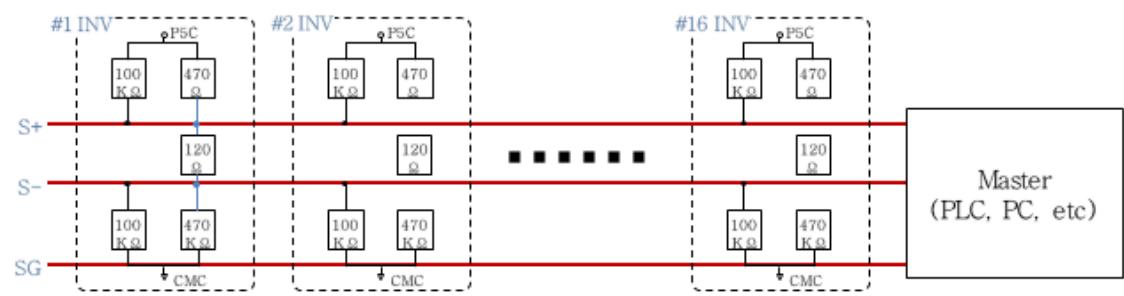
H100

■ General specifications

Dual CPU Topology allows faster scan cycle time to control motor.
Also CAN communication between Control and I/O block helps electromagnetic noise reduction.

[Dual CPU Topology]

Keypad

SCI

Parameter Copier

Main DSP
-Motor Control
-Drive Sequence
-Sensor Interface

CAN

I/O MCU
-I/O Interface
-RS-485 Interface

Option
- LonWork
- Ext I/O

Main DSP*

Speed	60MIPS*
Memory	Flash: 256kByte RAM: 36kByte

- *DSP: Digital Signal Processor*
- *MIPS: million Instructions Per Second*

I/O MCU*

System Clock	48Mhz
Memory	Flash: 32kByte RAM: 16kByte

- *MCU: Micro Controller Unit*

H100

■ General specifications

H100 has various functions which fulfilled HVAC Application.

Function	LSIS (H100)	LSIS (iP5A)	ABB (ACQ810)	Delta (CP2000)	Danfoss (FC200)	Vacon (100)
RTC	○	-	○	○	○	○
Underload(No Flow, Dry Pump)	○	○	○	○	○	○
Pipe Broken	○	○	-	-	○	○
Flow Compensation	○	-	-	-	○	○
Payback Counter	○	-	○	-	○	○
Fire Mode	○	○	-	○	-	○
Soft Pipe-Fill	○	-	○	-	○	-
Master Follower	-	-	○	-	○	-
Pump Clean Function	○	-	○	-	○	-
MMC	○	○	○	○	○	○
Check Valve Ramp	○	-	-	-	○	-
Sleep Boost/Wakeup	○	○	○	-	○	○
USB Connectivity	○	-	-	-	○	-
Level Detection(Outlet Protection)	○	○	○	-	○	○
Damper/Lubrication	○	○	○	-	-	-
HAND/OFF/AUTO	○	-	○	-	○	-
Regular Bypass	○	○	○	-	○	○

H100

Features (1)

HAND/OFF/AUTO

✓ HVAC customized Keypad (same H/W configuration as iS7)

✓ Standard functions for HVAC Industry Drive

- Hand key: Operation via keypad

- Hand key + up/down: changes speed

- Off key: Functions as Stop / Reset button in iS7 keypad

- Auto key: Operation as preset functions
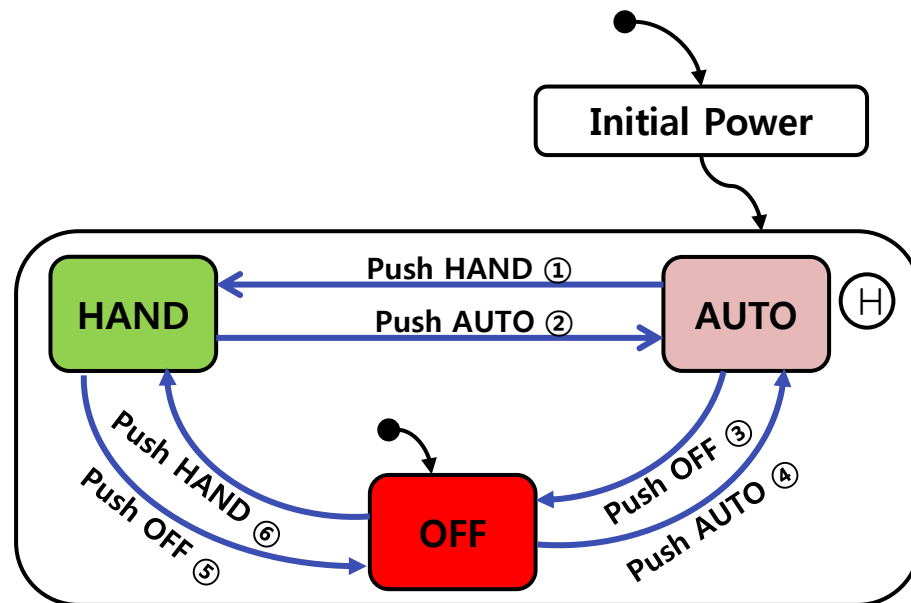
H100

Features (2)

Pump Clean

✓ Due to scraps that build up in the impellers of pumps, it decreases the efficiency of motor performance. Through consecutive FWD/REV or ACCL/DECL operation, the residue gets eliminated.

✓ Extension of pump lifespan and energy saving effect through removal of scraps in impellers.
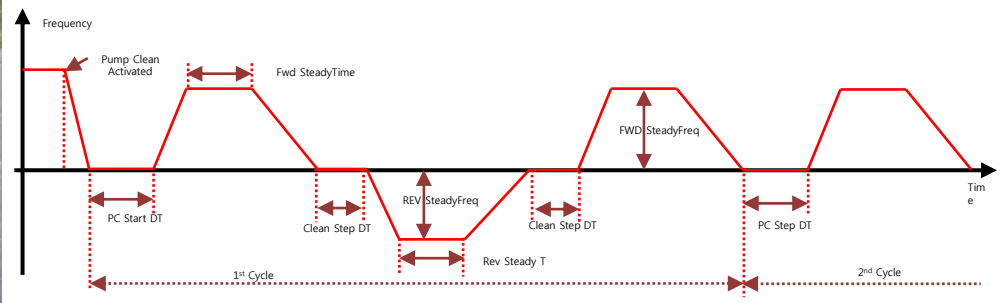
Level Detection

✓ In basis of LDT source, Warning or Trip is initiated either at a level higher or lower than a preset level
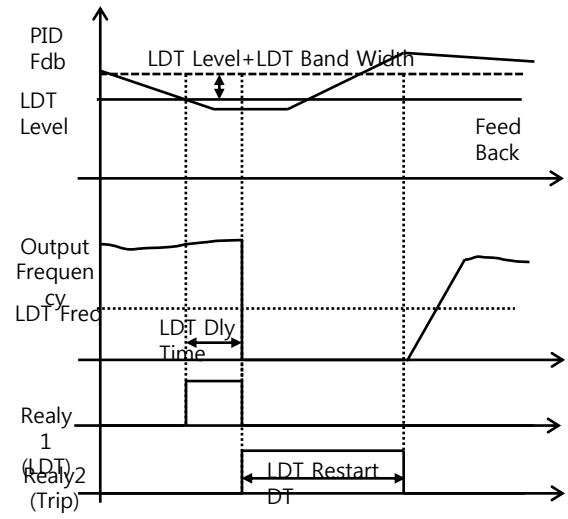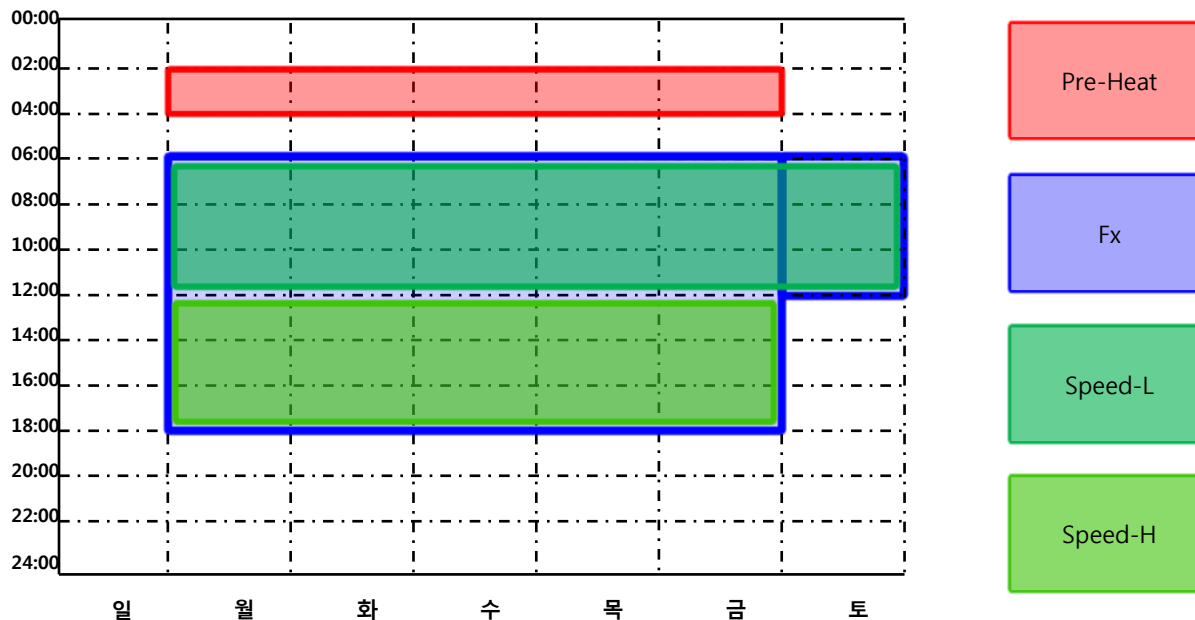
H100

Features (3)

RTC (Real Time Clock)

✓ Drive operation or certain function to operate through RTC

✓ A CR2032 Lithium-Manganese battery is installed on the I/O board. Approximately 25,800 hours with the inverter turned off, and 53,300 Hours with the inverter turned on

✓ 4 Time period module types.

✓ 8 Time Event module types

✓ 8 Exception day types
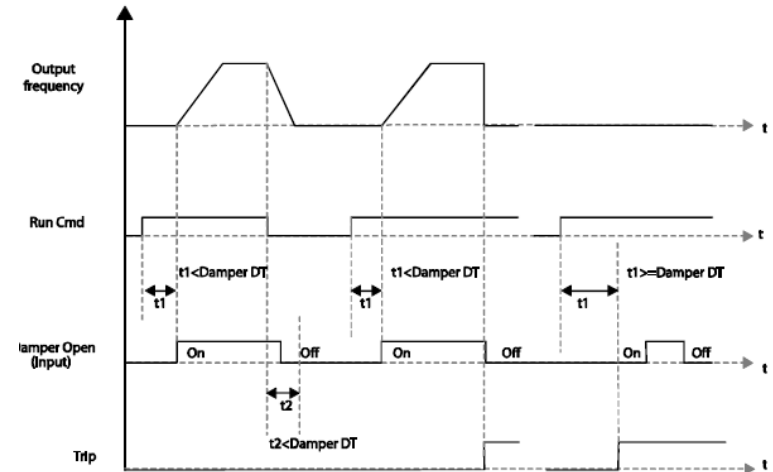
✓ Summer time Function included (start date / End date)

H100

Features (4)

Damper Control

✓ A damper is a device that controls the flow in a ventilation system.

✓ If a fan and a damper are used together in a system, the inverter may be configured to operate according to the damper's operation status.

Soft Fill

✓ A function to prevent excessive from building in the pipe system at the initial stage of a operation.
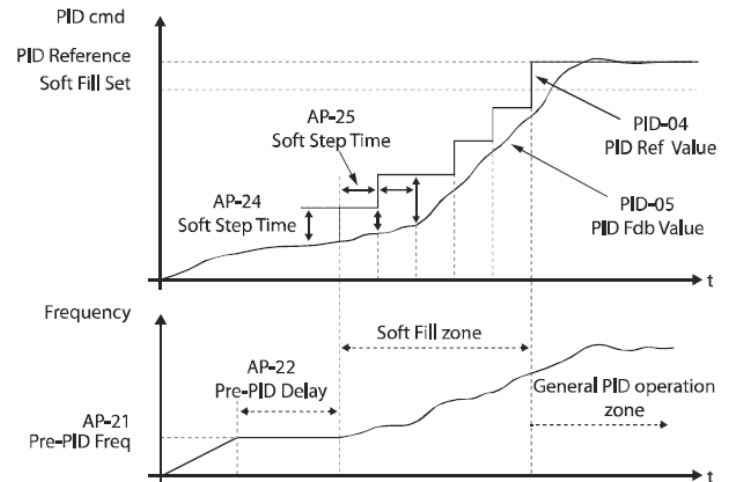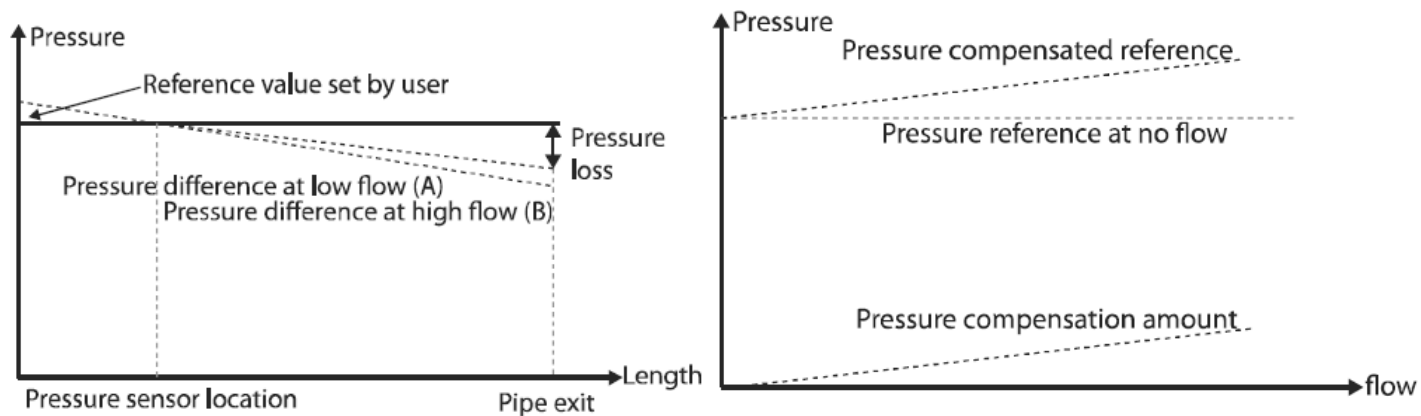
H100

Features (5)

Flow Compensation

✓ In a pipeline system, pressure is lost due o long pipe length.

✓ A flow compensation operation compensates pressure loss by increasing the volume of the PID reference

Fire Mode

✓ Emergency operation for ventilation fan in which the drive operates at its fullest ignoring all trip or warnings except hardware-related critical faults.

Start Ramp & End Ramp

✓ Function that minimizes water hammering effect during stop or valve closing

✓ Function that modifies the ACCL/DECL curve to prevent thrust bearing damage

H100

Features (6)

Aux Motor PID Compensation

✓ When the number of operating auxiliary motors increases, the flow rate of the pipe also increases and the pressure of the pipe line decreases. Aux motor PID compensation compensates for this pressure when the number of the auxiliary motor increases
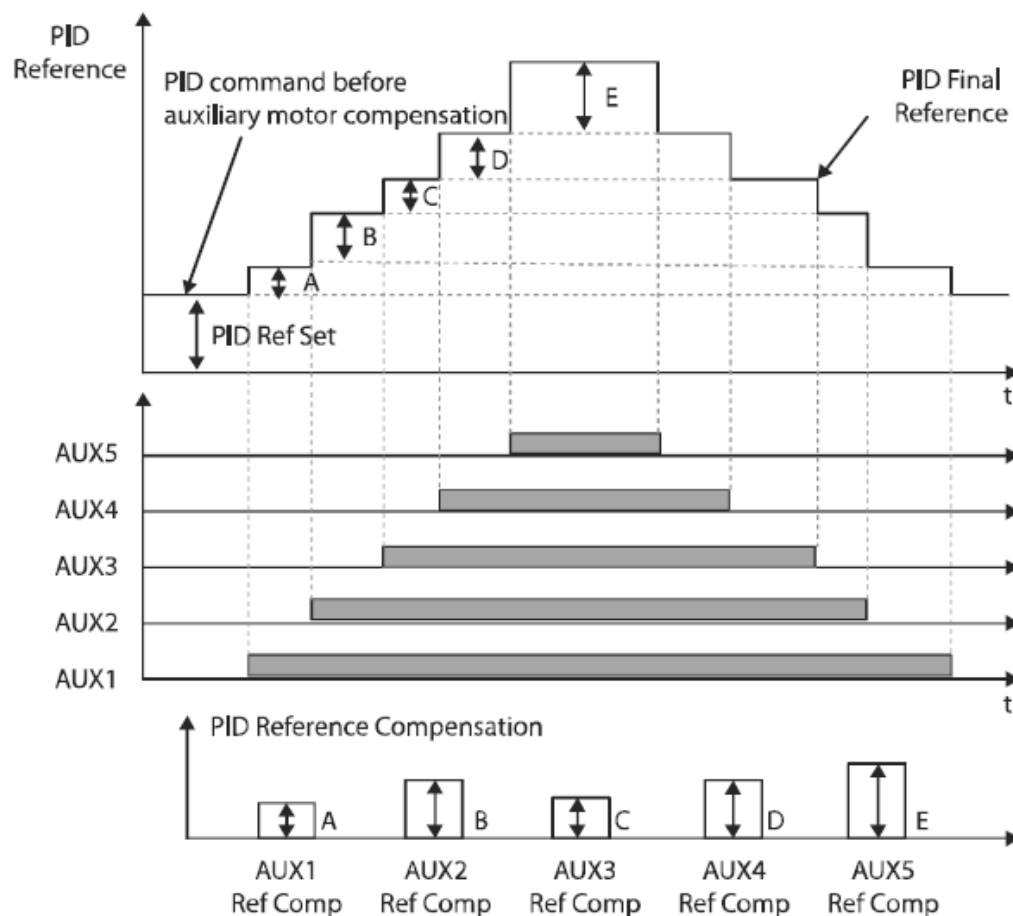
H100

Features (7)

MMC (Multi Motor Control)

✓ The MMC function is used to control multiple motors for a pump system.
  (up to 5 motors simultaneously)

✓ The main motor connected with the inverter output is controlled by the PID controller. The auxiliary motors are connected with the supply power and turned on and off by the relay within the inverter

<MMC related modes>

✓ FIFO (First-in-first-out) mode, Aux exchange, Main exchange
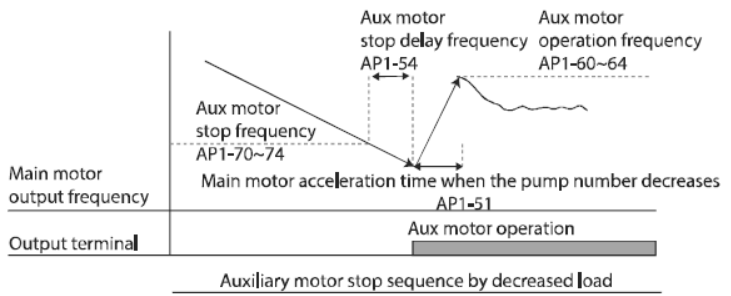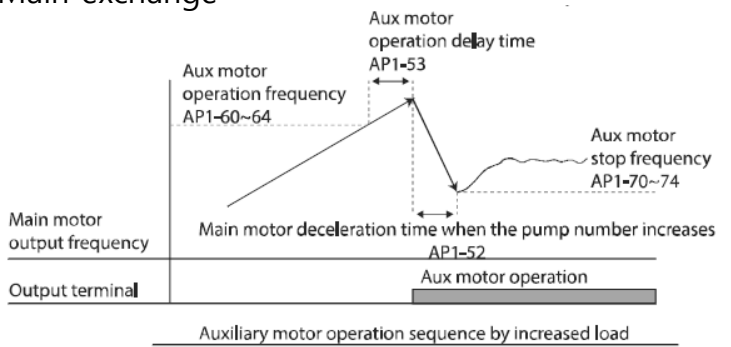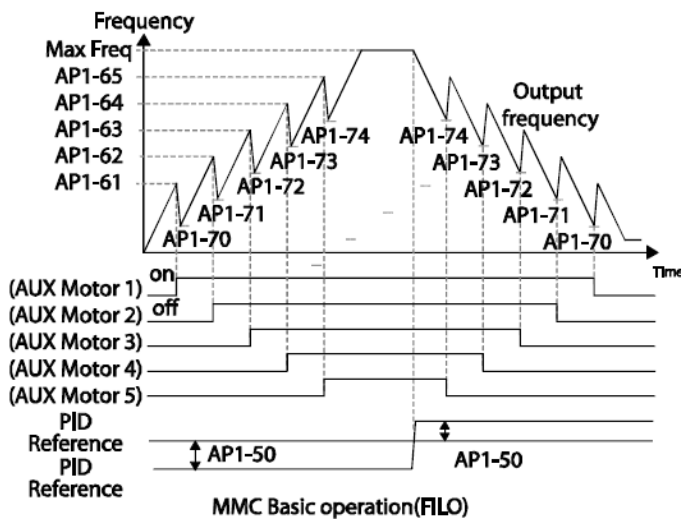
MMC Basic operation(FILO)

Auxiliary motor operation sequence by increased load

Auxiliary motor stop sequence by decreased load

H100

Features (8)

▼ Decelerating Valve Ramping

✓ This function is used to prevent pump damage due to abrupt deceleration.

✓ When the pump operation frequency reaches the valve ramp frequency while decelerating rapidly based on the deceleration ramp time. It begins to slow down the deceleration based on the deceleration valve ramp time
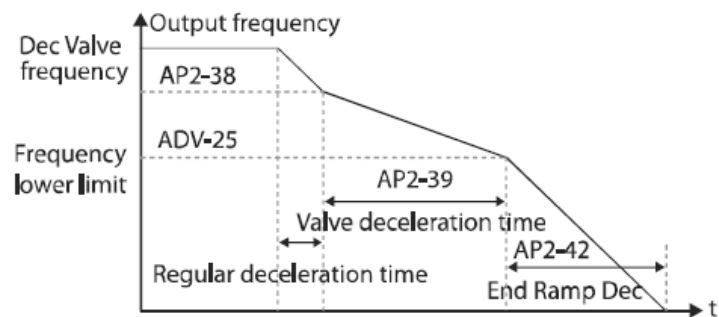
▼ Load Tuning

✓ Load tuning refers to an operation that detects the load applied to a specific inverter operation (current and voltage) and creates an ideal load curve for under load and pump clean operations.
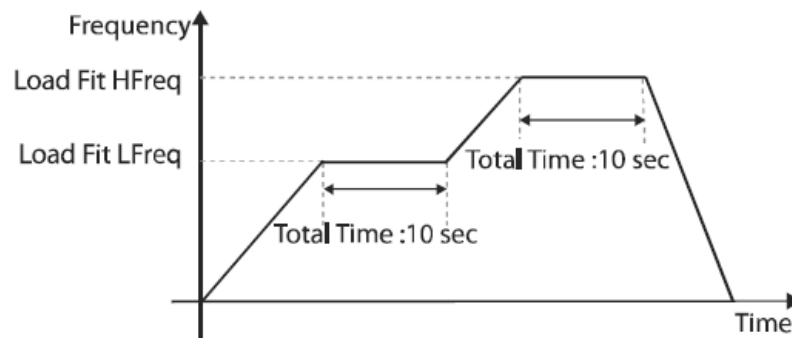
H100

Features (9)

Main Capacitor Life Estimation

✓ The life of the main capacitor in the inverter can be predicted

-. Configure the current level of the inverter's output when capacitance life examination is in operation

-. After installing the inverter, configure estimated capacitance value of Main capacitor and if this value is lower than the value set in standard level for the capacitance replacement, "CAP Warning" message appears on the display.

PRT-84 = 1 or 2

INV Out Curr

PRT-83

DC Link Volt

V_1

V_2

Δt

INV Input Volt
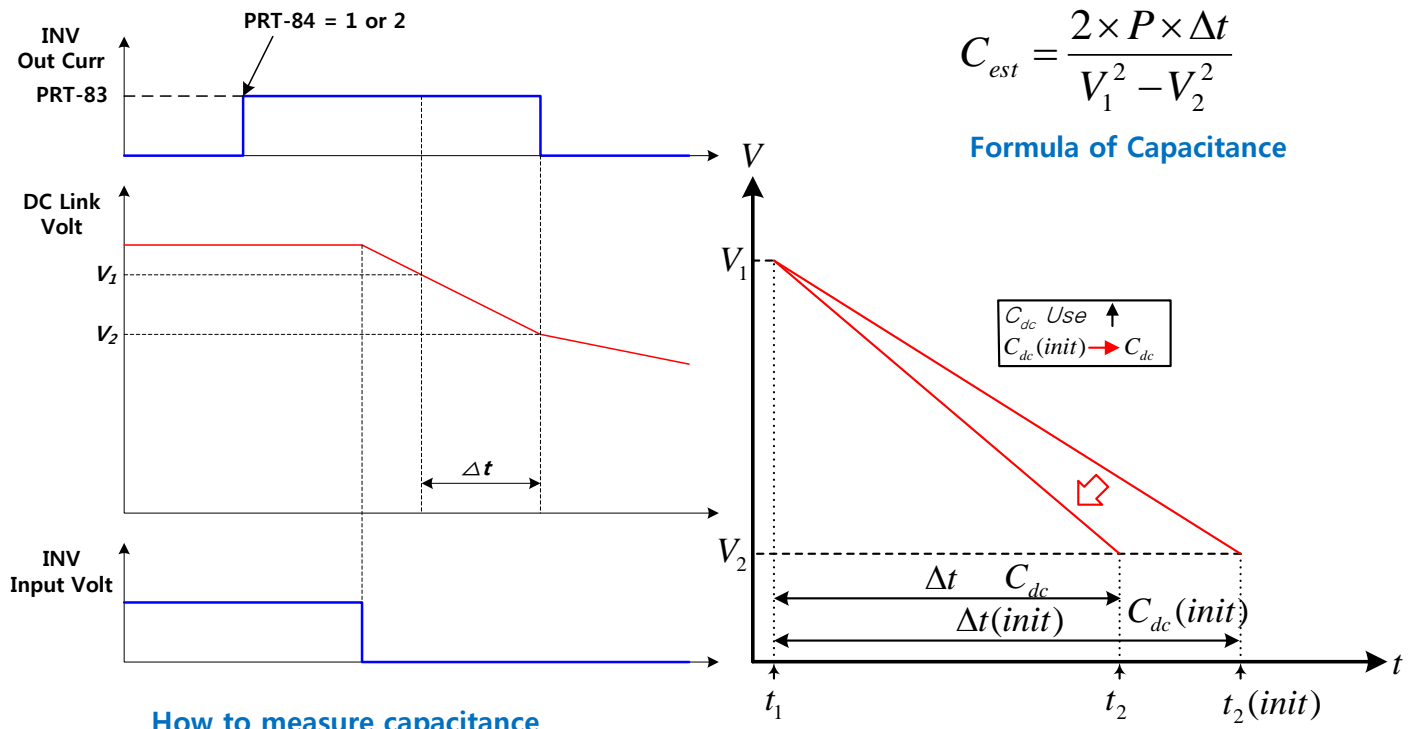
How to measure capacitance

$$C_{est} = \frac{2 \times P \times \Delta t}{V_1^2 - V_2^2}$$

Formula of Capacitance

V_1

$C_{dc}\ Use$

$C_{dc}(init) \rightarrow C_{dc}$

V_2

$\Delta t \quad C_{dc}$

$\Delta t(init) \quad C_{dc}(init)$

t_1 t_2 $t_2(init)$

H100

Features (10)

Macro Selection

✓ The Macro selection function is used to put various application functions together in a group. When a Macro function is selected, all the related parameters are automatically changed based on the inverter's Macro Settings.

7 Macro configurations are available

0	**Basic**
1	**Compressor**
2	**Supply Fan**
3	**Exhaust Fan**
4	**Cooling Tower**
5	**Circul. Pump**
6	**Vacuum Pump**
7	**Constant Torque**

Example of Compressor Macro

Macro Code	Code	LCD Display	Initial Value	Macro Code	Code	LCD Display	Initial Value
0	-	Jump Code	0 CODE	1	DRV 3	Acc Time	10.0
2	DRV 4	Dec Time	20.0	3	DRV 7	Freq Ref Src	1: Keypad-2
4	DRV 9	Control Mode	1: Slip Compen	5	DRV 11	JOG Frequency	20.00
6	DRV 12	JOG Acc Time	13.0	7	DRV 13	JOG Dec Time	20.0
8	DRV 15	Torque Boost	1: Auto1	9	BAS 70	Acc Time-1	10.0
10	BAS 71	Dec Time-1	20.0	11	ADV 10	Power-on Run	1: Yes
12	ADV 65	U/D Save Mode	1: Yes	13	CON 4	Carrier Freq	3.0
14	CON 70	SS Mode	0: Flying Start-1	15	CON 77	KEB Select	1: Yes
16	OUT 32	Relay 2	14: Run	17	PID 1	PID Sel	1: Yes
18	PID 3	PID Output	0.00	19	PID 4	PID Ref Value	-
20	PID 5	PID Fdb Value	-	21	PID 10	PID Ref 1 Src	4: I2
22	PID 11	PID Ref 1 Set	0.5000	23	PID 25	PID P-Gain 1	70.00
24	PID 26	PID I-Time 1	5.0	25	PID 50	PID Unit Sel	5: inWC
26	PID 51	PID Unit Scale	4: x0.01	27	AP1 8	PID Sleep1Freq	5.00
28	AP1 21	Pre-PID Freq	30.00	29	AP1 22	Pre-PID Delay	120.0
30	PRT 8	RST Restart	11	31	PRT 9	Retry Number	3
32	PRT 10	Retry Delay	4.0	33	PRT 11	Lost KPD Mode	3: Dec
34	PRT 12	Lost Cmd Mode	2: Dec	35	PRT 13	Lost Cmd Time	4.0
36	PRT 40	ETH Trip Sel	1: Free Run	37	PRT 42	ETH 1min	120
38	PRT 52	Stall Level 1	130	39	PRT 66	DB Warn %ED	10
40	PRT 70	LDT Sel	1: Warning	41	PRT 72	LDT Source	0:Output Current
42	PRT 75	LDT Band Width	LDT Source 최대치의 10%	43	PRT 76	LDT Freq	20.00
44	M2 4	M2-Acc Time	10.0	45	M2 5	M2-Dec Time	20.0
46	M2 8	M2-Ctrl Mode	1: Slip Compen	47	M2 28	M2-Stall Lev	125
48	M2 29	M2-ETH 1min	120				

H100

🖐 Comparison

Model	LSIS(H100)	DANFOSS(FC200)	ABB(ACQ810)
Exterior			
Capacity and framework	• 200[V] : 5.5[kW]~18.5[kW] • 400[V] : 5.5[kW]~90[kW] • Same hardware configuration as S100	• 200[V] : 1.1[kW]~45[kW] • 400[V] : 1.1[kW]~90[kW] • 575[V] : 1.1[kW]~90[kW] • Same frame as FC100, FC200, FC300	• 200[V] : 0.37[kW]~22[kW] • 400[V] : 1.1[kW]~400[kW] • Same frame as ACS850
I/O	• 2 analog input • 2 analog output • 7 digital input • 5 relay output • 1 open collector • 1 pulse input	• 2 analog input • 1 analog output • 6 digital input • 1 relay output	• 2 analog input • 2 analog output • 6 digital input • 2 relay output • 2 Bidirectional DIO
Characteristics	• Built-in RS-485,BACnet • 2 External PID • Various HVAC Applications • Built-in USB • Built-in RTC • MACRO per application • Supports Lonworks (optional)	• High performance of MMC function through Cascade Controller (Master follower, cascade function, etc.) • 4 PID • Sames H/W framework and different production line-up per application • Various options per product line	• Basic Modbus/Drive to drive link function • Various options - DeviceNet, Profibus-DP, EtherNet, Modbus, Lonworks -Extension I/O(A I/O, D I/O) -I/O extension(Relay)