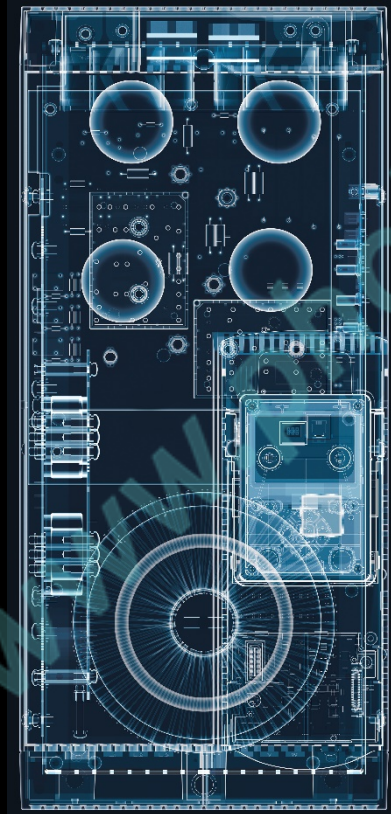


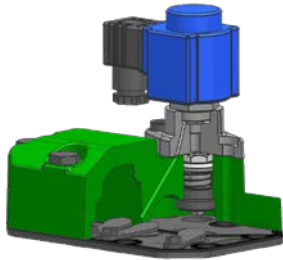
VARIPACK



Capacity regulation methods for BITZER reciprocating compressors

Sophisticated BITZER Solutions

CRII - System



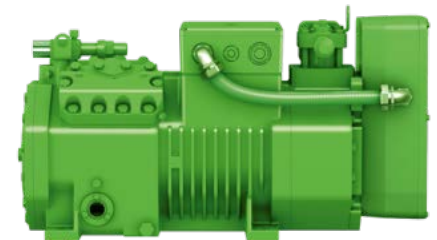
“The cheap way of enhanced capacity regulation”

VARIPACK **NEW!**



“The flexible solution.
The easiest to use external frequency inverter”

VARISPEED



“The easiest to use and most compact frequency inverter solution”

External BITZER frequency inverters (380 – 480 V)

A frequency inverter series for all BITZER reciprocating compressors



Technical details

www.pholod.com.ua



General technical data

/ 380 – 480 V \pm 10 %

/ IP20 → For switchboard mounting

/ Communication ports

- RS485: Modbus RTU
- Ethernet: Modbus TCP/IP, Webserver
- 2 x RS232 (for future extension cards)

/ Safe torque off (STO) → No mains/safety contactor required

/ Real time clock

/ EMC category C2 acc. EN61800-3 / corresponding to EN61000-6-4

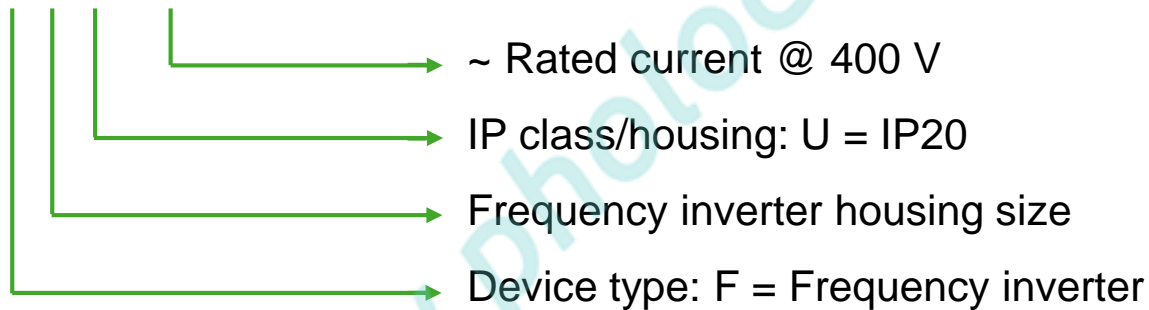
/ Approvals:    

Brand name and nomenclature

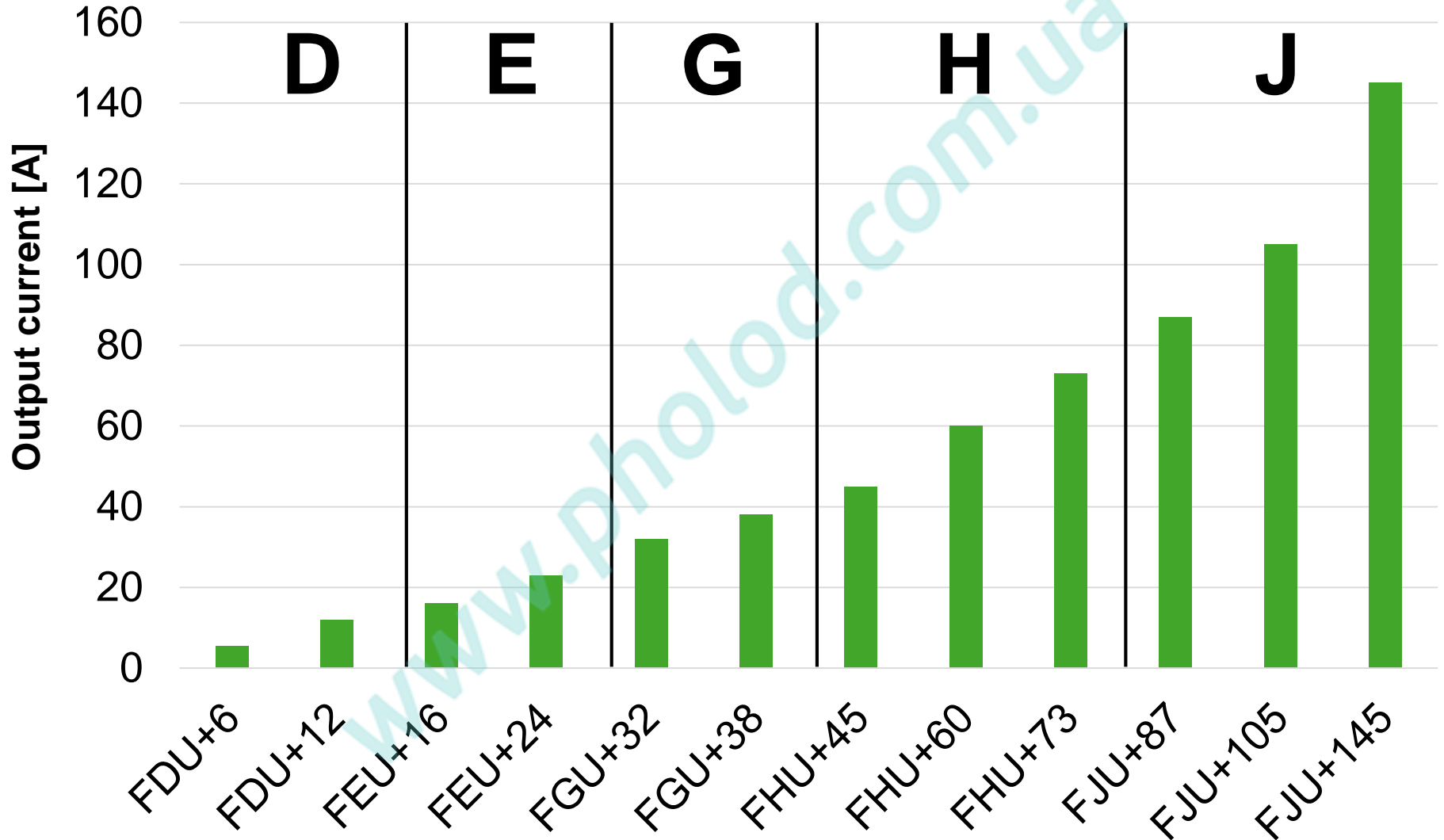
/ Brand name: **VARIPACK**

/ Nomenclature

- **FGU+38**



Power range (rated current vs. housing)



Available options

Frequency inverter	FDU+6	FDU+12	FEU+16	FEU+24	FGU+32	FGU+38	FHU+45	FHU+60	FJU+73	FJU+87	FJU+105	FJU+145
EMC filter for category C2 (according EN61800-3)	S	S	S	S	S	S	S	S	S	S	S	S
Through-switch cabinet mounting kit	•	•	•	•	•	•	•	•	•	•	•	•
BEST converter						•						
Removable display with key pad						•						
Display remote mounting kit (3 m)						•						
Extension kit for pressure regulation (12,5/33 bar(a))						•						

Legend:

/ S = Standard

/ • = Available option

Operating modes

www.pholod.com.ua



Operating modes

1. External control
2. Evaporating and condensing pressure regulation (with option kit)

/ General

- FI detects if an option card is mounted (and which one it is)
- Based on that, the FI changes automatically the control mode and visible parameters

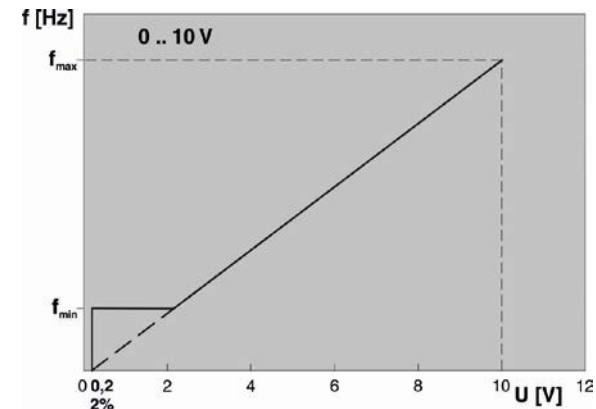
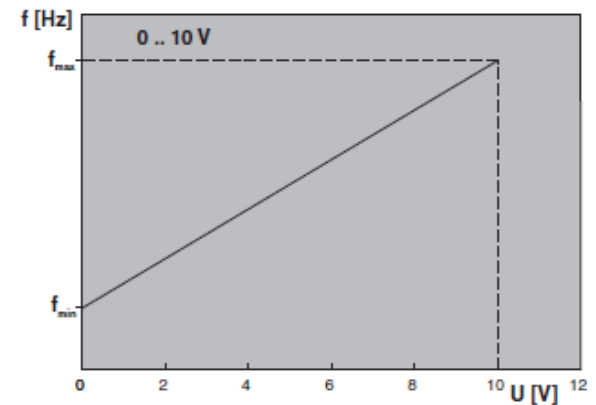


Operating modes: External control

/ **0 .. 10 V** or **4 .. 20 mA** signal can be used without parameter change

/ 2 control characteristics available

- “Min .. Max” (Standard)
 - Compressor starts when start signal is applied
 - External control signal corresponds to min. and max. frequency
- “0 .. Max”
 - Compressor starts when start signal + setpoint > 2 % are applied
 - External control signal corresponds to 0 Hz – max. frequency



Operating modes: Pressure regulation (1/2)

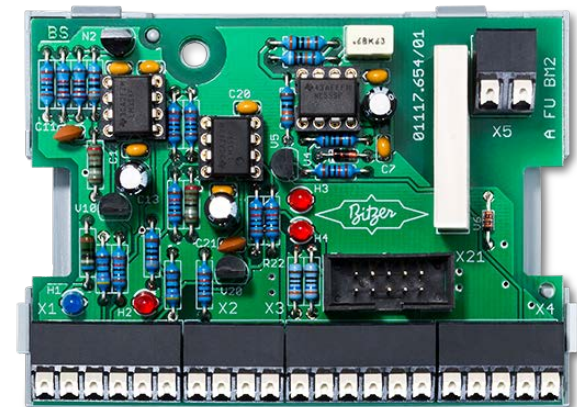
/ External controller not required anymore

/ Features

- **Direct evaporating pressure regulation**
- **Condenser fan regulation by 0 – 10 V output signal**
- **Control of another fixed speed compressor (FsCs)**

/ Pressure regulation kit includes










- Extension module for pressure regulation
- Low and High pressure transmitter (12,5 / 33 bar)
- Connection cables with 6 m in IP67



Operating modes: Pressure regulation (2/2)

/ Data for more than 35 refrigerants are integrated in the FIs

Refrigerant data integrated in the Frequency inverters

R14	R22	R23	R134a	R152a 	R170 	R227ea	R236fa
R245fa	R290 	R404A	R407A	R407C	R407F	R417A	R417B
R422A	R422D	R427A	R434A	R437A	R438A	R442A	R448A
R449A	R450A	R507A	R508A	R508B	R513A	R600 	R600a 
R1150 	R1234yf 	R1234ze 	R1270 				

- Common safety measurements must be considered by flammable refrigerants
- R32, R410A, R717, R723 and R744 also implemented, but actually no pressure transducers available for these refrigerants

Communication with the VARIPACK

www.pholod.com.ua

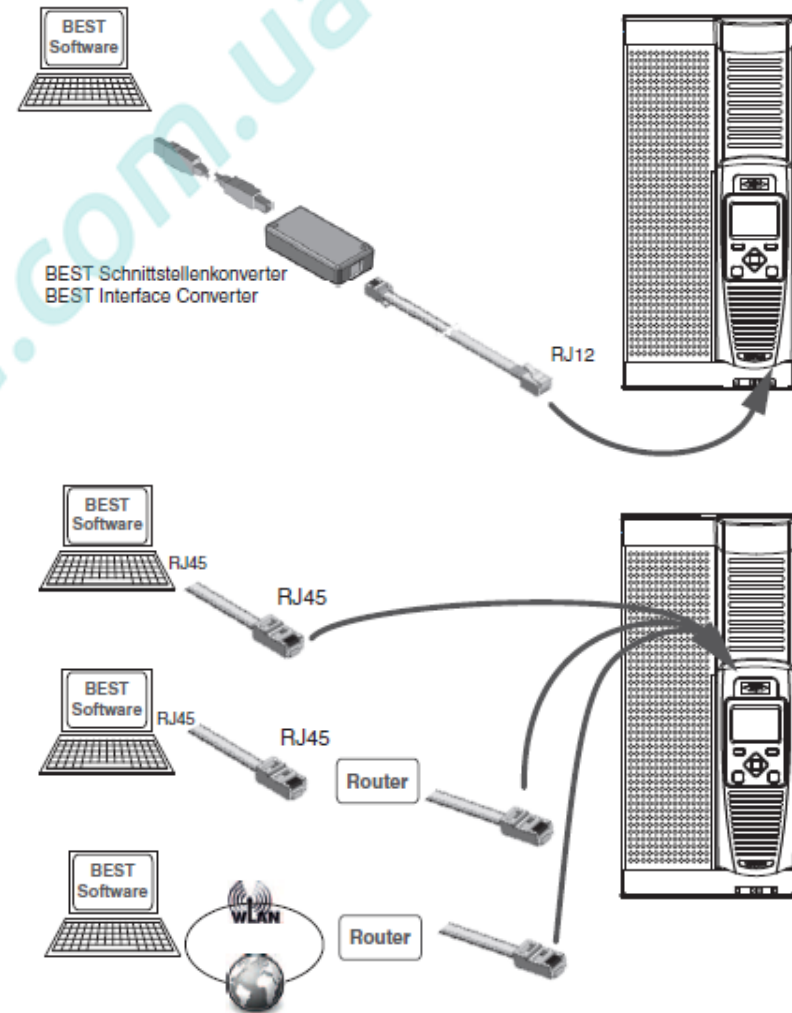


Communication with the VARIPACK (1/3)

/ BEST

(BITZER Electronics Service Tool)

- Recommended user interfaces
 - Most user-friendly one
 - Most powerful one
- Connection possibilities
 - Via BEST converter
 - Per Ethernet direct connection (crossed or not crossed cable)
 - Via the network (router with or without DHCP)



Communication with the VARIPACK (2/3)

/ Removable Display with key pad (+ SD card)

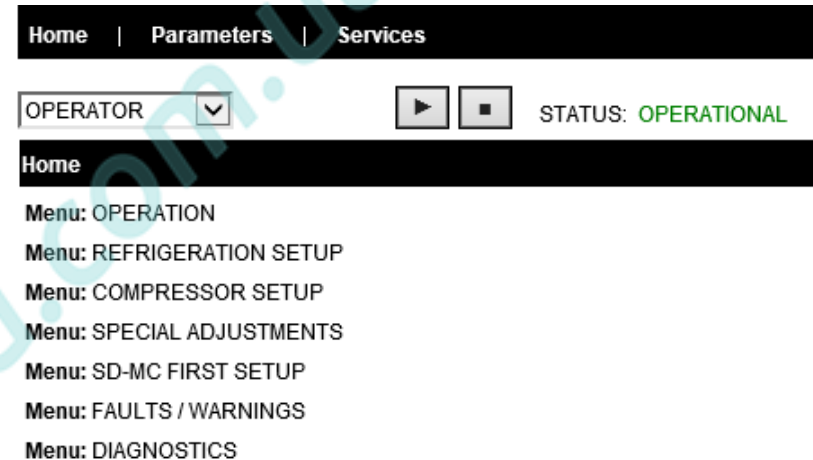
- Multi-language
- SI and IP units selectable
- 2 modes for customers
 - ⇒ Standard
 - ⇒ Refrigeration technician (password protected)
- SD card includes the Compressor and Refrigerant databases



Communication with the VARIPACK (3/3)

/ Integrated Webserver

- Menu structure identical to the display
- For use with Smartphones and Apple PCs, for Windows devices the BEST Software is the preferred interface



/ For communication with superior controllers or building management systems

- Modbus RTU
- Modbus TCP/IP

Selection

www.pholod.com.ua



Selection of the frequency inverters

- / The VARIPACK FIs will be fully implemented in the BITZER Software
- / They can be found under the button „**Accessories**“
- / The BITZER Software allows to select for each individual application, the optimum combination of compressor, frequency inverter and motor
- / Thanks to the visualisation of the application envelope, related to the actual selection, **it allows to design the most cost effective but still reliable solution without the need of having a lot of expertise** and doing several calculation steps.

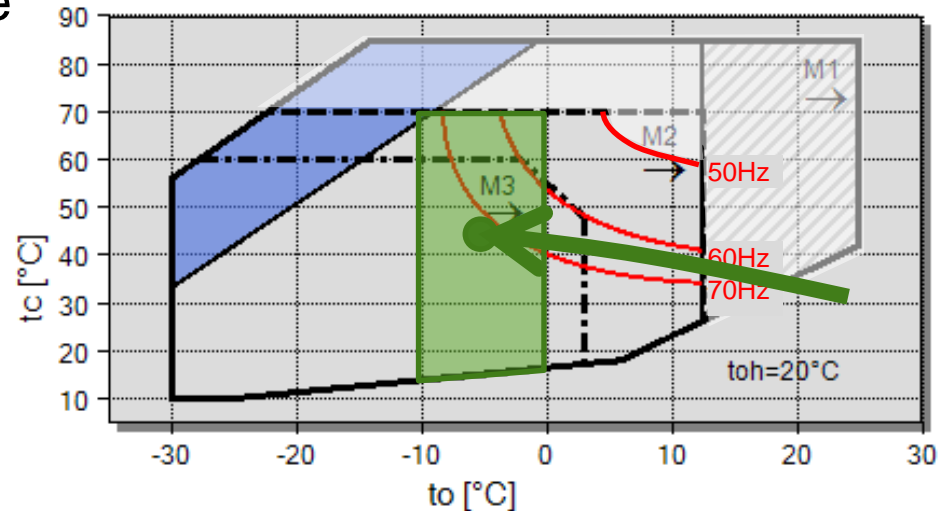
Selection example 1

/ 4CES-6Y; R134a; MT application

- (-5 °C / 45 °C) $\Rightarrow Q_0 = 17 \text{ kW @ } 70 \text{ Hz}$
- $I_{\text{max}} = 17,7 \text{ A} \Rightarrow I_{\text{Starting}} = 17,7 \text{ A} * 1,6 = 28,3 \text{ A}$
 - \Rightarrow Standard selection: FEU+24

/ Looking into the BITZER Software

- \Rightarrow FDU+12 usually sufficient
- \Rightarrow 33 % cost savings
- \Rightarrow Or FEU+16 with reduced max. frequency limitation



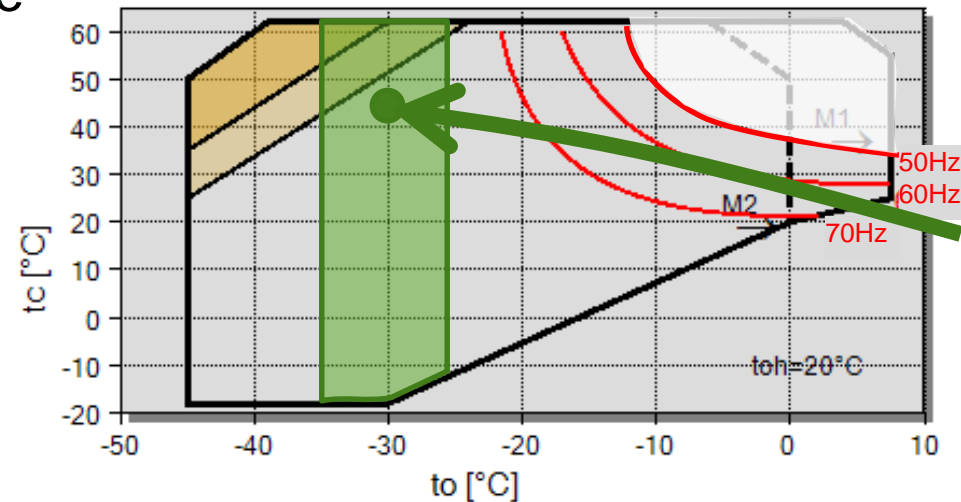
Selection example 2

/ 4NES-14Y; R404A; LT application

- $(-30\text{ °C} / 45\text{ °C}) \Rightarrow Q_0 = 5,5\text{ kW @ } 70\text{ Hz}$
- $I_{\max} = 26,6\text{ A} \Rightarrow I_{\text{Starting}} = 26,6\text{ A} * 1,6 = 42,6\text{ A}$
 - ⇒ Standard selection: FGU+32

/ Looking into the BITZER Software

- ⇒ FEU+24 usually sufficient
- ⇒ 20 % cost savings



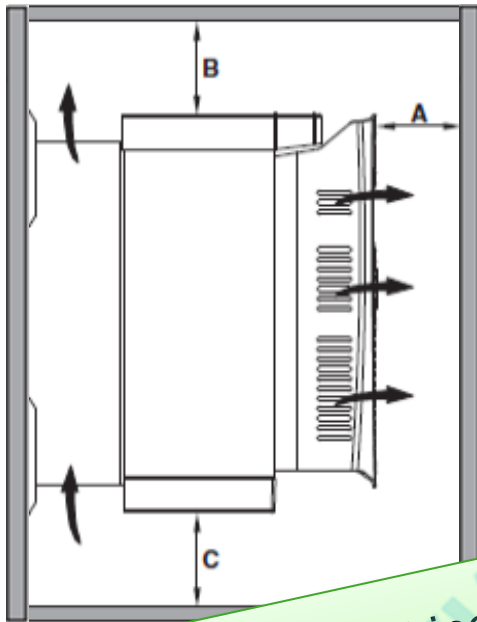
Installation

www.pholod.com.ua



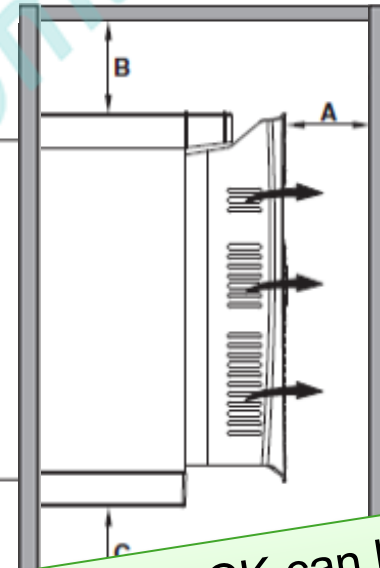
Mounting possibilities

/ Switch cabinet mounting



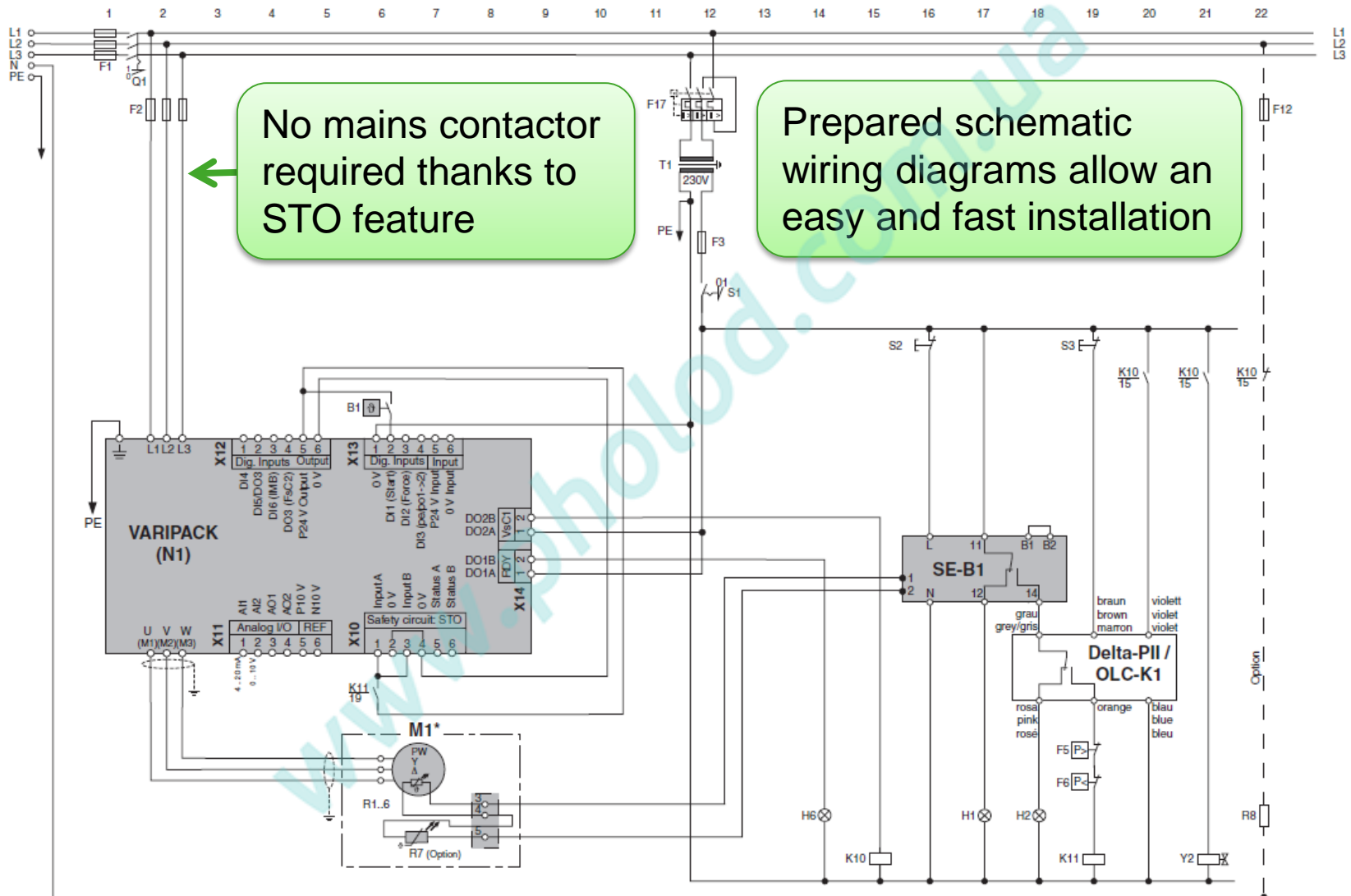
- “Trough-switch cabinet mounting kit” not required
- Faster installation

/ Through-switch cabinet mounting

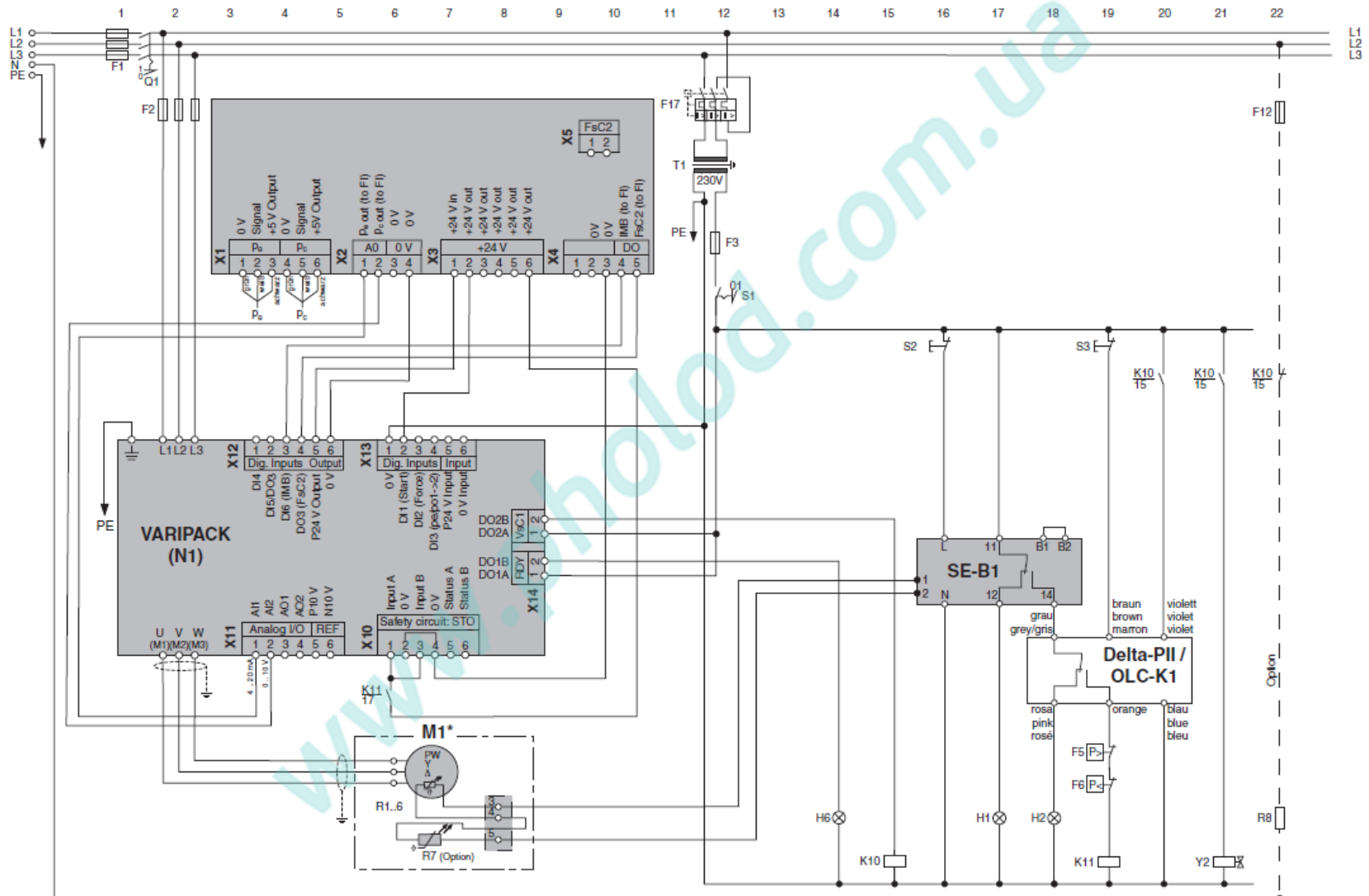


- The VARIPACK can be kept clean and dry more easily
- The ventilation of the switch cabinet can be reduced to a minimum

Schematic wiring diagram: External control

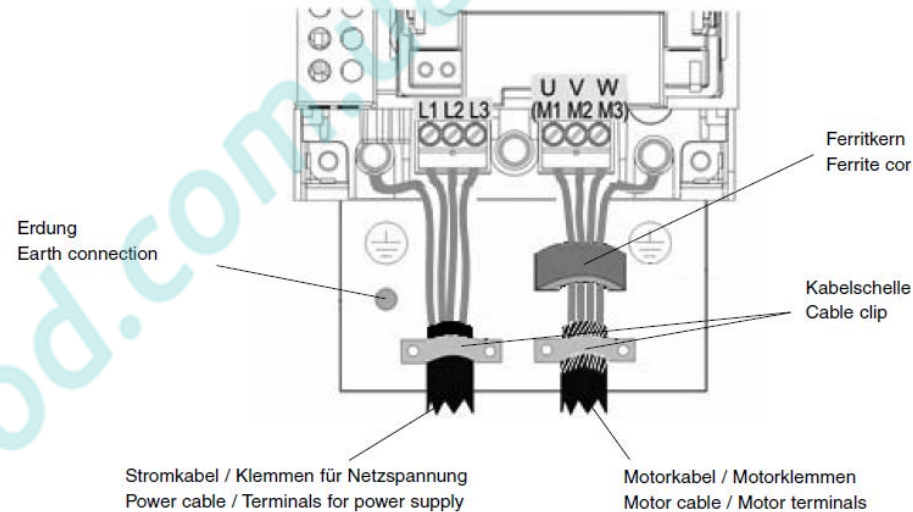


Schematic wiring diagram: Pressure control



Some words about EMC

- / In general, EMC is a quite manifold and complex topic
- / Our approach to reduce the risk of EMC issues
 - EMC C2 filters as standard up to FJU+145
 - Providing practical and clear hints and recommendations



	FI	FDU	FEU	FGU	FHU	FJU	FKU
Conducted emissions	EN 61800-3						
	Category C1	Specific filter in preparation	Specific filter in preparation	Specific filter in preparation	Unsuitable	Unsuitable	Unsuitable
	Category C2	Motor cable ≤ 10 m	Motor cable ≤ 10 m	Motor cable ≤ 10 m	Motor cable ≤ 10 m	Motor cable ≤ 10 m	Specific filter (upon request)
	Category C3	Motor cable ≤ 50 m	Motor cable ≤ 50 m	Motor cable ≤ 50 m	Motor cable ≤ 50 m	Motor cable ≤ 50 m	To be defined

Commissioning

www.pholod.com.ua



Today's situation



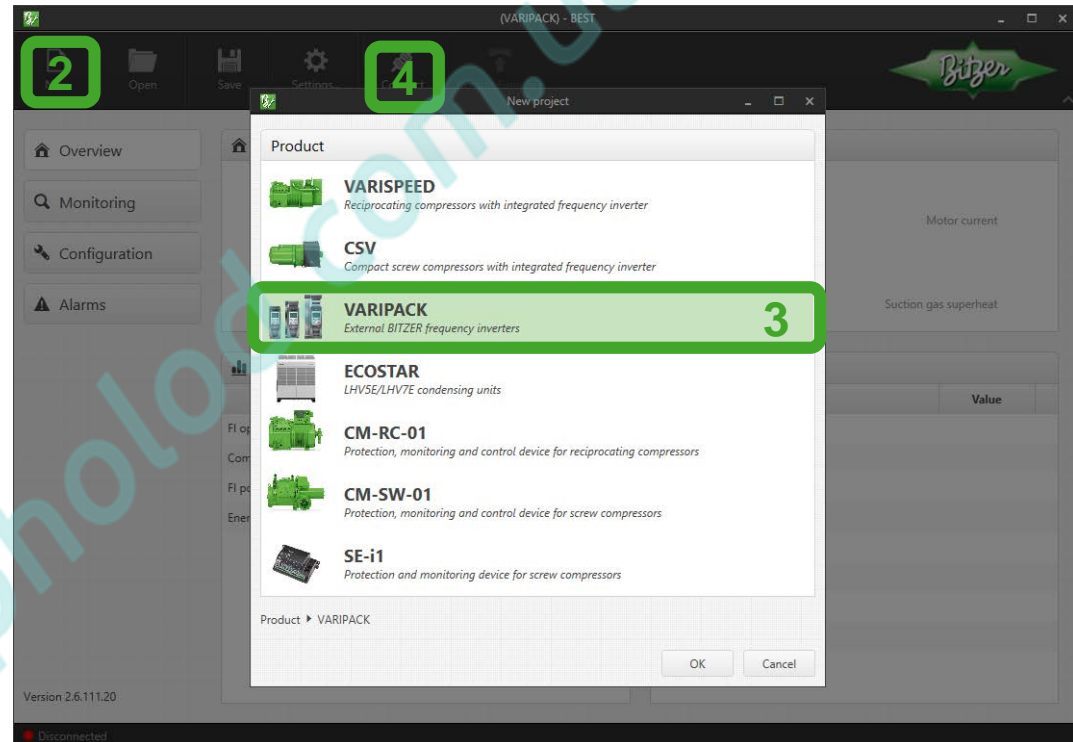
No.	Overview User Setting						
1	Language Selection	51	Speed Search Selection wh	101	Power Detection Filte	151	Integral Operation during
2	Access Level Selection	52	Timer Function On-Delay T	102	Search Operation Voi	152	Motor Inertia
3	Control Method Selection	53	Timer Function Off-Delay Tir	103	Energy Saving Paran	153	Load Inertia Ratio
4	Initialize Parameters	54	H2-01 ON Delay Time	104	Energy Saving Paran	154	Motor 2 ASR Proportiona
5	Password	55	No. Name User	105	Zero Servo Gain	155	Motor 2 ASR Integral Tir
6	Password Setting	56	Setting	106	Zero Servo Completic	156	Motor 2 ASR Proportiona
7	Application Preset	57	H2-01 OFF Delay Time	107	Acceleration Time 1	157	Motor 2 ASR Integral Tir
8	User Parameters 1 to 32	58	H2-02 ON Delay Time	108	Deceleration Time 1	158	Motor 2 ASR Limit
9	User Parameter Automatic Selection	59	H2-02 OFF Delay Time	109	Acceleration Time 2	159	Motor 2 ASR Primary De
10	Frequency Reference Selection 1	60	H2-03 ON Delay Time	110	Deceleration Time 2	160	Motor 2 ASR Gain Switc
11	Run Command Selection 1	61	H2-03 OFF Delay Time	111	Acceleration Time 3 (161	Motor 2 ASR Integral Lirr
12	Stopping Method Selection	62	PID Function Setting	112	Deceleration Time 3 (162	Integral Operation during
13	Reverse Operation Selection	63	Proportional Gain Setting (P	113	Acceleration Time 4 (f	163	Motor 2 Inertia
14	Action Selection below Minimum Outp	64	Integral Time Setting (I)	114	Deceleration Time 4 (164	Motor 2 Load Inertia Rati
15	Digital Input Reading	65	Integral Limit Setting	115	<2> Fast-Stop Time	165	<1> ASR Primary Delay
16	LOCAL/REMOTE Run Selection	66	Derivative Time (D)	116	Accel/Decel Time Set	166	Drive Duty Selection
17	Run Command Selection while in Pro	67	PID Output Limit	117	Accel/Decel Time Sw	167	Carrier Frequency Select
18	Phase Order Selection	68	PID Offset Adjustment	118	S-Curve Characterist	168	Carrier Frequency Upper
19	Frequency Reference Selection 2	69	PID Primary Delay Time Cor	119	Carrier Frequency Lower	169	Carrier Frequency Lower
20	Run Command Selection 2	70	PID Output Reverse Selectio	120	Frequency Reference 1	170	Frequency Reference 1
21	Run Command at Power Up	71	PID Output Reverse Selectio	121	S-Curve Characterist	171	Frequency Reference 2
22	Start Condition Selection at Closed Lo	72	PID Output Reverse Selectio	122	Slip Compensation G	172	Frequency Reference 3
23	DC Injection Braking Start Frequency	73	PID Feedback Loss Detectio	123	Slip Compensation P	173	Frequency Reference 4
24	DC Injection Braking Current	74	PID Feedback Loss Detectio	124	Slip Compensation T	174	Frequency Reference 5
25	DC Injection Braking Time at Start	75	Feed Forward Gain	125	Slip Compensation U	175	Frequency Reference 6
26	DC Injection Braking Time at Stop	76	Feed Forward Gain	126	Slip Compensation V	176	Frequency Reference 7
27	Magnetic Flux Compensation Value	77	PID Sleep Delay Time	127	Output Voltage Limit	177	Frequency Reference 8
28	Short Circuit Brake Time at Start	78	PG 1 Detection	128	Modulation)	178	Frequency Reference 9
29	Short Circuit Brake Time at Stop	79	PID Setpoint Selection	129	Maximum Output Vol	179	No. Name User
30	Short Circuit Braking Current	80	<2> PID Setpoint Value	130	Modulation)	180	Setting
31	Speed Search Selection at Start	81	PID Setpoint Scaling	131	Output Voltage Limit	181	Frequency Reference 8
32	Speed Search Deactivation Current	82	PID Output Lower Limit	132	Motor 2 Slip Comp	182	Frequency Reference 9
33	Speed Search Deceleration Time	83	PID Input Limit	133	Motor 2 Slip Comp	183	Frequency Reference 10
34	V/f Gain during Speed Search	84	PID Feedback High Detectio	134	Motor 2 Slip Comp	184	Frequency Reference 11
35	Speed Search Delay Time	85	PID Feedback High Detectio	135	Motor 2 Slip Comp	185	Frequency Reference 12
36	Output Current 1 during Speed Search	86	PID Setpoint User Display	136	Torque Compensation	186	Frequency Reference 13
37	Output Current 2 during Speed Search	87	PID Setpoint Display Digits	137	Torque Compensation	187	Frequency Reference 14
38	Current Control Gain during Speed Search	88	Frequency Reference Monit	138	Torque Compensation	188	Frequency Reference 15
39	Estimation Type)	89	PID Output Reverse Selectio	139	Torque Compensation	189	Frequency Reference 16
40	Speed Search Detection Compensation	90	Dwell Reference at Start	140	Torque Compensation	190	Jog Frequency Referenc
41	Minimum Current Detection Level dur	91	Dwell Time at Start	141	Torque Compensation	191	Frequency Reference Up
42	Bi-Directional Speed Search Selection	92	Dwell Reference at Stop	142	Motor 2 Torque Comp	192	Frequency Reference Lo
43	Speed Search Restart Current Level	93	Dwell Time at Stop	143	ASR Proportional Ga	193	Master Speed Reference
44	Speed Search Restart Detection Time	94	Droop Control Gain	144	ASR Integral Time 1	194	Jump Frequency 1
45	Number of Speed Search Restarts	95	Droop Control Delay Time	145	ASR Proportional Ga	195	Jump Frequency 2
46	Speed Search Method Selection	96	Droop Control Limit Selection	146	ASR Integral Time 2	196	Jump Frequency 3
47	Speed Search Wait Time	97	Energy Saving Control Sele	147	ASR Limit	197	Jump Frequency Width
48	Direction Determining Level	98	Energy Saving Gain	148	ASR Primary Delay T	198	Frequency Reference Hc
49	Start Speed Search Select	99	Energy Saving Control Filter	149	ASR Gain Switching I	199	Frequency Reference Bias
50	Speed Search Induced Voltage Level	100	Energy Saving Coefficient V	150	ASR Integral Limit	200	Frequency Reference Bias
						201	Frequency Reference Bias (Up
							Analog Frequency Reference F
						202	(Up/Down 2)
							Frequency Reference Bias Up
						203	(Up/Down 2)
							Frequency Reference Bias Low
						204	(Up/Down 2)
						205	Up/Down Frequency Reference
						206	Bi-directional Output Selection
						207	Stop Position Gain
						208	Torque Control Selection
						209	Torque Reference Delay Time
						210	Speed Limit Selection
						211	Speed Limit
						212	Speed Limit Bias
						213	Speed/Torque Control Switcho
						214	Unidirectional Speed Limit Bias
						215	Field Weakening Level
						216	Field Weakening Frequency Li
						217	Field Forcing Selection
						218	Field Forcing Selection
						219	Motor Rated Current (for PM Motors)
						220	Number of Motor Poles (for PM Motors)
						221	Motor Stator Resistance (for PM Motors)
						222	Motor d-Axis Inductance (for PM Motors)
						223	Motor q-Axis Inductance (for PM Motors)
						224	Motor Induction Voltage Constant 1 (for PM Motors)
						225	Encoder Z-pulse Offset (for PM Motors)
						226	Motor Induction Voltage Constant 2 (for PM Motors)
						227	Polarity Switch for Initial Polarity Estimation (for PM Motors)
						228	PG 1 Pulses Per Revolution
						229	Operation Selection at PG Open Circuit (PGO)
						230	Operation Selection at Overspeed (oS)
						231	Operation Selection at Deviation
						232	PG 1 Rotation Selection
						233	PG 1 Division Rate for PG Pulse Monitor
						234	Overspeed Detection Level
						235	Overspeed Detection Delay Time
						236	Excessive Speed Deviation Detection Level
						237	Excessive Speed Deviation Detection Delay Time
						238	PG 1 Gear Teeth 1
						239	PG 1 Gear Teeth 2
						240	PG Open-Circuit Detection Time
						241	PG 2 Detection
						242	PG 2 Rotation Sele
						243	PG 2 Gear Teeth 1
						244	PG 2 Gear Teeth 2
						245	+ ~200 further parameters

1. Up to 500 inverter settings
2. Inverter expert often required

298	PG 2 Rotation Sele
299	PG 2 Gear Teeth 1
300	PG 2 Gear Teeth 2
300	+ ~200 further parameters

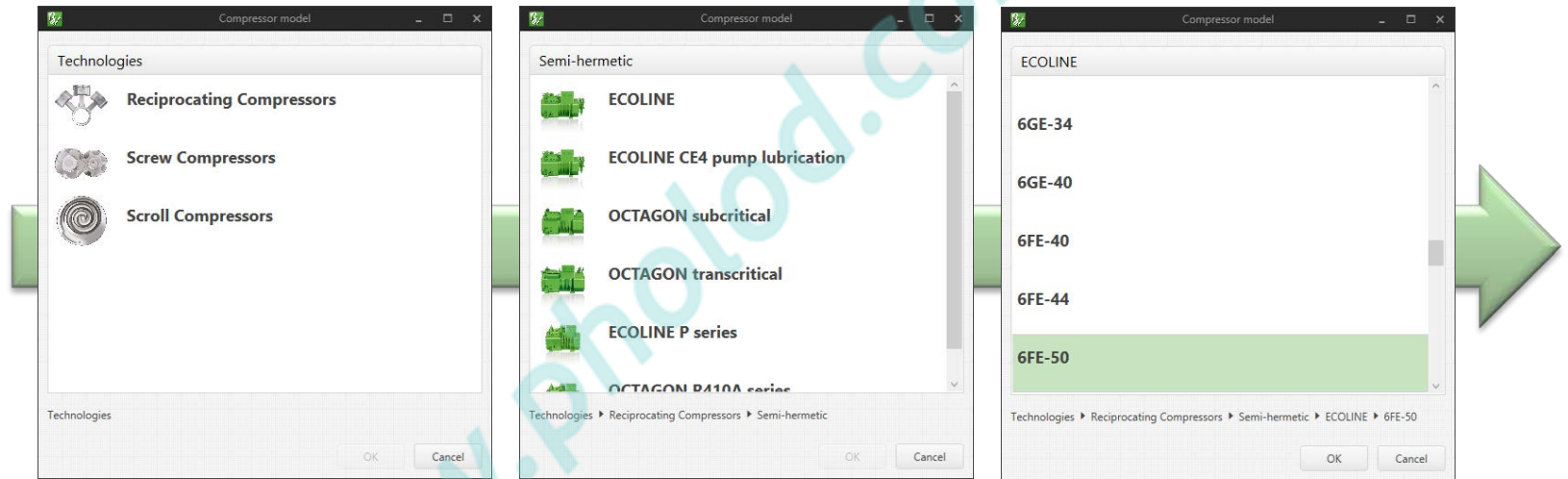
Connect to a VARIPACK

1. Start BEST
2. Click “New”
3. Select “VARIPACK”
4. Click “Connect”
5. Select “BEST converter” or “Ethernet”
6. Done



Configuring a VARIPACK for external control

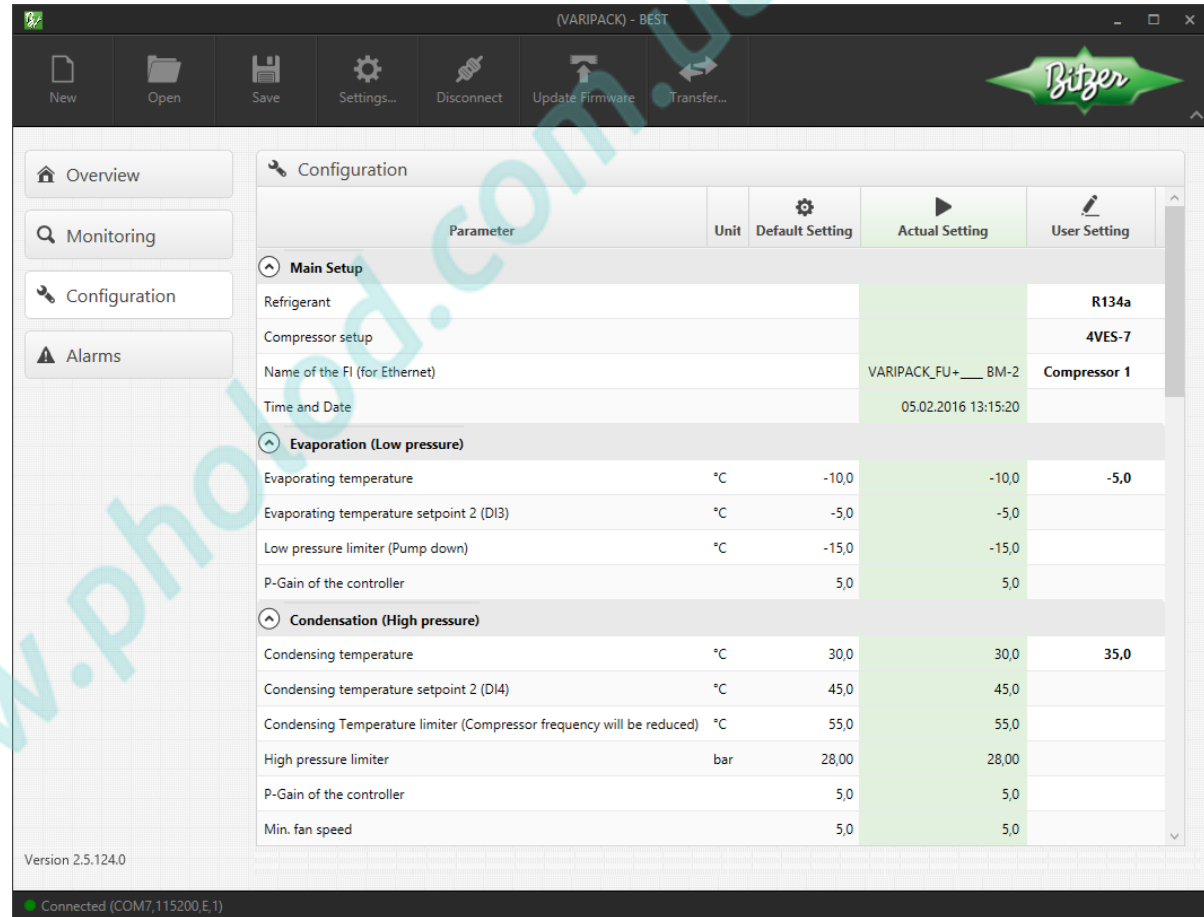
1. Go to the tab “Configuration”
2. Click on the parameter “Compressor” and select the compressor



3. Click on “Transfer...”, select “Transfer user values to device”
4. Main Configuration is done

Configuring a VARIPACK for pressure control

1. Select the “Compressor” as just described
2. Select the “Refrigerant”
3. Adapt the temperature and pressure settings if necessary
4. Transfer the changes
5. Done



The screenshot displays the Bitzer VARIPACK configuration software interface. The window title is "(VARIPACK) - BEST". The interface includes a menu bar with options: New, Open, Save, Settings..., Disconnect, Update Firmware, and Transfer... The Bitzer logo is in the top right corner. A left sidebar contains navigation buttons for Overview, Monitoring, Configuration, and Alarms. The main area is titled "Configuration" and contains a table of parameters. The table has columns for Parameter, Unit, Default Setting, Actual Setting, and User Setting. The parameters are grouped into sections: Main Setup, Evaporation (Low pressure), and Condensation (High pressure).

Parameter	Unit	Default Setting	Actual Setting	User Setting
Main Setup				
Refrigerant				R134a
Compressor setup				4VES-7
Name of the FI (for Ethernet)			VARIPACK_FU+___ BM-2	Compressor 1
Time and Date			05.02.2016 13:15:20	
Evaporation (Low pressure)				
Evaporating temperature	°C	-10,0	-10,0	-5,0
Evaporating temperature setpoint 2 (DI3)	°C	-5,0	-5,0	
Low pressure limiter (Pump down)	°C	-15,0	-15,0	
P-Gain of the controller		5,0	5,0	
Condensation (High pressure)				
Condensing temperature	°C	30,0	30,0	35,0
Condensing temperature setpoint 2 (DI4)	°C	45,0	45,0	
Condensing Temperature limiter (Compressor frequency will be reduced)	°C	55,0	55,0	
High pressure limiter	bar	28,00	28,00	
P-Gain of the controller		5,0	5,0	
Min. fan speed		5,0	5,0	

Version 2.5.124.0
Connected (COM7,115200,E,1)

Monitoring the operation

/ The most important parameters are visible on the „Overview“ tab

/ All monitoring parameters are shown on the „Monitoring“ tab

/ Graphical visualisation will follow

Overview

0,00 kW
Motor power

0,0 °C
Evaporating temperature

Stopped Ready to Start
Compressor

0,00 A
Motor current

0,0 Hz
Compressor frequency

0,0 °C
Condensing temperature

0,00 %
Compressor load

0,0 k
Suction gas superheat

Name	Value	Unit
FI operating time	3541237773	s
Compressor running time	405405696	s
FI power-ups	78	
Energy meter	0,00	kWh

Name	Value
Frequency inverter type	16.0A 400V
Serial number of the FI	30200000020050
SD card fitted	NO CARD
Firmware version	17.1.21.43
MAC address	00-46-01-00-9F
Ethernet IP Address	0.0.0.0
Ethernet Netmask	0.0.0.0
Ethernet Gateway	0.0.0.0

Version 2.6.111.20

Connected (COM7,115200,E,1)

Monitoring

Name	Value	Unit
Status		
Compressor	ready to Start	
Compressor frequency	0,0	Hz
Compressor speed	0,00	rpm
Compressor load	0,00	%
Operating temperatures		
Power module (IGBT) temperature	0,0	°C
Control module temperature	0,0	°C
Electrical operating values		
Motor power	0,00	kW
Motor current	0,00	A
Motor voltage	0	V
Motor current / Max compressor current	0,0	%
FI current / Max. FI current	0	%
DC link voltage	0	V
DC link voltage (filtered)	0	V

Version 2.6.111.20

Connected (COM7,115200,E,1)

Summary: Frequency inverter configuration

/ External control

- 1 Parameter required to get the compressor up and running

/ Pressure control

- 4 Parameters required to get a system up and running

Parameter	Unit	Default Setting	Actual Setting	User Setting
Main Setup				
Refrigerant				R134a
Compressor setup				4VES-7
Name of the FI (for Ethernet)			VARIPACK_FU+___ BM-2	Compressor 1
Time and Date			05.02.2016 13:17:31	
Evaporation (Low pressure)				
Evaporating temperature	°C	-10,0	-10,0	-5,0
Evaporating temperature setpoint 2 (DI3)	°C	-5,0	-5,0	
Low pressure limiter (Pump down)	°C	-15,0	-15,0	
P-Gain of the controller		5,0	5,0	
Condensation (High pressure)				
Condensing temperature	°C	30,0	30,0	35,0
Condensing temperature setpoint 2 (DI4)	°C	45,0	45,0	
Condensing Temperature limiter (Comp...	°C	55,0	55,0	

Miscellaneous and Summary

www.pholod.com.ua



Documentation

/ Leaflet

- CP-100-1

/ Operating instructions

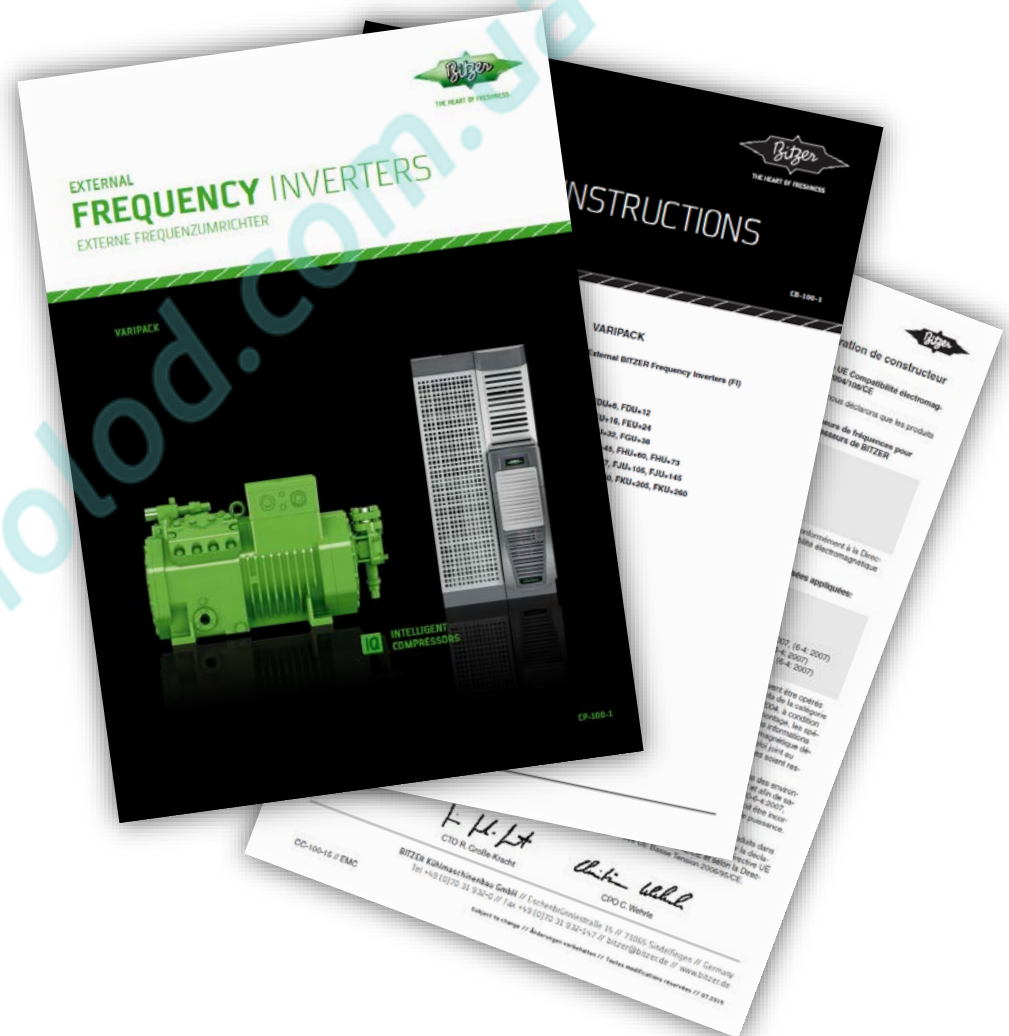
- CB-100-1

/ Declaration of conformity

- CC-100-15 + CC-101-15

/ Reference guide (Modbus Programming)

- CG-100-1
- In preparation



Extract of the product highlights

/ Easy

- Automatic and optimum selection by the BITZER Software
- Easy commissioning by the BEST Software

/ Safe

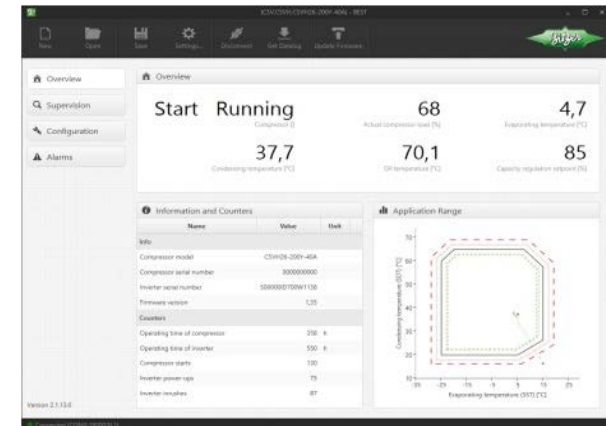
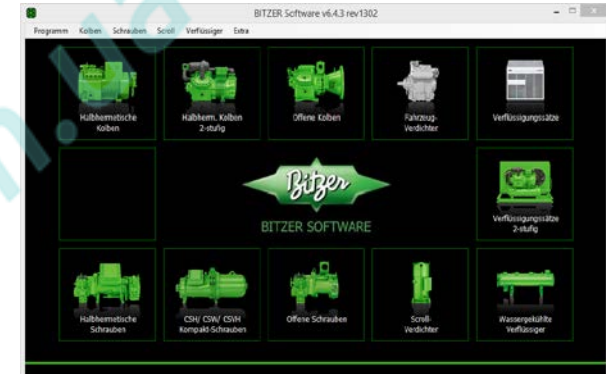
- VARIPACK + BITZER compressors are adapted to each other, tested and optimised

/ Intelligent

- During trans-synchronous operation, the maximum frequency is automatically limited according to the load

/ With surplus values

- System control is possible via extension module



BENEFIT – BITZER VARIPACK

Easy to
select

Easy to
install

Easy to
support

SOPHISTICATED SIMPLICITY

results in

SAFETY & RELIABILITY

... and not in time consuming phone calls from frustrated installers lost in configuration menus.



THE HEART OF FRESHNESS

www.photoblog.com.ua