NRC·CNRC

Addendum / Addenda

No./No
4

Project Description / Description de projet		
M-38 Acoustics Facility - Phase 3		
Solicitation No./N° de solicitation	Project No./N° de projet	W.O. No./N° d'ordre de travail
18-22095	5310	A1-010300-01-01-01
Departmental Representative / représentant ministériel		Date
Allan Smith		February 8, 2019

Notice:	**Nota**:
This addendum shall form part of the tender documents and all conditions shall apply and be read in conjunction with the original plans and specifications.	Cet addenda fait partie intégrale des dossiers d'appel; toutes les conditions énoncées doivent être lues et appliquées en conjonction avec les plans et les devis originaux.

1 Within this addendum, if there is a conflict between the meaning of the english and french text, the english version will be accepted as correct.

2 See attached Question and Answer document.

3 S103 is included in this addendum for reference to answer a question included in the question and answer document.

4 For questions regarding the Kone cranes please contact: Tim briand tim.briand@konecranes.com 905-464-6639

5 Refer to attached mechanical addendum M3.

6 Attached are shop drawings for the existing exhaust fan and heat recovery unit that need to be connected to the BAS and controlled.

18-22095 Addendum #4
18-22095 Addenda n° 4
Questions and answers
Questions et réponses

1. What is our scope for the granular portion of this project?
   A: Note 9 and unshaded area on detail 2/ASK03 provides extent of Granular B Type II area. Height of Granular B to be brought up to future final asphalt grades. Future final asphalt grades are provided on Civil Drawing C1 dated 2018-03-21 which was provided for reference for this purpose.
   Quelle est l'ampleur du remplissage dans le cadre du projet?
   R. La remarque 9 et la zone ombrée sur la vue partielle n° 2 du plan ASK03 indiquent la surface à recouvrir avec du matériau granulaire de classe B (type II). Le sol devait être de niveau avec le revêtement final en asphalte indiqué sur le dessin de génie civil C1, en date du 21 mars 2018, servant de référence.

2. What are the existing grades, are there any adjustments to MH required, what are they?
   A: The existing conditions are not reflective of the pre-phase 1 survey grades and no new survey was performed as part of phase 2. Use the following as a baseline assumption: Phase 1 contractor excavated 1500mm below grade for footings and backfilled to the top of footing which is 300mm high. This results in a potential depth next to the existing building of ±1350mm (±99.25 geodetic elevation) below the ground floor geodetic elevation of 100.60. The existing grade elevation of 99.24 near Howlett Street can be found on the referenced Civil Drawing C1 dated 2018-03-21. Future Final asphalt grade elevations are found on the referenced Civil Drawing.
   Quelles sont les pentes actuelles? À quels ajustements devra-t-on procéder, s'il y a lieu, lors de la manutention des matériaux?
   R. Les pentes actuelles ne correspondent pas à celles calculées avant que débute la première phase du projet et l'on n'a procédé à aucun autre arpentage à la deuxième phase. Veuillez utiliser ce qui suit comme hypothèse pour les calculs : lors de la première phase, l'entrepreneur a creusé 1 500 mm pour poser la fondation. Ensuite, il a remblayé l'excavation jusqu'au sommet de la fondation, qui mesure 300 mm de hauteur. Le long du bâtiment existant, le sol pourrait donc s'enfoncer de ±1 350 mm (hauteur géodésique de ±99,25) par rapport à la hauteur géodésique de 100,60 du sol. Le dessin de génie civil C1 en date du 21 mars 2018, fourni à titre de référence, indique une hauteur de 99,24 près de la rue Howlett. Le niveau final, après asphaltage, apparaît sur le même dessin.

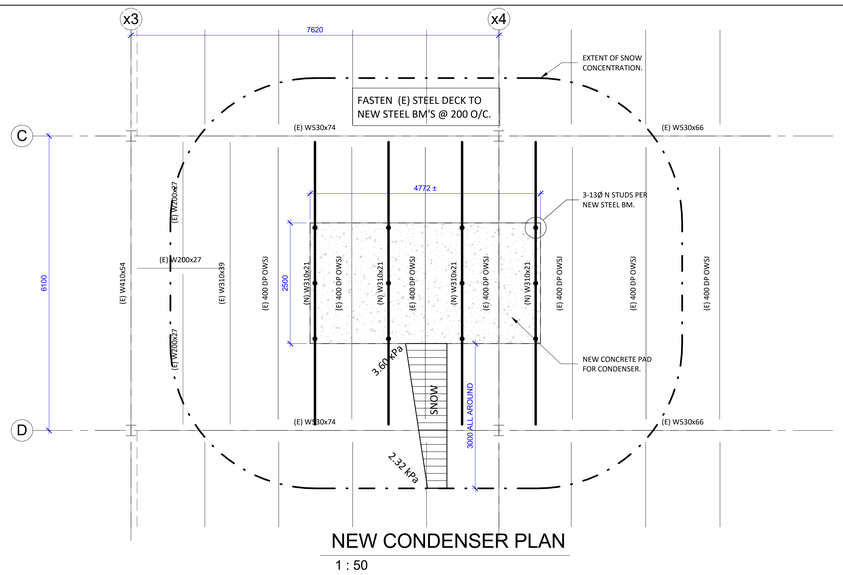
3. To what elevation are we to bring the granular to? Note 9 on ASK03 does not reference existing elevations. The Civil drawing is for reference but there is no scope for this project.
   A: Note 9 and unshaded area on detail 2/ASK03 provides extent of Granular B Type II area. Height of Granular B to be brought up to future final asphalt grades. Future final asphalt grades are provided on Civil Drawing C1 dated 2018-03-21 which was provided for reference for this purpose.

Jusqu'à quelle hauteur faut-il porter le matériau granulaire? La remarque 9 du plan ASK03 ne mentionne pas les élévations existantes. Un dessin de génie civil a bien été fourni comme référence, mais rien n'indique l'importance du remplissage.
R. La remarque 9 et la zone ombrée sur la vue partielle n° 2 du plan ASK03 indiquent la surface à recouvrir avec du matériau granulaire de classe B (type II). Le remplissage devait être de niveau avec le revêtement final en asphalte, indiqué sur le dessin de génie civil C1, en date du 21 mars 2018, servant de référence.

4. Please clarify IB-S17 is for reference only and the structural steel listed on this document is not required for this project. Are the Mechanical openings already in place and the roof penetrations are sealed.
   A: IB-S17 provides new steel to be installed by the contractor in Phase 3 to reinforce the locations where new mechanical units are going. The mechanical unit locations changed from where they were initially designed to go in Phase 2 which is why this detail needs to be carried by the Phase 3 contractor. The existing roof is currently sealed with curbs in place at the location the new units will be going.
   Veuillez préciser si le bulletin IB-S17 sert uniquement de référence et si l'acier de construction mentionné doit être fourni ou pas dans le cadre du projet. Les ouvertures pour les unités mécaniques ont-elles déjà été pratiquées et celles dans le toit sont-elles scellées?
   R. Le bulletin IB-S17 indique les nouveaux éléments en acier que l'entrepreneur devra installer lors de la troisième phase afin de renforcer le sol, là où seront installées les nouvelles machines. L'endroit où les unités mécaniques auraient normalement dû aller au départ a été modifié à la deuxième phase, de sorte que c'est l'entrepreneur responsable de la troisième phase qui se chargera de la consolidation. Le toit est actuellement scellé et des bordures ont été aménagées là où seront installées les nouvelles machines.

5. Item #6 on Addendum No. 2 Structural Information Bulletin IB-S17 item #3 Description states "Revised mechanical unit framing on S103". S103 is not listed in Section 00 10 00 Item 2.1.1 to .19. Do you have a copy of S103 to forward to us?
   A: S103 is attached to this addendum for reference.
   La description à laquelle renvoie le point n° 6 de l'addenda n° 2, qu'on trouve au point n° 3 du bulletin d'information sur la structure IB-S17, mentionne « *Revised mechanical unit framing on S103* », mais le document S103 n'apparaît pas dans la liste des articles 2.1.1 à 2.1.19, à la section 00 10 00. Pourriez-vous nous fournir une copie de ce document?
   R. Vous trouverez le document en annexe, à titre de référence.

6. Please see addendum 2, item 5 and 13. This site instruction is addressed to M. Sullivan with the wrong job name.
   A: this addendum was originally issued as part of a different project however the work was never completed. It is now part of this contract.
   Aux points 5 et 13 de l'addenda n° 2, les instructions sont adressées à M. Sullivan et le titre du projet ne correspond pas.
   R. Cet addenda faisait partie d'un autre projet qui n'a jamais été vu le jour. Il fait maintenant partie intégrante de ce marché.



NEW CONDENSER PLAN

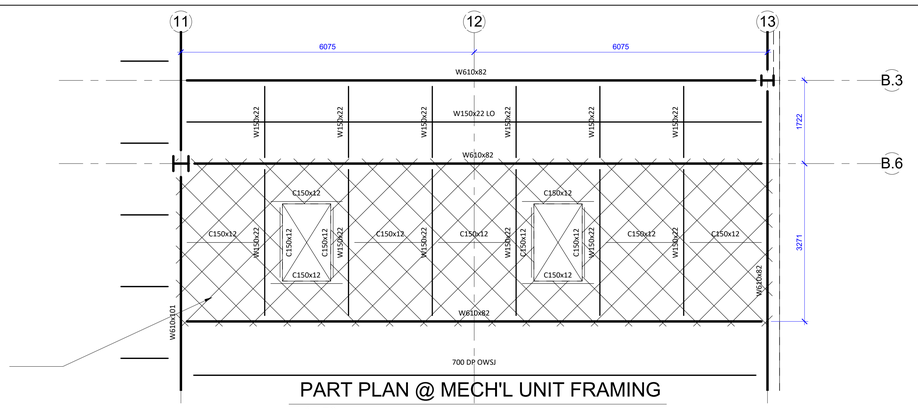
1 : 50

ROOF LOADS @ RTU -HATCHED

ROOFING & INSUL	0.60 kPa
CONC ON DECK	3.00
STEEL DECK	0.15
STRUCTURE	0.30
MECH/ELECT/MISC	2.80
DEAD LOAD	6.90 kPa
SNOW LOAD	2.32 kPa OR SNOW
TOTAL LOAD	9.22 kPa

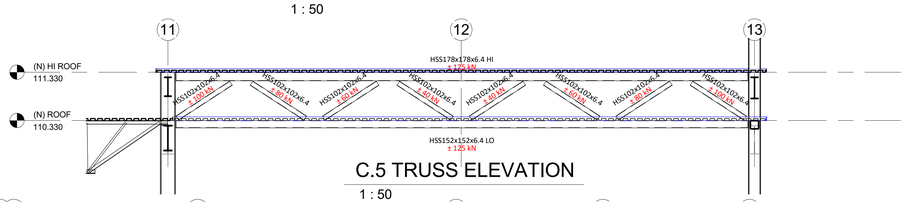
ROOF LOADS-TYPICAL

ROOFING & INSUL	0.60 kPa
BOARD	0.10
STEEL DECK	0.15
STRUCTURE	0.30
MECH/ELECT/MISC	0.55
DEAD LOAD	1.70 kPa
SNOW LOAD	2.32 kPa OR SNOW
TOTAL LOAD	4.02 kPa



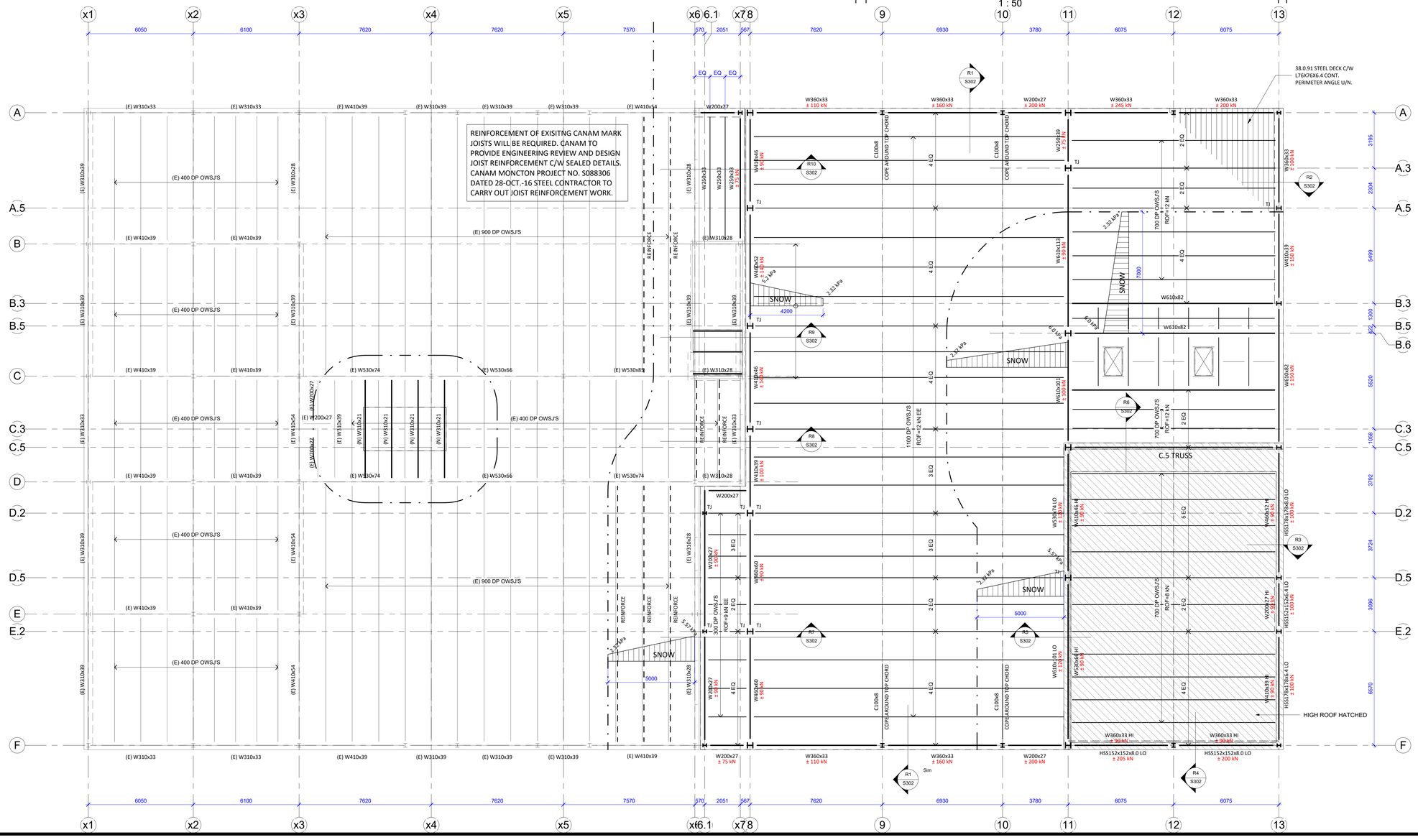
PART PLAN @ MECH'L UNIT FRAMING

1 : 50



C.5 TRUSS ELEVATION

1 : 50



No.	REVISION	DATE
9	ISSUE FOR CONSTRUCTION	DEC 11, 2017
8	ISSUE FOR FOUR ROOM & FLOOR FACILITY TENDER	NOV 22, 2017
7	ISSUE FOR SUPERSTRUCTURE TENDER	NOV 13, 2017
6	ISSUE FOR TWO ROOM TENDER	NOV 07, 2017
5	ISSUE FOR FOUNDATION TENDER	NOV 03, 2017
4	ISSUE FOR REVIEW & COORDINATION	OCT 30, 2017
3	ISSUE FOR FOUNDATION COORDINATION	OCT 20, 2017
2	ISSUE FOR REVIEW	OCT 17, 2017
1	ISSUE FOR REVIEW	OCT 10, 2017

1. THE CONTRACTOR IS RESPONSIBLE FOR CHECKING AND VERIFYING ALL DIMENSIONS. ANY DISCREPANCY SHALL BE REPORTED TO THE ENGINEER
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL MATERIAL RELEVANT TO THE PROJECT
3. ADDITIONAL INFORMATION MAY BE ISSUED FOR CLARIFICATION TO ASSIST PROPER EXECUTION OF WORK. SUCH DRAWINGS WILL HAVE THE SAME MEANING AND INTENT AS IF THEY WERE INCLUDED WITH THE DRAWINGS IN THE CONTRACT DOCUMENTS
4. DO NOT SCALE DRAWINGS

PROJECT
BUILDING M-38 - ADDITION
ACOUSTICAL FACILITY

ARCHITECT
EDWARD J CUHACI &
ASSOCIATE ARCHITECTS

DRAWING
ROOF PLAN

CUNLIFFE & ASSOCIATES
CONSULTING STRUCTURAL ENGINEERS
102-1737 WOODWARD DR. OTTAWA ON. K2C 0P9
TEL (613) 729-7242 FAX (613) 728-1461
Email <cunliffe@cunliffe.ca>

ENGINEERS SEAL

SCALE
As indicated

DRAWN
PMD

REVIEWED
JC

PROJECT No.
17-109

SHEET No.
S103

REVISION No.
9

The following additions, deletions & revisions form part of the drawings and specifications for the above referenced project:

DRAWINGS

1. Reference Drawing 5310-M001

.1 Add to Boiler Schedule in remarks section:

.1 "c/w BACKNET INTEGRATION MODULE."

.2 Revise RTU Schedule as follows:

.1 Delete 38RTU01.

.2 Delete "standalone controls" in 38RTU02 remarks section.

.3 Add to 38RTU02 remarks section:

"Unit controller to interface with BAS through BACNET integration module and with contacts for:

- Fan enable
- Cooling – 2 stage
- Heating – 2 stage
- Occupied/unoccupied
- Dehumidification"

.3 Add to Pump Schedule in remarks for all pumps:

.1 Pumps to come with BACNET integration modules for BAS controls.

DRAWINGS (CONT'D)

2. Reference Addendum M1-R1 & Drawings 5310-M401, M5310-M402 & 5310-M403

.1 Delete item 2.1.3 and replace with the following:

".3 Hire the services of Ainsworth to complete the controls scope of work associated with this job.

.1 Controls scope of work shall include installation of NRC standard Master Network Controller and associated application specific controllers, field devices, conduit, wiring and programming to accommodate:

- One (1) 38HRV01 start/stop, status, defrost, SA fan speed control with isolation damper control, EA fan speed control with isolation damper control and discharge air temperature monitoring.
- One (1) 38EXH01 start/stop, status, 0-10V speed control.
- One (1) 38RTU02, enable/disable, heating (Stage 1 & Stage 2), occupied/unoccupied control, alarm, return air temperature monitoring, space temperature and humidity monitoring, mixed air temperature monitoring, cooling stage control c/w dehumidification sequence (hot gas reheat), BACNET integration.
- Three (3) return damper modulations with feedback with user selectable push button at 4 room facility.
- Boiler plant controls field wiring and integration to BAS through BACNET for monitoring of pump operation, speed, loop temperature and status with loop temperature reset. Coordinate with boiler supplier.
- Pump operation to be controlled through the BAS.
- Field wiring and control of radiant floor zones, coordinated with radiant floor supplier. Provide space temperature sensor and slab temperature sensor for control. Supply 2-way modulating control valves for installation at manifolds.
- Field wiring and remote monitoring of the domestic hot water production, coordinate with boiler supplier to interlock with boiler prioritization.
- Three (3) field wirings and controls of electronic trap seal primer stations.
- Monitoring of water meter.
- Sump pump control panel monitoring, and high level alarm. Refer to shop drawings included with specifications. Three (3) Simplex systems, one (1) duplex.
- Light controls with photocell.
- 38XAF01 to be scheduled on/off by the BAS.
- 38XAF02 to be enabled (disabled based on space temperature by the BAS).
- Three (3) space temperature and humidity monitoring sensors located within Phase I area of the building."

- END OF MECHANICAL ADDENDUM NO. M3 -

CANARM®

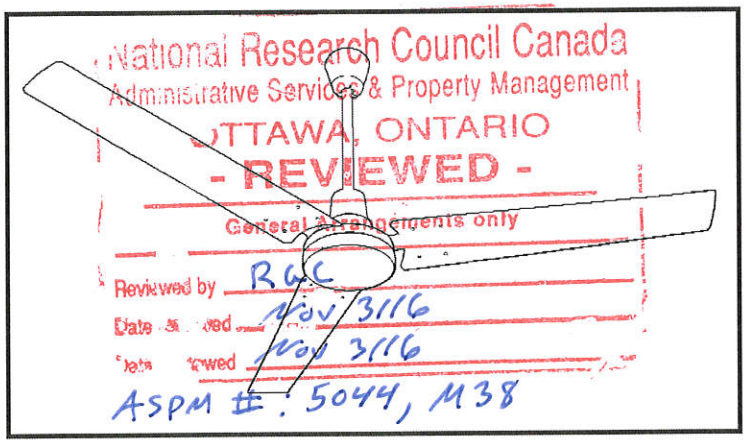
Tag: 38CAF01 to 38CAF06
c/w DR36CPH6HP Down Rod
c/w FRMC5 Controller

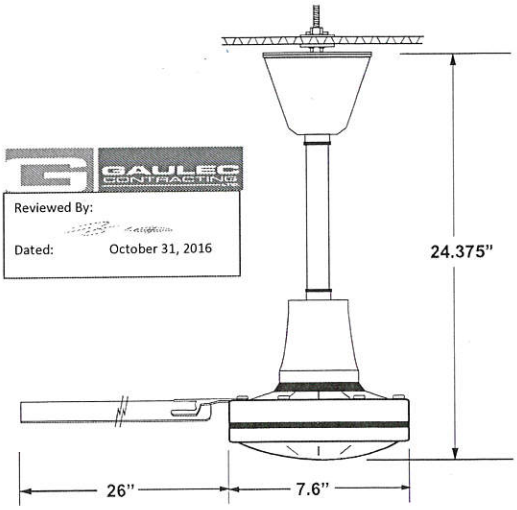
OCTOBER, 2010

HIGH PERFORMANCE CEILING FANS

MODEL: CP60HPWP

HEAVY DUTY • HIGH PERFORMANCE • MAXIMUM OUTPUT





Features

- Engineered and designed for spacious applications where maximum floor coverage is required.
- Reversible motor for both winter heat destratification and summer time cooling.
- All fans are sealed and suitable for high moisture applications.
- Designed for above average area coverage and cooling velocity.
- Variable speed motor (all motors are impedance protected, PSC type variable speed with permanently lubricated ball bearing motors).
- When used with our MC series speed controls the speed range is infinite.

Performance Data & Specifications

914.4 mm Drop Rod.

Model Number	Fan Size	Max RPM	Air Velocity 5' from fan	Air Delivery @ floor	Amps High	Watts High	Downrod Length	Shipping Weight (Lbs.)
CP60 HPWP	60"	292	650 ft/min	46,000 cfm	0.84	101	16"	24.65

Ratings

C SA US

CEILING FAN SPEED CONTROLS

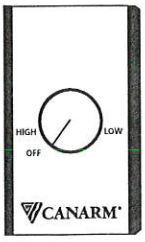
MODELS: "MC" CONTROL & "FRMC5" CONTROL

"MC" CONTROL

- Available in 4 models: 3 amp, 5 amp, 10 amp and 15 amp.
- The MC15 can operate up to 12 fans on a single control.
- Infinite speed adjustment
- Minimum speed adjustment screw.
- Designed to fit a standard 3" x 5" electrical box.
- Mount in a dry location such as the control room.

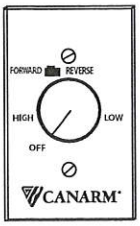
"FRMC5" CONTROL

- A slide switch is provided to change the direction of the fan from updraft to downdraft.
- 5 amp rating for all reversible models.
- Up to 4 fans can operate on a single control.
- Infinite speed adjustment.
- Minimum speed adjustment screw.
- Designed to fit a standard 3" x 5" electrical box.
- Mount in a dry location such as the control room.



c UL

Model Number	Max # of Fans/control	Variable Speed Operation	Power Supply	Ampere Rating
MC-3	2	Manual	120V/1/60HZ	2.5
MC-5	4			5.0
MC-10	8			10.0
MC-15	12			15.0
FRMC5	4	Manual c/w Forward/Reverse Switch		5.0



Subject to change without notice. 10/10

CANARM LTD. - Corporate Office
2157 Parkedale Ave., Brockville, ON
Canada K6V 5V6
Tel: (613) 342-5424 Fax: 1-800-263-4598

CANARM LTD. - USA Warehouse
808 Commerce Park Drive
Ogdensburg, New York, USA 13669
Tel: 1-800-267-4427 Fax: 1-800-263-4598

Arthur Manufacturing Facility
#7686 Concession 16, RR 4 Arthur, ON
Canada N0G 1A0
Tel: (519) 848-3910 Fax: (519) 848-3948

www.canarm.com E-Mail: agsales@canarm.ca

PENNBARRY

Date/Time: 10/28/16 1:56:11 PM **Tag:** 38EXH01
Job: NRC M-38 Flexible Researc **Company:** Walmar Ventilation Products
Project: **Sales Person:** Caleb Cox

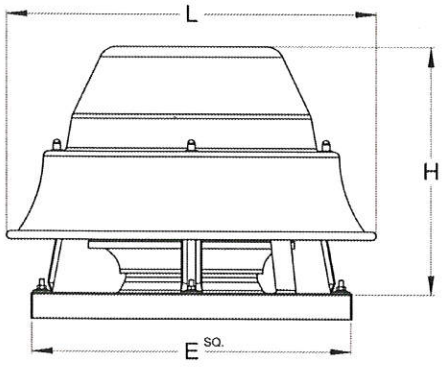
Reviewed By:
Dated: October 31, 2016

DX

Aluminum Exhaust Roof Ventilator

Product Main

DX



- Spun aluminum housing
- Backward inclined centrifugal aluminum wheel
- Birdscreen
- Aluminum pre-punched curb cap with welded corners
- Oversized electrical conduit
- Pre-wired junction box (single speed ODP motors up to 3/4hp)
- Direct drive (Open/TE) motors include overload protection as standard
- Corrosion resistant fasteners

National Research Council Canada
Administrative Services & Property Management
OTTAWA, ONTARIO
- REVIEWED -
General Arrangements only
Reviewed by RGC
Date Reviewed Nov 3/16
Date Reviewed Nov 3/16

Unit Size	E	H	L	Ro	Weight
13	18.5	18.5	21.44	11.5	51

ASPM #: 5044, M38

Fan Performance

Performance

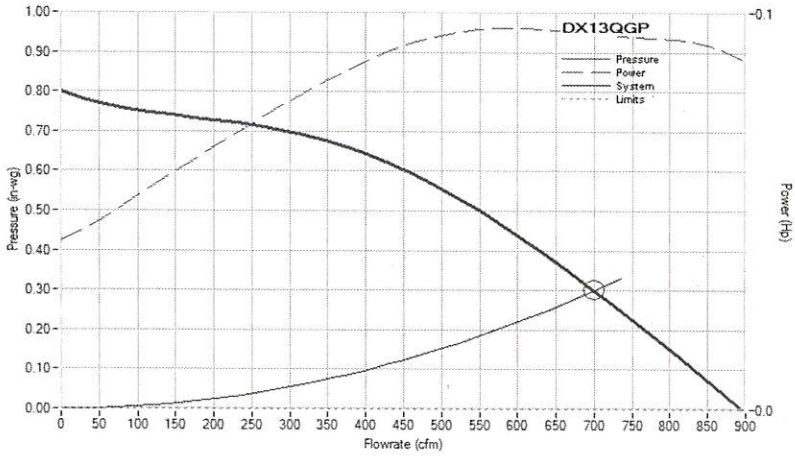
Qty	Model	Volume (CFM)	S.P. (w.c)	RPM	BHP/Watts
1	DX13QGP	700	0.30	1206	0.09

Motor Information

Motor HP	Volt/Ph/Hz	Enclosure
0.33 - 1/3 HP	115V /1/ 60	O - ODP

SOUND POWER

OCTAVE POWER CENTER FREQUENCY (hz)								LWA	Dba	Sones
63	125	250	500	1000	2000	4000	8000			
69	74	68	61	56	53	52	43	65	53.6	7.1



ACCESSORIES

Drive Type: D - Direct
EC Motor: G - ECM with Mntd Pot
Motor RPM: 1 - Single Speed
Efficiency: S - Standard
AMCA Classification: C - "C" AL LN/PL
Damper: BDD - Back Draft Damper
Screen: B - Bird Screen
Aluminum Base: A - Aluminum Base
Disconnect Switch: 1 - Nema 1

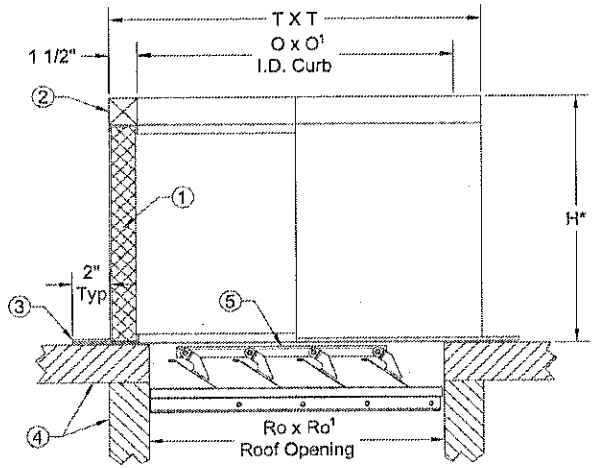
c UL us LISTED

UG18

Prefabricated Heavy-gauge steel Roof Curbs

Product Image

UG18



T	T1	O	O1	H	RO	RO1
17	17	14	14	18	11.5	11.5

Prefabricated Roof Curbs shall be Unibeam supplied by PennBarry, Plano, Texas 75074.

Heavy-gauge steel with welded corner seams shall cover 1-1/2" thick 3 lb. density

GAULEC CONTRACTING

Reviewed By:

Dated: October 31, 2016

Options or Accessories Listing

Curb Parent	DX13Q
Roof Slope	0 - None
Curb Liner	0 - None
Damper Hold Plate	0 - None
Curb Gasket	0 - None
Wood Nailer	W - Wooden Nailer

Product Notes

1. 1 1/2" Rigid Fiberglass Insulation
2. Wood Nailer
3. Curb Fastening Flange
4. Roof Structure - By Others
5. Backdraft Damper – Optional

Schedule

ID	Quantity	Tag	Curb Dim1	Curb Dim2	Roof Pitch Dim by 12
1	1	38EXH01	17	17	0

PENNBARRY

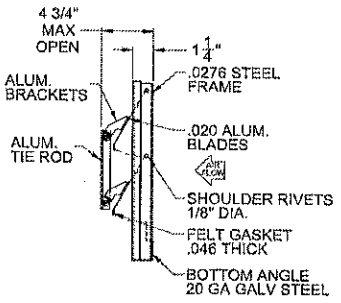
Date/Time: 10/28/16 1:56:12 PM **Tag:** 38EXH01
Job: NRC M-38 Flexible Researc **Company:** Walmar Ventilation Products
Project: **Sales Person:** Caleb Cox

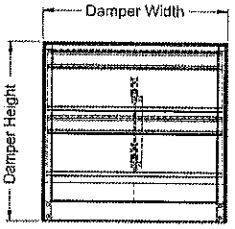
Back Draft

Gravity Operated Back Draft Damper

Product Image

Back Draft





- Sensitive and responsive to low velocities up to 1500 FPM range.
- Square galvanized steel frame,
- Multi-leaf, roll formed aluminum blades; with
- Nylon bearings; and
- Belt Edges for quiet operation

Model Parent	Size	Part Number	Height	Width	No Blades	No Sections
DX13Q	13	25003-0	11.25	11.25	2	1

Options or Accessories Listing

Model Parent DX13Q
Application E - Exhaust
Duty H - Heavy

Schedule

ID	Quantity	Tag
1	1	38EXH01

GAULEC CONTRACTING

Reviewed By:

Dated: October 31, 2016

HE 2X

Submitted by: Dave Digel
DigelAir HVAC Supply Inc.
Energy Recovery Ventilator (38HRU01)

AHRI CERTIFIED — Globally Recognized. Industry Respected.

c UL us LISTED DUCTED HEAT RECOVERY VENTILATOR 89S5

ROOFTOP UNIT

SPECIFICATIONS

Ventilation Type:
Static plate, heat and humidity transfer

Typical Airflow Range: 500-2,000 CFM

AHRI 1060 Certified Core: Two L125-G5

Standard Features:
TEFC Premium efficiency motors
Motor starters
Non-fused disconnect
24 VAC transformer/relay package

Filters
Total qty. 4, MERV 8: 20" x 20" x 2" + Spare

Unit Dimensions & Weight:
87 1/2" L x 43 1/2" W x 42 1/2" H
498-643 lbs.

Max. Shipping Dimensions & Weight (on pallet):
96" L x 47" W x 50" H
740 lbs.

Motor(s):
Qty. 2, Belt drive blower/motor packages with adjustable sheaves (see table below)

Options:
Fused disconnect
Double wall construction
Factory supplied and mounted variable frequency drives (VFDs) - one or both airstreams
Motorized isolation dampers - OA, EA or both airstreams
Qty. 2, Factory mounted filter alarms
Exterior paint - white or custom colors

Accessories:
Filters - MERV 13, 2" (shipped loose)
Roof curb - standard 14" To be Seismic Rated
Curb wind clip
Engineered combo curb for Carrier RTU
Engineered combo curb for Trane RTU
Digital time clock - wall mount (TC7D-W)
Digital time clock - in exterior enclosure (TC7D-E)
Motion occupancy control - ceiling mount (MC-C)
Motion occupancy control - wall mount (MC-W)
Carbon dioxide control - wall mount (CO2-W)
Carbon dioxide control - duct mount (CO2-D)

ASPM Project : 5044
Building M38

AIRFLOW PERFORMANCE

Motor HP	Blower RPM	Sheave Adj. Turns Open	External Static Pressure (in. w.g.) 0.00 SCFM	0.00 BHP	0.25 SCFM	0.25 BHP	0.50 SCFM	0.50 BHP	0.75 SCFM	0.75 BHP	1.00 SCFM	1.00 BHP	1.25 SCFM	1.25 BHP	1.50 SCFM	1.50 BHP
1.5	1192	4	1560	0.7	1460	0.7	1300	0.6	1100	0.5	845	0.4				
	1348	2	1765	1.1	1685	1.0	1560	0.9	1380	0.8	1210	0.7	975	0.6	650	0.4
	1504	0	1970	1.5	1900	1.4	1800	1.3	1670	1.2	1500	1.1	1345	1.0	1135	0.8
2.0	1516	2	2087	1.6	2000	1.5	1915	1.4	1775	1.2	1635	1.1	1475	1.0	1260	0.8
	1594	1	2194	1.8	2110	1.7	2035	1.6	1920	1.5	1765	1.3	1630	1.2	1470	1.1
	1671	0					2145	1.9	2050	1.7	1905	1.5	1775	1.4	1640	1.3

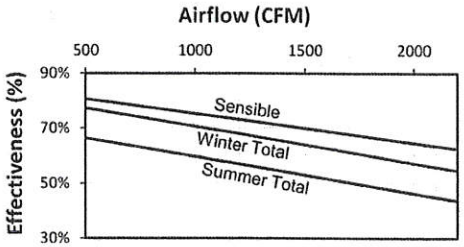
Note: Brake Horse Power (BHP) is for one blower motor package only. Operation in this zone will likely exceed FLA limits. Operation in this zone outside of core airflow limits.

Note: Airflow performance includes effect of clean, standard filter supplied with unit.

ELECTRICAL DATA

HP	Volts	HZ	Phase	Standard Electrical Specifications FLA per motor	Min. Cir. Amps	Max. Overcurrent Protection Device	Optional Factory Installed VFD Electrical Specifications FLA per motor	Min. Cir. Amps	Max. Overcurrent Protection Device
1.5	120	60	Single	15.2	34.2	45			
1.5	208-230	60	Single	8.2-7.6	18.5	25	4.6-4.8	20.6	25
	208-230	60	Three	4.6-4.8	10.8	15	4.6-4.8	11.9	15
	460	60	Three	2.4	5.4	15	2.4	5.9	15
	575	60	Three	1.8	4.1	15	1.8	4.5	15
2.0	120	60	Single	20.0	45.0	60			
2.0	208-230	60	Single	10.8-10.0	24.3	35	6.1-5.8	26.0	30
	208-230	60	Three	6.1-5.8	13.6	15	6.1-5.8	15.0	15
	460	60	Three	2.9	6.5	15	2.9	7.2	15
	575	60	Three	2.4	5.4	15	2.4	5.9	15

CORE PERFORMANCE



At AHRI 1060 standard conditions.
See all AHRI certified ratings at www.ahrinet.org.

Ryan Mechanical Enterprises Inc.

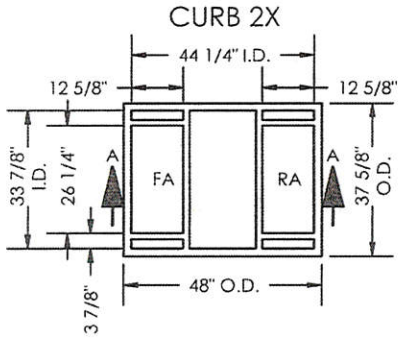
DRAWING REVIEW
Project: M-38
Signed by:
Date: Oct 17/2016
☐ Reviewed
☐ Revise and Re-Submit

15 Pages

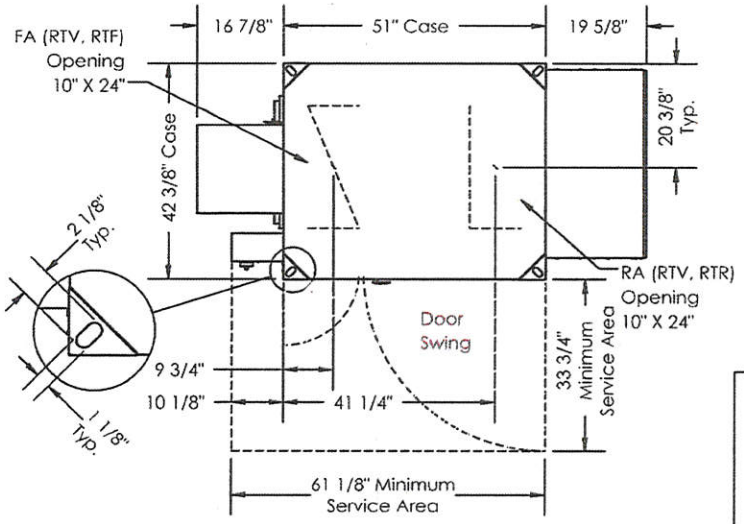
Specifications may be subject to change without notice.

RenewAire Energy Recovery Ventilation

HE2X



TOP VIEW



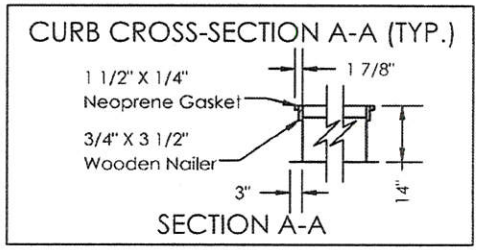
TOP VIEW

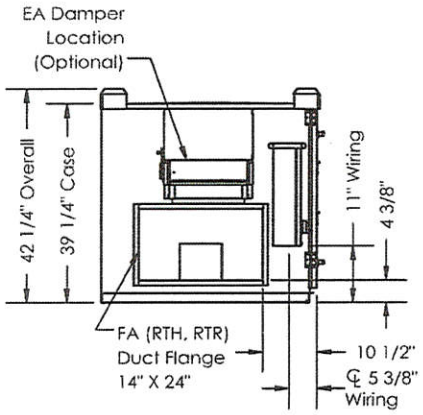
ABBREVIATIONS
EA: Exhaust Air to outside
OA: Outside Air intake
RA: Room Air to be exhausted
FA: Fresh Air to inside
RTV: Rooftop Vertical RA & FA
RTF: Rooftop Vertical FA Only
RTR: Rooftop Vertical RA Only
RTH: Rooftop Horizontal RA & FA

INSTALLATION ORIENTATION
Unit must be installed in orientation shown.

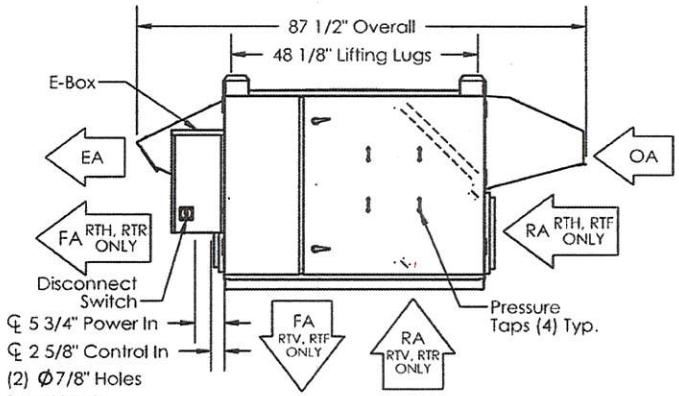
NOTE:
1. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE ROUNDED TO THE NEAREST EIGHTH OF AN INCH.

2. SPECIFICATIONS MAY BE SUBJECT TO CHANGE WITHOUT NOTICE.

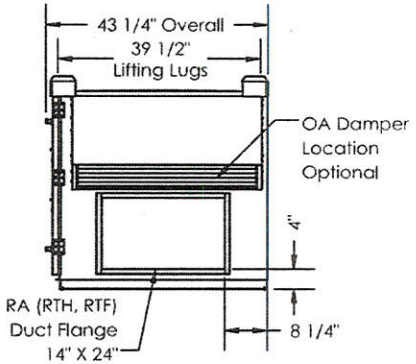




LEFT VIEW

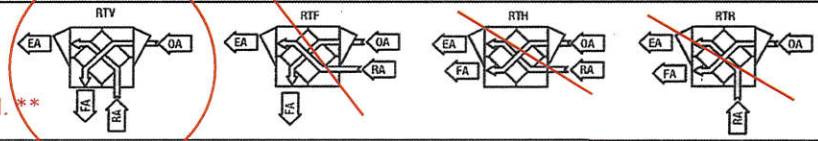


FRONT VIEW



RIGHT VIEW

AIRFLOW CONFIGURATION
Available as shown:



** Please confirm airflow configuration required. **

UNIT MOUNTING & APPLICATION
Must be mounted as shown. Airstreams can not be switched.

RenewAire®
Energy Recovery Ventilation

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Factory-Installed ABB Variable Frequency Drives (VFD) in RenewAire (ERV) Ventilators

- ABB ACS320 VFDs are generally supplied in indoor ERVs and ABB ACS355+N831 VFDs in roof top ERVs. Both models have built in BACnet® building communication protocol and the ACS355+N831 also has low ambient firmware that extends the lower starting temperature limit to -25°F.

⚠WARNING

RISK OF FIRE, ELECTRIC SHOCK, OR INJURY. OBSERVE ALL CODES AND THE FOLLOWING:

1. Before servicing or cleaning the unit, switch power off at disconnect switch or service panel and lock-out/tag-out to prevent power from being switched on accidentally. More than one disconnect switch may be required to de-energize the equipment for servicing.
2. This installation manual shows the suggested installation method. Additional measures may be required by local codes and standards.
3. Installation work and electrical wiring must be done by qualified professional(s) in accordance with all applicable codes, standards and licensing requirements.
4. Any structural alterations necessary for installation must comply with all applicable building, health, and safety code requirements.
5. This unit must be grounded.
6. Use the unit only in the manner intended by the manufacturer. If you have questions, contact the manufacturer.
7. When cutting or drilling into unit, wall or ceiling, do not damage electrical wiring and other hidden utilities.
8. Do not re-wire the VFD(s) to control more than one motor per VFD.
9. Do not operate the motors in this unit above the motor's rated full load amps (FLA) as indicated on the unit's nameplate.

NOTE: VFD(s) in this unit can be operated in many ways. This Manual provides only an outline of common methods.

HOW TO USE THIS MANUAL

IN THIS MANUAL YOU WILL FIND:

- **Orientation** - basic concepts including ON and SPEED signals, Parameters and Keypad.
- **Simple Startup** - how to make the unit run temporarily for testing and start-up.
- **Control Connections** - examples of control system wiring connections to the ERV and the VFD(s).
- **VFD Parameters** - information about the most commonly used Parameters
- **Scaling and Response to Analog Inputs** - step-by-step approach to scaling VFD speed so that it responds correctly to an analog input from the external control system.

FOR COMPLETE ERV INSTALLATION YOU WILL ALSO NEED:

- **Standard Installation and Operation Manual for the ERV** - physical installation and duct connection, maintenance procedures, etc.
- **Supplemental Wiring Schematic Manual** - complete unit wiring diagrams.
- **User's Manual ACS320 Drives or Users Manual ACS355 Drives** - ABB's user's/installer's manual. More detailed information is available online in the Document Library at www.abb.com/drives.

⚠WARNING

DO NOT OPERATE VFD IN CONDITIONS OUTSIDE OF TEMPERATURE LIMITS. The manufacturer's normal ambient temperature limits for ACS320 VFDs are 14°F to 122°F. RenewAire has worked with the manufacturer to implement low-ambient-start firmware for the ACS355+N831 that extends the lower temperature limit for starting the VFD down to -25°F, which has been validated by manufacturer and RenewAire testing. The manufacturer recommends that the VFD not be operated for prolonged periods at temperatures below 14°F to ensure longevity of the VFD. RenewAire commercial ERVs are VFD ready, in extreme climates consider field installing VFDs in a climate controlled indoor electrical cabinet.

ORIENTATION

"ON" AND "SPEED" SIGNALS

VFD operation in this unit is dependent on two signals: an ON signal and a SPEED (or REFERENCE) signal. The sources and types of these signals can vary. If the ERV is equipped with dampers the ON signal to the VFD comes from the end switch on the damper. If the ERV is not equipped with dampers, the ON signal comes from an external control connected directly to the VFD. When an ON signal is received by the VFD, it starts the motor. The VFD then operates the blower at the speed established by the SPEED signal. The SPEED signal is often provided by an external control, but in some applications "pre-set" speeds are set inside the VFD and are selected by external switches or relays.

PRINCIPLES OF EXTERNAL CONTROL

This ERV can be operated by various external control devices including remote switch or relay, digital time clock with relay, occupancy sensor with relay, and carbon dioxide sensor with relay and analog output. These devices are commonly known as 2-wire, 3-wire, and 4-wire devices. A Building Management System (BMS) can control this ERV through relay contacts and with 0-10vdc or 4-20mA analog inputs.

The external control devices can be connected to this ERV to operate each blower independently or for one blower to act as leader and the other blower to act as follower. In leader-follower mode, a single external switch or relay calls for operation and the leader VFD sets SPEED to internal presets, or in response to an analog input signal. The follower VFD then operates at either exactly the same speed, at an offset above or below the leader's speed, or at a scaled speed.

The VFD's are pre-programmed at the factory so only a few parameters need change for a specific installation.

CONNECTING EXTERNAL CONTROLS

If this ERV is equipped with damper(s), the ON signal is connected to the terminal strip in the electrical enclosure ("E-box").

If this ERV is not equipped with damper(s), and has 2 VFDs, the ON signal is connected directly to the VFDs.

The SPEED signals are always connected directly to the VFD(s).

WIRE ROUTING

Route input power cables, motor cables and control cables separately to decrease electromagnetic interference caused by the rapid changes in the drive output voltage. Where control cables must cross power cables make sure that they are arranged at an angle as near to 90 degrees as possible. See the ABB VFD manual for more detailed wire routing instructions.

Power cables and control cables can be brought into the bottom of the electrical box attached to the ERV unit or through the bottom of the unit itself. There are plugged holes to run control wires and power wires between the electrical box and the unit interior, marked on the interior of the ERV unit and another plugged hole in the unit compartment divider to run wires to VFDs in the other airstream compartment if needed.

In some configurations the VFD and/or VFD protective guard may need to be removed to access the control wire hole plug to run wires. A label is located in the ERV on the left interior wall indicating the power and control wire hole plug locations. Bring wires out from the top or bottom of the VFD mounting bracket and not through the mounting bracket window when routing wires if the VFD is mounted over the hole plug.

After the wires are run, apply caulk around the wires at wire bushings used between the electrical box and ERV unit and between compartments in the unit to prevent air leakage between these compartments.

PURPOSE OF PROVIDED KEYPAD

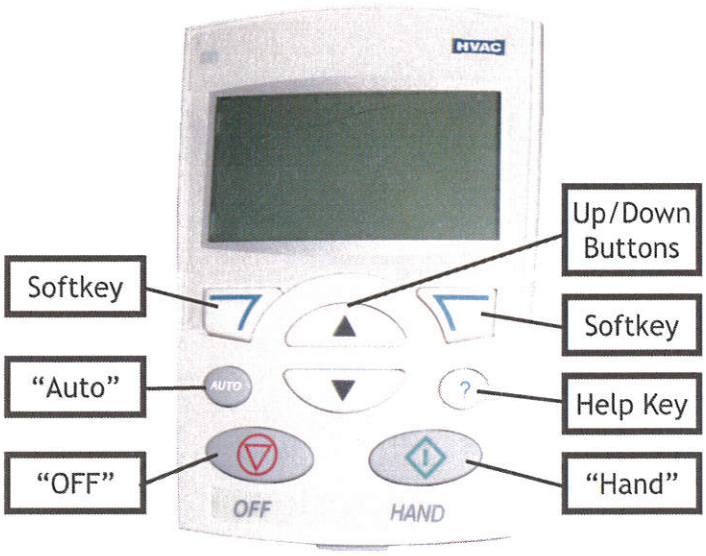
Each VFD has a keypad which is accessible at the E-box while the unit is operating.

You can check the status of the VFD at the keypad, and make changes to the VFD parameters at the keypad. You can manually control the VFD from the keypad during start-up and commissioning.

(VFD is factory programmed to cover most needs but some parameters will need to be set to interact with the external control system.)

Access the keypad(s) through the removable cover to the E-box.

ABB Key Pad Buttons



The function of each Softkey changes and is shown just above the Softkey in the display.

SIMPLE STARTUP

CAUTION

230V Power Supplies

ERVs rated for 208-230VAC power supplies are shipped with VFD parameters set for 208V operation. For 230VAC operation, change the following Parameters:
2003 MAX CURRENT Change to no more than 125% of motor FLA for 230V, as listed on the unit nameplate.
9905 MOTOR NOM VOLT Change from 208V to 230V.
9906 MOTOR NOM CURR Change to match the motor FLA for 230V, as listed on the unit nameplate.

TO START ERV

1) Turn off power to the ERV at its Disconnect Switch.

- Make sure the ERV is wired to provide an ON signal. (See Control Wiring Schematics later in this Manual.) You may need to install a temporary jumper at the ERV or VFD low-voltage terminal strip.
- VFDs are set at the factory to respond to the keypad. If an external controller providing an analog input is connected to the VFD, you may want to temporarily disconnect it.
- Close ERV doors and main cover for the E-box; leave keypads accessible.

2) Turn on power to the ERV at its Disconnect Switch.

- Wait for keypad display to appear.

3) For each VFD:

- Press the HAND button on the keypad. Motor should start running at about 425 RPM.
- Use the UP/DOWN buttons to set motor speed as desired. Confirm the motor amps are no greater than the motor FLA as listed on the unit nameplate.

4) To transfer control of the VFD to a control system:

- Press the OFF button on the keypad. Motor should stop running.
- Change the VFD parameters as required for the specific controls system (see "Control Connections" and "VFD Parameters", below, for examples; see also the ABB Manuals.)
- Press the AUTO switch on the keypad.

MOTOR PROTECTION BY THE VFD(s)

Each VFD in this unit protects one motor against overload. It is critical that the VFD MAX CURRENT be properly set at no more than 125% of the Full Load Amps (FLA) of the motor. The following Parameters must be set correctly and individually for each VFD to match the characteristics of the motor attached to it:

2003	MAX CURRENT	9905	MOTOR NOM VOLT
9906	MOTOR NOM CURR	9909	MOTOR NOM POWER

These parameters are set at RenewAire to match the motor controlled by the VFD. In most cases they should not be changed.

CAUTION

Capacitors in VFDs retain Charge

Allow 2 minutes after shutting off power to the VFDs to allow the capacitors in the VFD to fully discharge. Do not connect or disconnect wires at the VFD without waiting 2 minutes.

CONTROL CONNECTIONS

"ON" SIGNAL CONNECTIONS

If the ERV is equipped with Damper(s) and/or with just one VFD, the ON Signal control wires are connected to the low-voltage terminal strip in the ERV E-box. See Fig. 1.

Install a jumper between terminals 2 and 3 to use the ERV's on-board 24VAC power. Do this when the external control(s) have isolated contacts that don't provide any voltage, as in the top two examples.

Make no connections between terminals 1&2 and terminals 3-5 if the external control has a voltage output to provide the ON signal. This voltage must be 24VAC.

With ERVs equipped with no dampers and 2 VFDs, the ON signal control wires are connected directly to the VFD. See Fig. 2 & 3.

"SPEED" SIGNAL CONNECTIONS

Any SPEED Signal connections are made directly to the VFD (see Figures 4, 6 & 7). The VFDs can accept 4-20mA or 0-10vdc analog control signals to operate at varying speeds. The VFDs also can accept momentary-contact inputs to operate at up to three pre-set speeds. VFD Parameters must be properly set to accept and act on Speed signals. Wiring for analog control signals should be twisted-pair, single- or double-shielded cable, with shield (and drain if provided) grounded at only one end of the cable.

LEADER-FOLLOWER CONNECTIONS

ON and SPEED signals can be passed from the LEADER VFD to a FOLLOWER VFD. See Figures 3 & 5.

Fig. 1: Connection of ON signals to low-voltage terminal strip in ERV E-box.

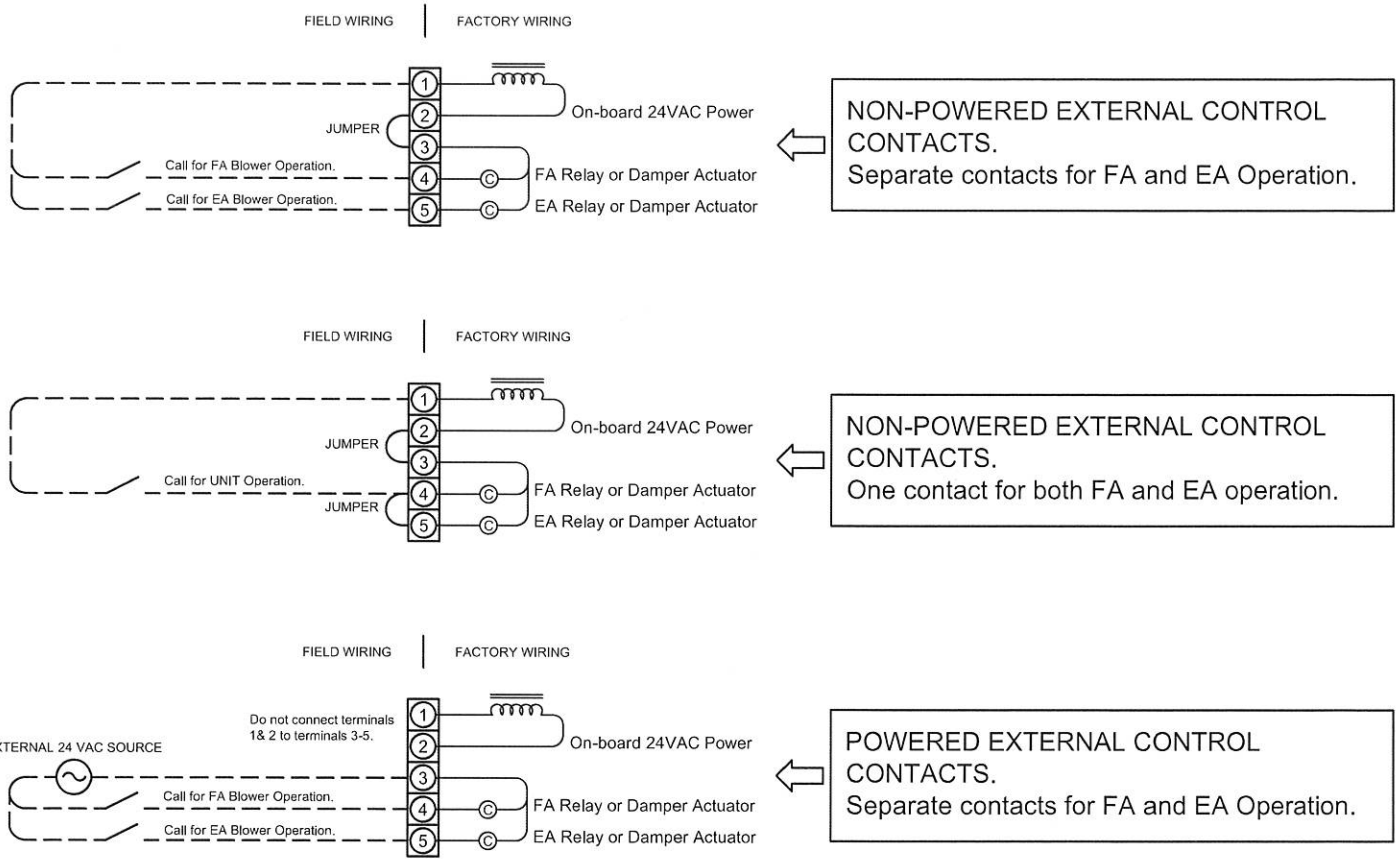
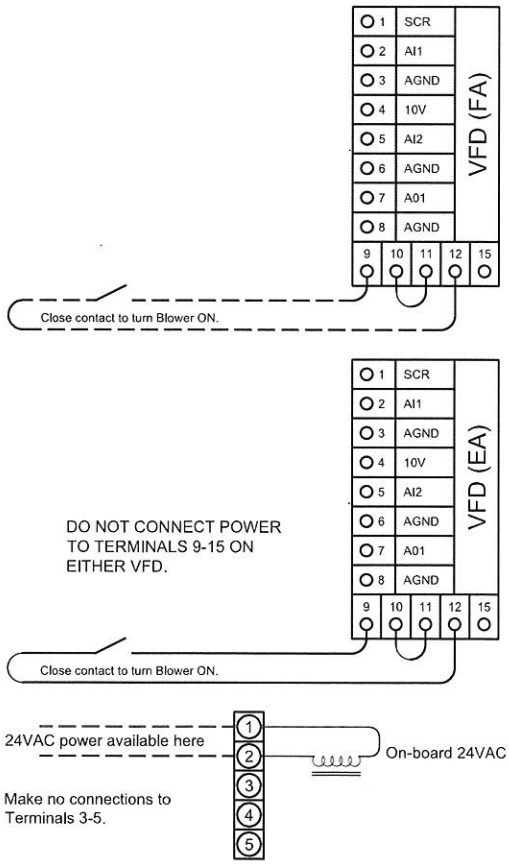
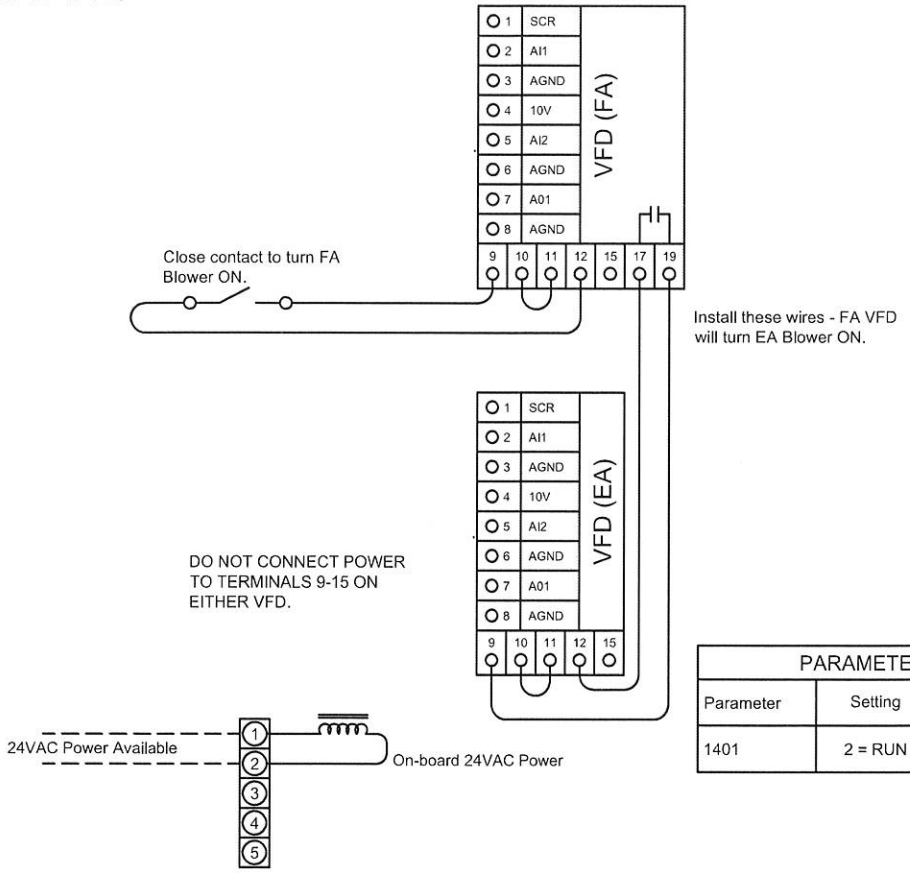


Fig. 2 (ERVs with 2 VFDs and NO Dampers only): Separate ON Signals connected to each VFD.



PARAMETER SETTINGS		
Parameter	Setting	Parameter Description
1103	1=AI1	Enables Frequency to be controlled by analog input signal from external control.

Fig. 3 (ERVs with 2 VFDs and NO Dampers only): ON Signal connected directly to one VFD, passed to second VFD from terminals 17 & 19.

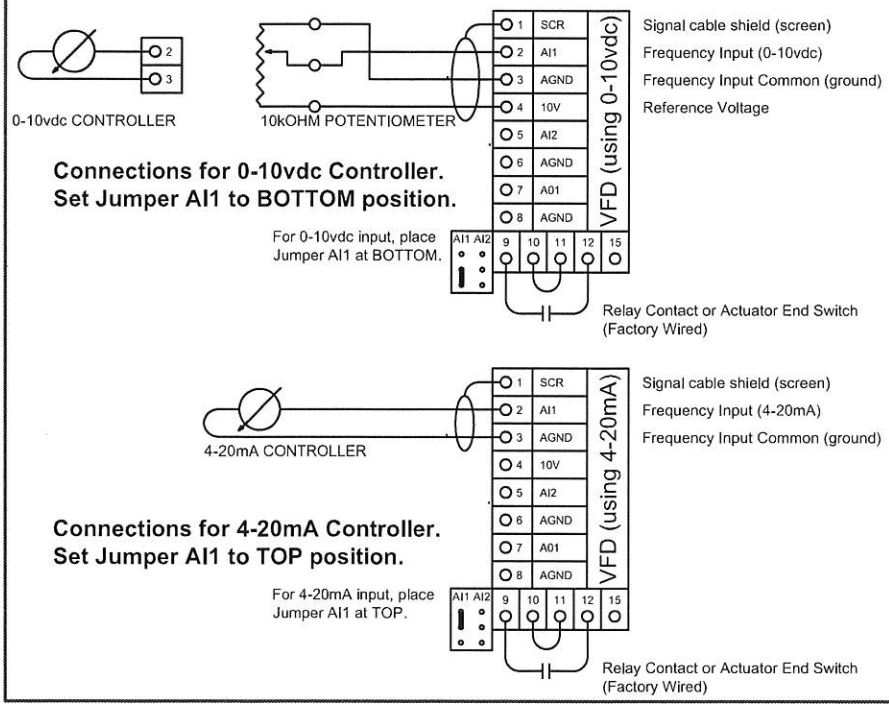


PARAMETER SETTINGS - FA VFD		
Parameter	Setting	Parameter Description
1401	2 = RUN	Closes contact between 17 & 19 when VFD is called to RUN.

ANALOG INPUTS TO PROVIDE THE SPEED SIGNAL

Analog inputs are connected as shown below. It may be necessary to scale the response of the VFD to the analog SPEED signal. See "Scaling and Response to VFD Parameters", below.

Fig. 4: Examples of Analog Input Connections.



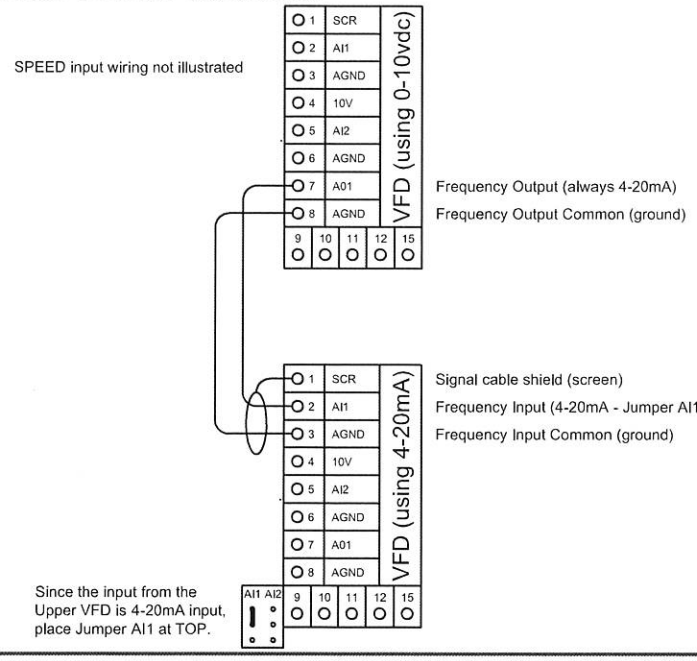
PARAMETER SETTINGS - GENERAL		
Parameter	Setting	Parameter Description
1103	1=AI1	Enables Frequency to be controlled by analog input signal from external control.
PARAMETER SETTINGS - 0-10vdc ANALOG INPUT		
3416	0%	Properly scales display of input.
3419	V	Sets display units as Volts.
3420	0V	Properly scales display of input.
3421	10V	Properly scales display of input.
PARAMETER SETTINGS - 4-20mA ANALOG INPUT		
3416	20%	Properly scales display of input.
3419	mA	Sets display units as mAmps.
3420	4mA	Properly scales display of input.
3421	20mA	Properly scales display of input.

NOTE: All wiring for analog signals connected to the VFDs should be double- or single-shielded twisted-pair cable. Ground the shield at one end of the cable only.

WIRING TWO VFDS FOR LEADER-FOLLOWER OPERATION

One VFD can provide the SPEED signal to a second VFD, as shown below.

Fig. 5: Leader-Follower Connection.



Connect VFDs as shown - FA VFD will pass the Freqency (Speed) Signal to the EA VFD. Use shielded cable and ground the shield to Terminal 1 on either VFD.

PARAMETER SETTINGS		
Parameter	Setting	Parameter Description
1103	1=AI1	Enables Frequency to be controlled by analog input signal from external control.

NOTE: Parameters 1501 and 1502 can be used to scale the Analog Output of the Leader VFD in order to offset or correct the speed of the Follower VFD.

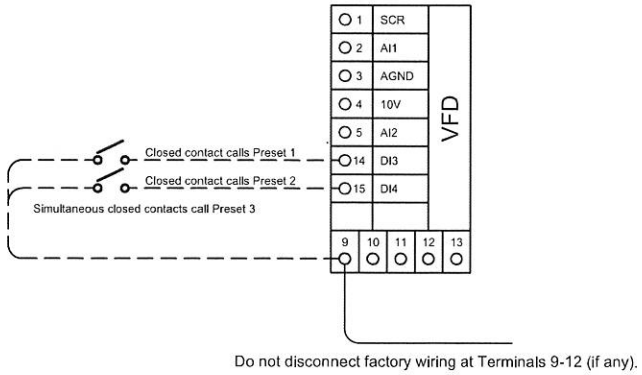
NOTE: If the FA VFD is controlled by an analog input signal, it is likely that the FA VFD's response to the analog input will need to be scaled, using parameters 1104, 1105, 1301 and 1302. See "Scaling and Response to VFD Parameters", below.

If both VFDs are to run at the same speed, no scaling parameters need be applied to the EA VFD since it is controlled as a "Follower".

USING VFD PRESETS FOR THE SPEED SIGNALS

The VFD can be programmed with 3 pre-set speeds. Contact switches can then be used to direct the VFD to operate at one of those speeds. See ABB manuals for additional options. Leader-follower wiring can also be used to make a second VFD operate at the same speed as the first VFD.

Fig. 6: Use of 2 Switches to command the VFD to operate at any of 3 pre-set speeds.



Pre-set speeds over-ride any Frequency (Speed) inputs.

Use switches across terminals 9-14 and 9-15 on the VFD.

Install Leader-Follower connection wiring if desired to operate 2nd VFD at the same speeds.

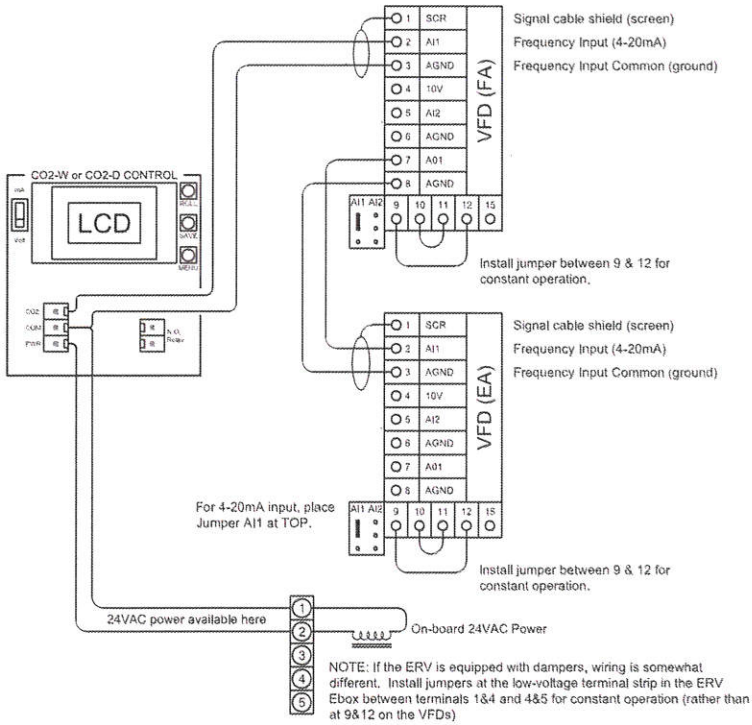
14	15	TERMINAL
DI 3	DI 4	STATUS
0	0	No constant speed
1	0	Constant Speed 1 (1202)
0	1	Constant Speed 2 (1203)
1	1	Constant Speed 3 (1204)

PARAMETER SETTINGS		
Parameter	Setting	Parameter Description
1201	DI 3,4	Enables combinations of inputs at DI3 and DI4 to select 3 presets.
1202	Speed 1 (hz)	Setting in hz for Preset Speed 1
1203	Speed 2 (hz)	Setting in hz for Preset Speed 2
1204	Speed 3 (hz)	Setting in hz for Preset Speed 3

USE WITH A CO2 CONTROLLER

The example below corresponds to the example in the section "Scaling and Response to Analog Inputs". The scaling parameters for the FA VFD in your application are likely to be different.

Fig. 7: Example of Operation of 2 VFDs by a CO2 Controller.



PARAMETER SETTINGS - BOTH VFDs		
Parameter	Setting	Parameter Description
1103	1=AI1	Enables Frequency to be controlled by analog input signal from external control.
3416	20%	Properly scales display of input.
3419	mA	Sets display units as mAmps.
3420	4mA	Properly scales display of input.
3421	20mA	Properly scales display of input.
PARAMETER SETTINGS - FA VFD		
1104	20Hz	Sets Minimum Speed of VFD
1105	50 Hz	Sets Maximum Speed of VFD
1301	55%	Scales the response of the VFD to the CO2 Controller Output
1302	91%	Scales the response of the VFD to the CO2 Controller Output

If both VFDs are to run at the same speed, no scaling parameters need be applied to the EA VFD in this example since it is controlled as a "Follower".

If it is desired that the VFDs should shut off when CO2 levels drop below a setpoint, connect the Normally Open contacts of the CO2 controller (terminals 3&4) to terminals 9 & 12 of the FA VFD. Adjust the operating parameters of the CO2 controller to set the relay setpoint.

USE WITH A BUILDING MANAGEMENT SYSTEM

The ABB ACS320 drive can be connected to an external control system via embedded fieldbus. The embedded fieldbus supports Modbus RTU, BACnet®, Metasys® N2 and APOGEE® FLN Protocols. See the ABB ACS320 Drives User's Manual for details on connecting to an external control system.

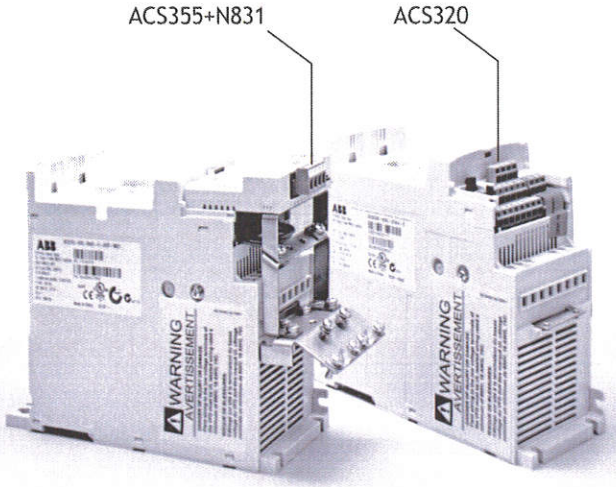
The ABB ACS355+N831 drive can also be connected to an external control system via embedded fieldbus and ABB FMBA-01 Modbus Adapter. The embedded fieldbus supports Modbus RTU and BACnet® protocols. The FMBA-01 Modbus Adapter is used for RS485 communications. See the ABB ACS355 User Manual Supplement - BACnet® (+N831) for details on connecting to an external control system.

Set drive parameter 9802, Communication Protocol Selection, to the desired protocol (e.g. 5=BACnet). If you cannot see the desired selection on the keypad panel for parimeter 9802, your drive does not have that protocol software in the application memory.

BACnet® is a Data Communication Protocol for Building Automation and Control Networks. Developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), BACnet is an American national standard, a European standard, a national standard in more than 30 countries, and an ISO global standard. The protocol is supported and maintained by ASHRAE Standing Standard Project Committee 135.

The inclusion of the BACnet protocol allows the ACS355+N831 and ACS320 VFDs to communicate with a Building Automation and Control system using BACnet.

Embedded fieldbus (EFB) Communications Port.



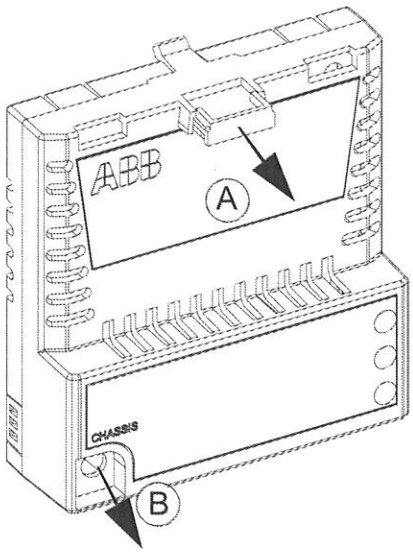
TO ACCESS POWER AND CONTROL WIRES BELOW FMBA-01 MODULE

The ACS355+N831 VFD will typically be provided with ABB FMBA-01 Modbus Adapter Module installed on the VFD. This module will need to be removed if access is required to the power and control wire terminals below it.

Fig. 8: FMBA-01 Module Removal / Installation Instructions

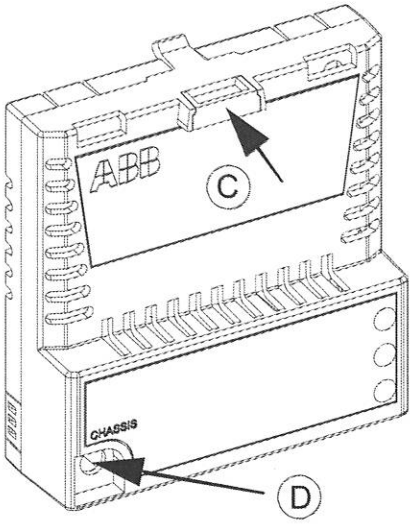
TO REMOVE THE ABB FMBA-01 MODBUS ADAPTER:

1. Pull out the plug lock. (A)
2. Disengage the chassis ground screw threads from the grounding plate below the module. (B)
3. Pull the FMBA-01 Modbus Adapter module off the VFD plug receptical and do required wiring (if any under the module.)



TO RE-INSTALL THE ABB FMBA-01 MODBUS ADAPTER:

1. Push the FMBA-01 Modbus Adapter module back on the plug receptical with the plug lock tab pulled out.
2. Push in the plug lock. (C)
3. Fasten the chassis ground screw. (D)



VFD PARAMETERS

VFD PARAMETER OVERVIEW

"VFD Parameters" are instructions that the Variable Frequency Drives follow. They can be adjusted by using the keypads on the VFDs. In some control configurations, they will need to be changed from the settings as shipped in the unit to interface with your control system.

To view the VFD's Parameters from the keypad, press the MENU softkey. Press up/down arrows to highlight PARAMETERS, then select it by pressing the ENTER softkey.

TO VIEW ALL VFD PARAMETERS

VFD must be powered up - something will be showing on the LED display.

If EXIT is displayed above the left softkey, press softkey repeatedly until MENU appears above the right softkey.

Press the MENU softkey.

Use the UP/DOWN arrows to scroll the display until PARAMETERS is selected, then press the ENTER softkey.

You will see a numbered list of Parameter "groups" - those numbers are the first two digits of the Parameters in each group.

Press the SEL softkey to view all the Parameters in each Group. Use the UP/DOWN buttons to scroll through the parameters. As each Parameter is selected, its value will be displayed.

TO CHANGE VFD PARAMETERS

Select the Parameter you want to edit (see above). Press the EDIT softkey.

Use the UP/DOWN arrows to scroll through the available settings for that Parameter.

Press the SAVE softkey to set the Parameter to the selected value.

TO VIEW ONLY CHANGED VFD PARAMETERS

If EXIT is displayed above the left softkey, press softkey repeatedly until MENU appears above the right softkey.

Press the MENU softkey.

Use the UP/DOWN arrows to scroll the display until CHANGED PAR is selected, then press the ENTER softkey.

All Parameters that have been changed from the HVAC Application Macro default values are displayed. Use the UP/DOWN buttons to view them all.

SUMMARY TABLE OF COMMONLY USED PARAMETERS

Note: Parameters not listed in this Table are shipped in ABB's defaults for the HVAC Application Macro.

** by parameter number indicates it is not visible in Short View.*

	Name/Selection	ABB HVAC Default ACS320/ACS355+N831	Settings as Shipped BY RenewAire	FUNCTION
9802	COMMUNICATION PROTOCOL SELECTION	0=NOT SEL/5=BACnet	0=NOT SEL	Activates the external serial communication and selects the interface. Set to 5=BACnet if integrating VFD into BACnet® system.
9902	APPLIC MACRO	HVAC	HVAC	Pressing SAVE softkey when USER 1 LOAD is selected returns the VFD to the parameters as shipped from RenewAire. Pressing SAVE softkey when HVAC DEFAULT is selected returns the VFD to the ABB defaults.
9905	MOTOR NOM VOLT	VFD rating	Equal to Motor Voltage	Must be set equal to wired motor voltage.
9906	MOTOR NOM CURR	VFD rating	Equal to Motor FLA	Must be set equal to motor nameplate FLA. CRITICAL FOR SAFETY.
9907	MOTOR NOM FREQ	60.0 Hz	60.0 Hz	Must be set 60.0 Hz
9908	MOTOR NOM SPEED	Size Dependent	Set per motor	Usually 1750.
9909	MOTOR NOM POWER	VFD rating	Equal to Motor HP	Must be set to Motor nameplate HP.

SUMMARY TABLE OF COMMONLY USED PARAMETERS

Note: Parameters not listed in this Table are shipped in ABB's defaults for the HVAC Application Macro.

** by parameter number indicates it is not visible in Short View.*

	Name/Selection	ABB HVAC Default ACS320/ACS355+N831	Settings as Shipped BY RenewAire	FUNCTION
1001*	EXT1 COMMANDS	1=DI1	1=DI1	Enables 2-wire start-stop when closing contact between 9&12. (Jumper req'd between 10&11.)
1103*	REF1 SEL	1=AI1	0=KEYPAD	Selects signal source for external reference REF 1. Change to 1=AI1 for operation by an external control signal.
1104*	REF1 MIN	0.0 Hz	0.0 Hz	Sets minimum value for speed reference. Used for scaling and offsetting the input to the VFD output.
1105	REF1 MAX	60.0 Hz	60.0 Hz	Sets maximum value for speed reference. Used for scaling and offsetting the input to the VFD output.
1201*	CONST SPEED SEL	3=DI3	9=DI3,4	Enables three-speed operation at three preset speeds using two switches between 9&13 and 9&14.
1202	CONST SPEED 1	6.0 (Hz)	30.0 Hz	Determines preset speed 1.
1203	CONST SPEED 2	12.0 (Hz)	45.0 Hz	Determines preset speed 2.
1204	CONST SPEED 3	18.0 (Hz)	60.0 Hz	Determines preset speed 3.
1301	MINIMUM AI1	20%	20%	Sets minimum value for analog input. Used for scaling and offsetting the input to the VFD output.
1302	MAXIMUM AI1	100%	100%	Sets maximum value for analog input. Used for scaling and offsetting the input to the VFD output.
1304	MINIMUM AI2	20%/1%	20%	Sets minimum value for analog input AI2.
1401	RELAY OUTPUT 1	1=READY	2=RUN	Energizes Relay 1 when drive is running. Terminal 17=COM, 18=N.C., 19= N.O.
1501	AO 1 CONTENT SEL	103=OUTPUT FREQ	103=OUTPUT FREQ	Sets the Analog Output of the VFD equal to the Output Frequency at which it is driving its Motor.
1502	AO 1 CONTENT MIN	0.0 Hz	0.0 Hz	Scales the minimum value of the analog output with respect to the VFDs Output Frequency.
1503	AO 1 CONTENT MAX	60.0 Hz	60.0 Hz	Scales the maximum value of the analog output with respect to the VFDs Output Frequency.
1504	MINIMUM AO 1	4.0 mA	4.0 mA	Sets the minimum current for the Analog Output.
1505	MAXIMUM AO 1	20.0 mA	20.0 mA	Sets the maximum current for the Analog Output.
1602*	PARAMETER LOCK	1=OPEN	0=LOCKED	Allows you to lock or change parameters from the keypad.
1603*	PASS CODE	0	0	Entering pass code 358 allows you to change parameter 1602 once. The entry reverts back to 0 automatically.
1607*	PARAM.SAVE	0 = DONE	0 = DONE	Saves parameters to permanent memory
1608*	START ENABLE 1	4=DI4	1=DI1	Enables DI1 as the source of the Start Enable Signal.
1611	PARAMETER VIEW	SHORT VIEW/DEFAULT	LONG VIEW/DEFAULT	(SHORT VIEW) Hides less commonly used parameters
2003*	MAX CURRENT	$1.1*I_{2N}$ /$1.8*I_{2N}$	Set to 125% motor FLA	CRITICAL PARAMETER. Defines motor protection level.
2007*	MINIMUM FREQ	0.0 Hz	15.0 Hz	Determines minimum frequency of VFD output
2008	MAXIMUM FREQ	60.0 Hz	60.0 Hz	Determines maximum frequency of VFD output
2101*	START FUNCTION	1=AUTO	6=SCAN START	Selects the motor start method. SCAN START provides a frequency-scanning flying start, and corrects backwards rotation.
2102	STOP FUNCTION	1=COAST	1=COAST	Sets motor to coast to a halt. Can be set to ramp down to a halt, following the deceleration time set at 2203.
2202	ACCELER TIME 1	30.0 s	30.0 s	Sets acceleration time.
2203	DECELER TIME 1	30.0 s	30.0 s	Sets deceleration time. This is ignored when 2102 STOP FUNCTION = COAST.
2607	SWITCH FREQ CONTROL	1=ON/2=ON (LOAD)	1=ON	Selects the control method for the switching frequency.
2609	NOISE SMOOTHING	0=DISABLED	0=DISABLED	Set to 1=enabled to activate the noise smoothing function. Noise smoothing lowers peak noise intensity by distributing acoustic motor noise over a range of frequencies.
3401*	SIGNAL 1 PARAM	103=OUTPUT FREQUENCY	101=SPEED AND DIR	Sets top line of keypad display to show motor speed in rpm.
3408*	SIGNAL 2 PARAM	104=CURRENT	104=CURRENT	Sets middle line of keypad display to show motor current in Amps.
3415*	SIGNAL 3 PARAM	120=AI 1	120=AI 1	Sets bottom line of keypad display to show value of analog signal input.

** This parameter is not visible in the "short view". To be able to view all signals and parameters, set parameter 1611 PARAMETER VIEW to 3 (LONG VIEW).*

NOTE: SPEED-SKIPPING is a function available through Parameters 2501-2507. It allows up to 3 critical speeds to be skipped as the VFD ramps speed up and down. If noise problems occur at specific frequencies, Speed-Skipping may help. See the VFD manual for details.

TO LOCK OR UNLOCK PARAMETERS

VFDs are shipped locked to prevent accidental changes to parameter settings. If changes to factory parameter settings are desired, the VFD will need to be unlocked for editing the settings.

To unlock all Parameters if Parameter 1602 reads LOCKED:

1. Select Parameter 1603 PASS CODE: press EDIT softkey.
2. Use the UP / DOWN buttons to scroll to 358: press SAVE softkey (the entry will automatically revert back to 0); press EXIT softkey.
3. Scroll up to Parameter 1602 PARAMETER LOCK which reads LOCKED; press EDIT softkey.
4. Scroll to OPEN; press SAVE softkey; press EXIT softkey.

Parameters are now unlocked. You can view and change them.

To lock Parameters after changes are made if Parameter 1602 reads OPEN:

1. Select Parameter 1603 PASS CODE: press EDIT softkey.
2. Use the UP / DOWN buttons to scroll to 358: press SAVE softkey (the entry will automatically revert back to 0); press EXIT softkey.
3. Scroll up to Parameter 1602 PARAMETER LOCK which reads OPEN; press EDIT softkey.
4. Scroll to LOCKED; press SAVE softkey; press EXIT softkey.

Parameters are now locked. You can view them but you cannot change them.

TO RESET VFD PARAMETERS TO FACTORY SETTINGS USING KEYPAD

The VFD will need to be unlocked as described above to reset Parameters to RenewAire factory or ABB defaults.

To return to RenewAire's defaults, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll down to USER 1 LOAD (Not USER 1 SAVE as this will overwrite the factory settings saved under USER 1 in the VFD base memory). Press the SAVE softkey.

Alternatively, to return to RenewAire's defaults, select PAR BACKUP in the keypad menu; scroll to and select DOWNLOAD FULL SET (not UPLOAD TO PANEL as this will overwrite the factory settings saved in the keypad memory).

To return to ABB's defaults, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll up or down to select HVAC DEFAULT. Press the SAVE softkey. If HVAC DEFAULT was displayed without scrolling after pressing EDIT in parameter 9902, you will need to scroll up to another macro numbered 2 through 15 and press SAVE, then scroll back down to 1=HVAC DEFAULT and press SAVE again to get the settings to revert back to the original ABB defaults.

To save an edited parameter set for possible restoration, select parameter 9902 APPLIC MACRO and press EDIT softkey. Scroll down to USER 2 SAVE (Not USER 1 SAVE as this will overwrite the factory settings saved under USER 1 in the VFD base memory). Press the SAVE softkey. This edited parameter set can now be reset using USER 2 LOAD.

The VFD should be relocked as described above after the desired parameter settings are entered to avoid further, accidental changes to parameter settings.

NOTE: VFD Manufacturer instructions list many other parameters. Copies of the complete manufacturer's instructions for the VFD are shipped with this unit, and are also available on-line in the Document Library at www.abb.com/drives.

⚠WARNING

DANGER OF MOTOR OVERLOAD LEADING TO SMOKE AND FIRE!

Do not change PARAMETER 2003 MAX CURRENT from RenewAire default setting, which should be set to no more than 125% of the motor nameplate FLA. This parameter controls the Motor OVERLOAD PROTECTION provided by the VFD.

SCALING AND RESPONSE TO ANALOG INPUTS

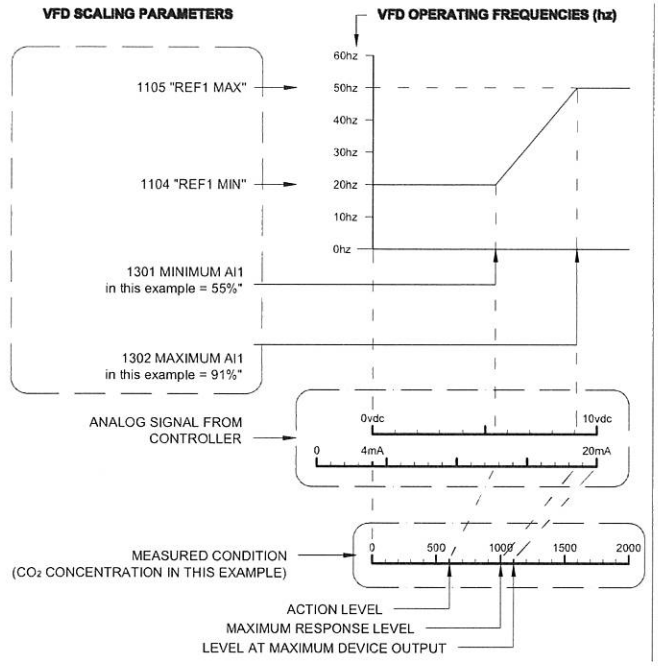
The most likely reason to control the VFD from an analog signal is to automatically change the amount of outside air ventilation to meet the actual needs for each time period.

If one or both of the VFDs will be controlled by an analog input from an external Control Device (e.g. a CO2 controller or a Building Management System), you may need to "scale" the rate of response of the VFD(s) to the rate of change of the analog signal.

We need to introduce two concepts relating to the amount of outside air ventilation needed in the building:

- The "ACTION LEVEL" is the level of measurement of indoor air quality or occupancy at which the ERV should start to deliver more than the "Design Minimum Supply Airflow";
- The "MAXIMUM RESPONSE LEVEL" is the level of measurement of indoor air quality or occupancy at which the ERV should be operating at the "Design Maximum Supply Airflow".

Fig.8: Schematic Relationship between Measurement by a Controller, the Analog Signal from the Controller, the VFD Scaling Parameters and the Motor Speed (VFD Operating Frequencies).



ADDITIONAL JOB INFORMATION NEEDED:

1. MEASUREMENT RANGE: the range of the values that can be measured by the Controller (e.g. a controller set to measure CO2 from 0ppm to 1100ppm).[2]
2. ANALOG SIGNAL TYPE: vdc or mA.
3. MINIMUM SIGNAL VALUE of the analog signal: e.g. 0vdc or 4mA. This is the signal that the controller puts out when it is measuring at the bottom of its measurement range.
4. MAXIMUM SIGNAL VALUE of the analog signal: e.g. 10vdc, 20mA. This is the signal that the controller puts out when it is measuring at the top of its measurement range.
5. SIGNAL RANGE: the difference between the maximum and minimum signal values from the controller. In the case of a 0-10vdc controller the Signal Range is 10vdc. In the case of a 4-20mA Controller the Signal Range is 16mA.
6. ACTION LEVEL SIGNAL: the value of the analog signal corresponding to the "Action Level".
7. MAXIMUM RESPONSE LEVEL SIGNAL: the value of the analog signal corresponding to the "Maximum Response Level".

APPLICATION EXAMPLE: CO2 CONTROLLER

The engineer wants the ERV to:

- Run at a minimum of 700 CFM, regardless of CO2 levels, in order to control the level of indoor air pollutants generated by the furnishings.
- Start to increase airflow when CO2 levels rise above 600ppm.
- As CO2 levels continue to rise, the ERV should increase airflow, hitting a maximum of 1500 CFM at 1000 ppm CO2 level.

The CO2 controller is set up to deliver a linear 4-20mA signal over a measurement range of 0 to 1100ppm.

During the test and balance process, the ERV is found to deliver 700 CFM at 20Hz, and 1500CFM at 50Hz.

THEREFORE:
ACTION LEVEL = 600ppm
MAXIMUM RESPONSE LEVEL = 1000ppm
MAXIMUM SPEED = 50Hz
MINIMUM SPEED = 20Hz
ANALOG SIGNAL TYPE = mA.
MINIMUM SIGNAL VALUE = 4mA
MAXIMUM SIGNAL VALUE = 20mA
SIGNAL RANGE = 16mA
MEASUREMENT RANGE of the controller = 1100ppm

CALCULATIONS AND SETTING THE PARAMETERS

1. Set the VFD parameters for the minimum and maximum SPEEDS of the VFD:

- Set Parameter 1104 REF1 MIN to "20Hz". The motors will never run below this speed.
- Set Parameter 1105 REF1 MAX to "50Hz". The motors will never run above this speed.

2. Next calculate the ACTION LEVEL SIGNAL, the value of the analog signal from the controller when CO2 = 600ppm:

$$\text{Action Level Signal} = \text{Minimal Signal} + \left[\frac{\text{Action Level}}{\text{Measurement Range}} \times \text{Signal Range}\right]$$

Therefore:

$$\text{Action Level Signal} = 4\,(\text{mA}) + \frac{600\,(\text{ppm})}{1100\,(\text{ppm})} \times 16(\text{mA}) = 12.72(\text{mA})$$

3. The calculated ACTION LEVEL SIGNAL now needs to be expressed as a percentage of the SIGNAL RANGE, but since the MINMUM SIGNAL VALUE = 4.0, calculate as follows:

$$\left[\frac{12.7(\text{mA})-4.0\,(\text{mA})}{16.0(\text{mA})} \times 100\right] = 54.5\%$$

4. Calculate the MAXIMUM RESPONSE LEVEL SIGNAL: the value of the analog signal from the controller when CO2 = 1000ppm:

$$\text{Maximum Response Level Signal} = \text{Minimal Signal} + \left[\frac{\text{Maximum Response Level}}{\text{Measurement Range}} \times \text{Signal Range}\right]$$

Therefore:

$$\text{Maximum Response Level Signal} = 4(\text{mA}) + \left[\frac{1000\,(\text{ppm})}{1100\,(\text{ppm})} \times 16(\text{mA})\right] 18.54(\text{mA})$$

5. This calculated MAXIMUM RESPONSE LEVEL SIGNAL now needs to be expressed as a percentage of the SIGNAL RANGE, but since the MINIMUM SIGNAL VALUE = 4.0, calculate as follows:

$$\left[\frac{18.54(\text{mA})-4.0(\text{mA})}{16.0(\text{mA})} \times 100\right] = 90.9\%$$

6. Set the parameters that will scale the response of the VFD to the inputs from the CO2 controller:

- Set Parameter 1301 MINIMUM AI 1 to "55%" (the MINIMUM SIGNAL VALUE).
- Set Parameter 1302 MAXIMUM AI 1 to "91%" (the MAXIMUM SIGNAL VALUE).

[2] This does not mean the range of values that will be measured. For example, a CO2 controller might be set so that it can measure from 0ppm to 1100ppm. The Measurement Range is therefore 0-1100ppm. In the field the controller might never read a value below 400ppm or above 1000ppm, but this is not the meaning of Measurement Range.

TECHNICAL SUPPORT

For questions about applications not covered in this manual, and for questions specific to the ABB Drives, contact ABB Technical Support at 800-HELP-365 (800-435-7365).

A listing of ABB support and service contacts can be found on the Internet at www.abb.com/drives and selecting Sales, Support and Service Network.

ABB manuals are available as pdfs at www.abb.com/drives; select Document Library.

Related ABB Manuals:

ACS320 User's Manual	3AUA0000062599
ACS320 Short Form User's Manual	3AUA0000086933
ACS355 User's Manual	3AUA0000066143
ACS355 HVAC with BACnet (+N831) Supplement	3AXD50000024172
FMBA-01 Modbus Adapter Module User's Manual	3AFE68586704
F-Series Fieldbus Adapter Modules Installation Note	3AXD50000008201
ACS355 HVAC With BACnet (+N831) Document Guide	3AXD50000023355

ABB offers training courses on their VFDs; navigate to www.abb.com/drives and select Training Courses.

For questions about applications covered in this manual, and for questions about how the VFDs are installed in your RenewAire ERV unit, contact RenewAire Customer Support at 800-627-4499.