

Collecting and sending operational data to K2n

This guidance document is split into three sections. These cover initial services design and the data collection process for meters and sensors.

The procedure for storing and sending the collected data from a BEMS or other data collection device is identical for both meters and sensors, but the setup requirements for a robust system are different for each.

The key to useful operational data is to make sure it is trusted. If there is uncertainty about its accuracy, then action is unlikely to follow.

Utilities supply design suggestions

Key to useful analysis is that the metering and monitoring provided enables actions to be taken from the data they produce.

The following utilities distribution design approaches are recommended:

Design item	Examples
Supplies to building services to be separated from supplies to end users	All Mechanical Plant should be on its own separately metered distribution board(s). Gas use for Heating Systems should be separated from Gas use for DHW, Catering and Process Use
Main incoming supplies for each utility should have a full set of submeters	All circuits on the Main Panel(s) served by the incoming electricity supply must be metered. This enables comparison of recorded loads. Same for other utilities.
Lighting and Small Power supplies to be separately metered.	This is commonly achieved through split panels with separate metering
Significant and balance loads should be separately metered	Server Rooms, Catering, Lifts would all warrant their own circuit and meter. Small loads such as Fire Alarm Panels, Disabled Refuge Alarm Panels, should all be grouped beneath one meter if possible.
Do not connect mechanical plant back to Small Power or Lighting circuits UNLESS the plant has its own in-built monitoring that will be used to separate its load	For example, some AHU's have in-built fan power monitoring as well as the ability to monitor heat supplied, room conditions, etc. These are capable of being connected back to the main data collection system.
Allow for BMS data collection connections to inbuilt energy monitoring on individual plant such as pumps, AHU's, AC units, etc	Where separating plant utility use would require significant additional wiring and/or meters to achieve then use of inbuilt monitoring may prove more cost-effective.
External conditions	External conditions must be measured with at least one high quality, well installed air temperature sensor. A full weather station with full solar, wind speed and wind direction instruments is desirable for post-occupancy tests
Internal Environmental Quality	At a minimum room air temperature/black bulb thermometers AND good CO2 sensors should be installed in all regularly occupied main teaching spaces. VOC sensors are a very useful addition if affordable.

Providing robust meter data to K2n

For meters there are a series of 'good practice' decisions which should ensure smooth installation and commissioning. These are shown for the various stages of design, construction and operation. The bullet points are considered essential to follow:

Metering: Design stage:

Example BMS Meter Points Partial Table			
The following are examples of each type of the key meter data that need to be recorded in the BMS points. Their description should coincide with the meters and sensors noted as installed in the building assets supplied to K2n:			
Label	Units		
EM01_Elec_Main_Incomer	kWh		
EM02_Refuge_Alarm_Panel	kWh		
EM03_Fire_Alarm_Panel	kWh		
EM04_BMS_MCC1	kWh		
EM05_EXT_Lighting	kWh		
EM06_Lift	kWh		
EM07_PV_Array	kWh		
EM08_DB_GF_VentPower	kWh		
EM09_DB_1F_VentPower	kWh		
EM10_DB_GF_12_KitchenPower	kWh		
EM11_DB_GF_11_AVPower	kWh		
EM12_DB_GF_10_ICTPower	kWh		
EM13_DB_GF_09_ITPower	kWh		
EM14_DB_GF_08_SciencePower	kWh		
EM15_DB_GF_07_RES MAT Power	kWh		
EM16_DB_GF_06_ARTPower	kWh		
EM17_DB_GF_05_FoodTECHPower	kWh		
EM18_DB_GF_04_SELights	kWh		
EM19_DB_GF_04_SEPower	kWh		
EM20_DB_GF_03_NELights	kWh		
EM21_DB_GF_03_NEPower	kWh		
EM22_DB_GF_02_NWLights	kWh		
EM23_DB_GF_02_NWPower	kWh		
EM24_DB_GF_01_SWLights	kWh		
EM25_DB_GF_01_SWPower	kWh		
EM26_DB_1F_05_ServerRMPower	kWh		
EM27_DB_1F_04_PlantRoom	kWh		
EM28_DB_1F_03_SELights	kWh		
EM29_DB_1F_03_SEPower	kWh		
EM30_DB_1F_02_NELights	kWh		
EM31_DB_1F_02_NEPower	kWh		
EM32_DB_1F_01_NWLights	kWh		
EM33_DB_1F_01_NWPower	kWh		
GM01_Main_Gas_Incomer	m ³		
GM02_Boiler Gas	m ³		
GM03_Kitchen Gas	m ³		
GM04_DHW_Gas	m ³		
WM01_Boundary_Water	m ³		
WM02_Main_Water_Incomer	m ³		
WM03_CAT5	m ³		
WM04_DHW_Calorifier_Water	m ³		
WM05_Existing_Building_Supply	m ³		
WM06_Kitchen_DHW_Supply	m ³		
WM07_Kitchen_CWS_Supply	m ³		
HM01_VT_Circuit_1	kWh		
HM02_VT_Circuit_2	kWh		
HM03_CT_Circuit_1	kWh		
HM04_CT_Circuit_2	kWh		

Each meter has its data initially recorded into the BMS database or other data collector system. This data is then all packaged into a csv file or files each evening for sending to the K2n platform

- The electricity, gas, heat and water distribution systems are designed to allow clear separation of consumption by the desired end uses and plant served.
- Sub-metering is applied to ALL sub-circuits fed directly from the main incomer(s) for each utility. This allows correlation of submeter demands with main meters
- Ensure ALL incoming supplies are accurately metered
- Choose a data collection and transmission system capable of collecting actual data at 15-minute intervals, storing this data, and automatically sending it to K2n in csv format via an email each evening at a specified time
- Ensure that an email server and external internet connection are available to the data collection and transmission system to be used

Metering: Construction stage:

- All meters sized to provide and record meaningful readings over a 15-minute period for the design loads served e.g. kWh not MWh for a heat meter recording DHW energy use
- All meters to have documentation showing the circuits and plant they serve ‘as-built’
- All meters installed have calibration certificates showing their accuracy over their range

Example BMS csv data file output for one day

Note the data for each meter should be the ACTUAL READING at each 15 minute interval, NOT an interpolation. **This csv data should be sent each night via email to the unique email address given for the school** once the final reading for the day has been taken and stored. This email address is of the form 'school_name_15min_data@data.k2energy.com'. The example file for one day shows data for just the first 8 meters as examples, but all meter and sensor data could be in here too. **Note that the column headings contain the BMS labels for each data stream**

timestamp	EM01_Elec_Main_Incomer	EM02_Refuge_Alarm_Panel	EM03_Fire_Alarm_Panel	EM04_BMS_MCC1	EM05_EXT_Lighting	EM06_Lift	EM07_PV_Array	EM08_DB_GF_VentPower	Etc for all meter and sensor points...
05/10/2020 00:00	89514	0.96	12.10	6189.1	578.8	2.59	2384.2	31.6	
05/10/2020 00:15	89520	0.96	12.11	6189.3	578.9	2.59	2384.2	31.6	
05/10/2020 00:30	89520	0.96	12.11	6189.3	579	2.59	2384.2	31.6	
05/10/2020 00:45	89526	0.96	12.12	6189.4	579.1	2.59	2384.2	31.6	
05/10/2020 01:00	89526	0.96	12.12	6189.4	579.2	2.59	2384.2	31.6	
05/10/2020 01:15	89531	0.96	12.13	6189.6	579.4	2.59	2384.2	31.6	
05/10/2020 01:30	89531	0.96	12.13	6189.6	579.5	2.59	2384.2	31.6	
05/10/2020 01:45	89537	0.96	12.14	6189.8	579.6	2.59	2384.2	31.6	
05/10/2020 02:00	89537	0.96	12.14	6189.8	579.7	2.59	2384.2	31.6	
05/10/2020 02:15	89543	0.96	12.15	6190.2	579.8	2.59	2384.2	31.6	
05/10/2020 02:30	89543	0.97	12.15	6190.2	579.9	2.59	2384.2	31.6	
05/10/2020 02:45	89549	0.97	12.16	6190.3	580	2.59	2384.2	31.6	
05/10/2020 03:00	89549	0.97	12.16	6190.3	580.1	2.59	2384.2	31.7	
05/10/2020 03:15	89555	0.97	12.17	6190.5	580.3	2.59	2384.2	31.7	
05/10/2020 03:30	89555	0.97	12.17	6190.5	580.4	2.59	2384.2	31.7	
05/10/2020 03:45	89561	0.97	12.18	6190.6	580.5	2.59	2384.2	31.7	
05/10/2020 04:00	89561	0.97	12.18	6190.6	580.6	2.59	2384.2	31.7	
05/10/2020 04:15	89566	0.97	12.19	6190.7	580.7	2.59	2384.2	31.7	
05/10/2020 04:30	89566	0.97	12.19	6190.7	580.8	2.59	2384.2	31.7	
05/10/2020 04:45	89573	0.97	12.20	6190.9	580.9	2.59	2384.2	31.7	
05/10/2020 05:00	89573	0.97	12.20	6190.9	581	2.59	2384.2	31.7	
05/10/2020 05:15	89578	0.97	12.21	6191	581.1	2.59	2384.2	31.7	
05/10/2020 05:30	89578	0.97	12.21	6191	581.3	2.59	2384.2	31.7	
05/10/2020 05:45	89584	0.97	12.22	6191.1	581.4	2.59	2384.2	31.7	
05/10/2020 06:00	89584	0.97	12.22	6191.1	581.5	2.59	2384.2	31.7	
05/10/2020 06:15	89590	0.97	12.23	6191.5	581.6	2.59	2384.2	31.7	
05/10/2020 06:30	89590	0.97	12.23	6191.5	581.7	2.59	2384.2	31.7	
05/10/2020 06:45	89596	0.97	12.24	6191.7	581.8	2.59	2384.2	31.7	
05/10/2020 07:00	89596	0.97	12.24	6191.7	581.9	2.59	2384.2	31.7	
05/10/2020 07:15	89602	0.97	12.25	6191.8	581.9	2.59	2384.2	31.7	
05/10/2020 07:30	89602	0.98	12.25	6191.8	582	2.59	2384.2	31.7	
05/10/2020 07:45	89607	0.98	12.26	6192	582	2.59	2384.2	31.7	
05/10/2020 08:00	89607	0.98	12.26	6192	582	2.59	2384.2	31.7	
05/10/2020 08:15	89613	0.98	12.27	6192.3	582	2.59	2384.2	31.7	
05/10/2020 08:30	89613	0.98	12.27	6192.3	582	2.6	2384.2	31.7	
05/10/2020 08:45	89619	0.98	12.28	6192.5	582	2.6	2384.2	31.7	
05/10/2020 09:00	89619	0.98	12.28	6192.5	582	2.6	2384.2	31.7	
05/10/2020 09:15	89625	0.98	12.29	6192.6	582.1	2.6	2384.4	31.7	
05/10/2020 09:30	89625	0.98	12.29	6192.6	582.1	2.61	2384.5	31.7	
05/10/2020 09:45	89631	0.98	12.30	6192.8	582.1	2.61	2384.6	31.7	
05/10/2020 10:00	89631	0.98	12.30	6192.8	582.1	2.61	2384.7	31.7	
05/10/2020 10:15	89637	0.98	12.31	6192.9	582.1	2.61	2384.8	31.7	
05/10/2020 10:30	89637	0.98	12.31	6192.9	582.1	2.61	2384.9	31.7	
05/10/2020 10:45	89642	0.98	12.32	6193.2	582.1	2.61	2385	31.7	
05/10/2020 11:00	89642	0.98	12.32	6193.2	582.1	2.61	2385.2	31.7	
05/10/2020 11:15	89648	0.98	12.33	6193.3	582.2	2.61	2385.4	31.7	
05/10/2020 11:30	89648	0.98	12.33	6193.3	582.2	2.62	2385.6	31.7	
05/10/2020 11:45	89653	0.98	12.34	6193.5	582.2	2.62	2385.8	31.7	
05/10/2020 12:00	89653	0.98	12.34	6193.5	582.2	2.62	2386	31.8	
05/10/2020 12:15	89659	0.98	12.35	6193.7	582.2	2.62	2386.2	31.8	
05/10/2020 12:30	89659	0.99	12.35	6193.7	582.2	2.62	2386.4	31.8	
05/10/2020 12:45	89664	0.99	12.36	6193.8	582.2	2.63	2386.6	31.8	
05/10/2020 13:00	89664	0.99	12.36	6193.8	582.3	2.63	2386.8	31.8	
05/10/2020 13:15	89669	0.99	12.37	6194	582.3	2.63	2387	31.9	
05/10/2020 13:30	89669	0.99	12.37	6194	582.3	2.64	2387.2	31.9	
05/10/2020 13:45	89674	0.99	12.38	6194.2	582.3	2.64	2387.4	31.9	
05/10/2020 14:00	89674	0.99	12.38	6194.2	582.3	2.64	2387.6	31.9	
05/10/2020 14:15	89679	0.99	12.39	6194.4	582.3	2.64	2387.6	31.9	
05/10/2020 14:30	89679	0.99	12.39	6194.4	582.3	2.64	2387.6	31.9	
05/10/2020 14:45	89683	0.99	12.40	6194.6	582.3	2.65	2387.6	31.9	
05/10/2020 15:00	89683	0.99	12.40	6194.6	582.4	2.65	2387.6	32	
05/10/2020 15:15	89688	0.99	12.41	6194.7	582.4	2.65	2387.6	32.1	
05/10/2020 15:30	89688	0.99	12.41	6194.7	582.4	2.65	2387.6	32.2	
05/10/2020 15:45	89692	0.99	12.42	6194.9	582.4	2.66	2387.6	32.3	
05/10/2020 16:00	89692	0.99	12.42	6194.9	582.4	2.66	2387.6	32.4	
05/10/2020 16:15	89696	0.99	12.43	6195.1	582.4	2.66	2387.6	32.5	
05/10/2020 16:30	89696	0.99	12.43	6195.1	582.5	2.66	2387.6	32.6	
05/10/2020 16:45	89700	0.99	12.44	6195.2	582.6	2.67	2387.6	32.7	
05/10/2020 17:00	89700	0.99	12.44	6195.2	582.7	2.67	2387.6	32.8	
05/10/2020 17:15	89704	0.99	12.45	6195.5	582.8	2.67	2387.6	32.8	
05/10/2020 17:30	89704	1.00	12.45	6195.5	582.9	2.67	2387.6	32.8	
05/10/2020 17:45	89707	1.00	12.46	6195.7	583	2.67	2387.6	32.8	
05/10/2020 18:00	89707	1.00	12.46	6195.7	583.1	2.67	2387.6	32.8	
05/10/2020 18:15	89710	1.00	12.47	6195.8	583.2	2.67	2387.6	32.8	
05/10/2020 18:30	89710	1.00	12.47	6195.8	583.4	2.67	2387.6	32.8	
05/10/2020 18:45	89713	1.00	12.48	6196	583.6	2.67	2387.6	32.8	
05/10/2020 19:00	89713	1.00	12.48	6196	583.7	2.67	2387.6	32.8	
05/10/2020 19:15	89715	1.00	12.49	6196.2	583.9	2.67	2387.6	32.8	
05/10/2020 19:30	89715	1.00	12.49	6196.2	584.1	2.67	2387.6	32.8	
05/10/2020 19:45	89717	1.00	12.50	6196.4	584.2	2.67	2387.6	32.8	
05/10/2020 20:00	89717	1.00	12.50	6196.4	584.4	2.67	2387.6	32.8	
05/10/2020 20:15	89719	1.00	12.51	6196.5	584.6	2.67	2387.6	32.8	
05/10/2020 20:30	89719	1.00	12.51	6196.5	584.8	2.67	2387.6	32.8	
05/10/2020 20:45	89720	1.00	12.52	6196.8	584.9	2.67	2387.6	32.8	
05/10/2020 21:00	89720	1.00	12.52	6196.8	585.1	2.67	2387.6	32.8	
05/10/2020 21:15	89721	1.00	12.53	6196.9	585.3	2.67	2387.6	32.8	
05/10/2020 21:30	89721	1.00	12.53	6196.9	585.4	2.67	2387.6	32.8	
05/10/2020 21:45	89721	1.00	12.54	6196.9	585.6	2.67	2387.6	32.8	
05/10/2020 22:00	89723	1.00	12.54	6197.1	585.8	2.67	2387.6	32.8	
05/10/2020 22:15	89723	1.00	12.55	6197.1	585.9	2.67	2387.6	32.8	
05/10/2020 22:30	89724	1.01	12.55	6197.3	586.1	2.67	2387.6	32.8	
05/10/2020 22:45	89724	1.01	12.56	6197.3	586.3	2.67	2387.6	32.8	
05/10/2020 23:00	89725	1.01	12.56	6197.5	586.4	2.67	2387.6	32.8	
05/10/2020 23:15	89725	1.01	12.57	6197.5	586.5	2.67	2387.6	32.8	
05/10/2020 23:30	89727	1.01	12.57	6197.6	586.7	2.67	2387.6	32.8	
05/10/2020 23:45	89727	1.01	12.58	6197.6	586.8	2.67	2387.6	32.8	

Metering: Commissioning and operation stage:

- The pulses per monitored unit are provided for each water or gas meter e.g. 1 pulse = 100 litres for a water meter or 1 pulse = 1 m³ of gas. Water meters are particularly prone to wrong multiplication factors being applied
- Gas and Water READINGS should be sent to K2n by cumulatively adding the pulses to an initial manual reading for each meter. Allows overall consumption to be checked if needed.
- Electricity meters have the meter READING recorded every 15 minutes, not the consumption
- All meters have their ACTUAL value recorded every 15 minutes. Do not use interpolation setting which is designed to reduce space use in the BEMS database.
- Check the data is being sent each night after 00:00 and received at the K2n database

K2n Operational Data Input Table (Partial)					
This table shows how the BMS Labels are used in the K2n asset sheet to connect the operational data to the right meter					
Name	Meter Type	Unit Type	Unique Meter Id (uses the labels from the csv file)		
Main Electrical Incomer	Electricity	kWh	EM01_Elec_Main_Incomer		
Refuge Alarm Panel	Electricity	kWh	EM02_Refuge_Alarm_Panel		
Fire Alarm Panel	Electricity	kWh	EM03_Fire_Alarm_Panel		
BMS MCC1 Power	Electricity	kWh	EM04_BMS_MCC1		
External Lighting	Electricity	kWh	EM05_EXT_Lighting		
Lift Supply	Electricity	kWh	EM06_Lift		
PV Array Output	Electricity	kWh	EM07_PV_Array		
DB GF Vent Power	Electricity	kWh	EM08_DB_GF_VentPower		
DB 1F Vent Power	Electricity	kWh	EM09_DB_1F_VentPower		
DB GF Kitchen Power	Electricity	kWh	EM10_DB_GF_12_KitchenPower		
DB GF Audio Visual Power	Electricity	kWh	EM11_DB_GF_11_AVPower		
DB GF ICT Power	Electricity	kWh	EM12_DB_GF_10_ICTPower		
DB GF IT Power	Electricity	kWh	EM13_DB_GF_09_ITPower		
DB GF Science Power	Electricity	kWh	EM14_DB_GF_08_SciencePower		
DB GF RM Power	Electricity	kWh	EM15_DB_GF_07_RES MAT Power		
DB GF Art Power	Electricity	kWh	EM16_DB_GF_06_ARTPower		
DB GF Food Tech Power	Electricity	kWh	EM17_DB_GF_05_FoodTECHPower		
DB GF SE Lights	Electricity	kWh	EM18_DB_GF_04_SELights		
DB GF SE Power	Electricity	kWh	EM19_DB_GF_04_SEPower		
DB GF NE Lights	Electricity	kWh	EM20_DB_GF_03_NELights		
DB GF NE Power	Electricity	kWh	EM21_DB_GF_03_NEPower		
DB GF NW Lights	Electricity	kWh	EM22_DB_GF_02_NWLights		
DB GF NW Power	Electricity	kWh	EM23_DB_GF_02_NWPower		
DB GF SWLights	Electricity	kWh	EM24_DB_GF_01_SWLights		
DB GF SW Power	Electricity	kWh	EM25_DB_GF_01_SWPower		
DB 1F Server Power	Electricity	kWh	EM26_DB_1F_05_ServerRMPower		
DB 1F Plant Room Power	Electricity	kWh	EM27_DB_1F_04_PlantRoom		
DB 1F SE Lights	Electricity	kWh	EM28_DB_1F_03_SELights		
DB 1F SE Power	Electricity	kWh	EM29_DB_1F_03_SEPower		
DB 1F NE Lights	Electricity	kWh	EM30_DB_1F_02_NELights		
DB 1F NE Power	Electricity	kWh	EM31_DB_1F_02_NEPower		
DB 1F NW Lights	Electricity	kWh	EM32_DB_1F_01_NWLights		
DB 1F NW Power	Electricity	kWh	EM33_DB_1F_01_NWPower		
GM01 Main Gas Incomer	Gas	m ³	GM01_Main_Gas_Incomer		
GM02 Boiler Gas	Gas	m ³	GM02_Boiler Gas		
GM03 Kitchen Gas	Gas	m ³	GM03_Kitchen Gas		
GM04 DHW Winter Gas	Gas	m ³	GM04_DHW_Gas		
WM01 Utility Supply Meter	Water	m ³	WM01_Boundary_Water		
WM02 Main Incomer	Water	m ³	WM02_Main_Water_Incomer		
WM03 CAT5	Water	m ³	WM03_CAT5		
WM04 DHW Calorifier	Water	m ³	WM04_DHW_Calorifier_Water		
WM05 Existing Building	Water	m ³	WM05_Existing_Building_Supply		
WM06 Kitchen DHW Use	Water	m ³	WM06_Kitchen_DHW_Supply		
WM07 Kitchen CWS	Water	m ³	WM07_Kitchen_CWS_Supply		
Main Radiator Circuit Heat Use	Heat	kWh	HM01_VT_Circuit_1		
Community Circuit Heat Use	Heat	kWh	HM02_VT_Circuit_2		
AHU Heat Use	Heat	kWh	HM03_CT_Circuit_1		
Solar Thermal DHW Heat Supply	Heat	kWh	HM04_CT_Circuit_2		

Note these meters are split panel Lighting and Power meters. The labels should make clear exactly what is being recorded, e.g TOTAL of the board or JUST Power OR Lighting

Providing robust sensor data to K2n

For sensors there are also a series of 'good practice' decisions which should ensure smooth installation and commissioning. These are shown for the various stages of design, construction and operation. The bullet points show essential elements to follow:

Sensors: Design stage:

BMS Sensor Points Partial Table Example

The following are examples of each type of the key sensor data that need to be recorded in the BMS points. Their description should coincide with the meters and sensors noted as installed in the building assets supplied to K2n:

Label	Units		
1st Floor Temp1	Centigrade		
1st Floor Temp2	Centigrade		
AHU Supply Temp	Centigrade		
CT Flow Temp	Centigrade		
CT RTN Temp	Centigrade		
Ground Floor Temp	Centigrade		
HWS Calorifier Temp	Centigrade		
HWS Flow Temp	Centigrade		
HWS RTN Temp	Centigrade		
HWS SECFLOW Temp	Centigrade		
HWS SECRTN Temp	Centigrade		
LTHW Flow Temp	Centigrade		
LTHW RTN Temp	Centigrade		
Outside Air Temp	Centigrade		
VT Flow Temp	Centigrade		
VT RTN Temp	Centigrade		
0021 Pupil Changing Temp	Centigrade		
0022 SportsHall CO2	ppm		
0022 SportsHall Temp	Centigrade		
0026 Dining RM CO2	ppm		
0026 Dining RM Temp	Centigrade		
0027 Kitchen RM CO2	ppm		
0032 MainHall CO2	ppm		
0032 MainHall Temp	Centigrade		
0042 YR6 ClassRM CO2	ppm		
0042 YR6 ClassRM Temp	Centigrade		
0047 Science ClassRM CO2	ppm		
0047 Science ClassRM Temp	Centigrade		
0051 Workshop CO2	ppm		
0051 Workshop Temp	Centigrade		
0054 Food ClassRM CO2	ppm		
0054 Food ClassRM Temp	Centigrade		
0057 ART ClassRM CO2	ppm		
0057 ART ClassRM Temp	Centigrade		
0065 ICT ClassRM CO2	ppm		
0065 ICT ClassRM Temp	Centigrade		
0068 GEN ClassRM CO2	ppm		
0068 GEN ClassRM Temp	Centigrade		
0071 ClassRM CO2	ppm		
0071 GEN ClassRM Temp	Centigrade		
0074 ClassRM CO2	ppm		
0074 GEN ClassRM Temp	Centigrade		
0080 GEN ClassRM CO2	ppm		
0080 GEN ClassRM Temp	Centigrade		
0083 GEN ClassRM CO2	ppm		
0083 GEN ClassRM Temp	Centigrade		
0086 GEN ClassRM CO2	ppm		
0086 GEN ClassRM Temp	Centigrade		

Each sensor has its data initially recorded into the BMS database or other data collector system. This data is then all packaged into a csv file or files each evening for sending to the K2n platform

- Ensure air temperature and CO₂ sensors are provided for ALL main teaching spaces
- Ensure air temperatures are provided for Server Rooms and LAN rooms
- Provide Outside Air Temperature (OAT) sensors
- Ensure temperatures are recorded for key plant and circuits
- Choose a data collection and transmission system capable of collecting actual data at 15-minute intervals, storing this data, and automatically sending it to K2n in csv format via an email each evening at a specified time
- Ensure that an email server and external internet connection are available to the data collection and transmission system to be used

Sensors: Construction stage:

- Ensure OAT sensors are located where direct solar and indirect heating effects cannot affect the readings as these are essential to plant operation and assessment of heating/cooling performance in practice. This usually means using a Stevenson’s screen located in a sheltered North facing area and on ground such as grass or a sedum roof.
- Locate CO2 and T sensors in the correct zones for each space
- Ensure all sensors have calibration certificates and their range is suitable for their use
- Ensure sensors are connected to the BEMS or other data collection and transmission device

BMS csv data file output for one day example

Note the data for each sensor should be the ACTUAL READING at each 15 minute interval, NOT an interpolation. This csv data should be sent each night via email to the unique email address given for the school once the final reading for the day has been taken and stored. This email address is of the form 'school_name_15min_data@data.k2nenergy.com'. The example file for one day shows data for just the first 8 sensors as examples, but all meter and sensor data could be in here too. Note that the column headings contain the BMS labels for each data stream

timestamp	HWS Calorifier Temp	HWS Flow Temp	HWS RTN Temp	HWS SECFlow Temp	HWS SECRTN Temp	LTHW Flow Temp	LTHW RTN Temp	Outside Air Temp	Etc for all meter and sensor points...
05/10/2020 00:00	65	79.8	75.5	78.7	61.2	79.8	71.1	11.3	
05/10/2020 00:15	64.4	78.7	77.8	78.7	58.8	80.4	61.7	11.2	
05/10/2020 00:30	64.9	77.2	76.4	77.2	55.2	80.8	62.6	11	
05/10/2020 00:45	65	75.9	75.2	75.9	52.8	80.6	61.8	10.8	
05/10/2020 01:00	65	74.7	74.1	74.7	51.8	80.1	62.2	10.8	
05/10/2020 01:15	65.1	73.5	73	73.5	50.2	80	62.2	10.8	
05/10/2020 01:30	65.1	72.4	71.9	72.4	48.5	80.7	62.1	10.9	
05/10/2020 01:45	65.1	71.3	70.9	71.3	48.2	80.2	63.4	10.9	
05/10/2020 02:00	64.9	70.2	69.8	70.2	49	80.2	63	11	
05/10/2020 02:15	64.9	69.2	69	69.2	48.6	80.6	62.4	11.1	
05/10/2020 02:30	64.9	68.4	68.2	68.4	48	80.6	62.5	11.1	
05/10/2020 02:45	64.9	67.5	67.3	67.5	47.6	79.8	61.5	11.1	
05/10/2020 03:00	64.8	66.7	66.5	66.7	46.9	80.1	62.4	11.2	
05/10/2020 03:15	64.7	65.8	65.7	65.8	47.4	79.9	63.1	11.4	
05/10/2020 03:30	64.7	65	64.9	65	47.2	80.1	62.6	11.5	
05/10/2020 03:45	64.6	64.2	64	64.2	47.5	80.7	63.1	11.6	
05/10/2020 04:00	64.4	63.4	63.2	63.4	47.2	80.4	62.7	11.8	
05/10/2020 04:15	64.3	62.6	62.4	62.6	46.5	79.8	62.5	12.1	
05/10/2020 04:30	64	61.8	61.5	61.8	46.9	79.7	63.3	12.2	
05/10/2020 04:45	63.8	61	60.7	61	46.8	80.1	63.6	12.5	
05/10/2020 05:00	63.4	60.2	59.9	60.2	46.5	80.4	63.9	12.7	
05/10/2020 05:15	63	59.5	59.3	59.5	46.1	80.4	63.9	12.9	
05/10/2020 05:30	62.5	59	58.7	59	46	79.6	64.3	13.2	
05/10/2020 05:45	62	58.4	58.1	58.4	46.3	79.6	64.1	13.4	
05/10/2020 06:00	61.5	57.8	57.5	57.8	46.3	79.5	63.5	13.5	
05/10/2020 06:15	61	57.2	57	57.2	46.3	79.9	63.4	13.8	
05/10/2020 06:30	60.5	56.6	56.4	56.6	46.3	79.7	63.7	13.9	
05/10/2020 06:45	60	56.1	55.8	56.1	46	79.9	64.3	14	
05/10/2020 07:00	59.5	55.5	55.2	55.5	45.4	80.3	64.1	14	
05/10/2020 07:15	59.1	54.9	54.6	54.9	44.9	80.4	63.6	14	
05/10/2020 07:30	58.7	54.4	54	54.4	45.9	80.4	63.5	13.9	
05/10/2020 07:45	58.4	53.8	53.2	53.8	46	80.4	63.3	13.9	
05/10/2020 08:00	58.1	53.2	52.2	53.2	46	80.3	64.4	13.9	
05/10/2020 08:15	57.7	52.7	51	52.7	45.6	80.4	64.3	13.9	
05/10/2020 08:30	57.4	52.2	50.1	52.2	45.3	80.3	63.9	14	
05/10/2020 08:45	57	51.6	49.5	51.6	45.2	80	63.8	14	
05/10/2020 09:00	56.7	51.1	49	51.1	44.4	80.3	64.4	14.1	
05/10/2020 09:15	49.9	60.3	57.6	60.3	47.8	60.4	55.2	14.4	
05/10/2020 09:30	58.2	82	74.7	82	52.8	82.2	71.9	14.6	
05/10/2020 09:45	62.1	74.9	71.4	74.9	55.4	75	69.8	14.9	
05/10/2020 10:00	65.8	78.1	75	78.1	58.6	77.8	74.2	15.3	
05/10/2020 10:15	66.5	76.9	73.9	76.9	61	77	71.7	15.6	
05/10/2020 10:30	67.4	75.5	75.2	75.5	63.1	78.9	72	15.8	
05/10/2020 10:45	67.4	78.5	75.2	78.5	63.1	78.9	72	15.8	
05/10/2020 11:00	66.5	80.8	80.2	80.8	63.5	80.9	74.2	16	
05/10/2020 11:15	64.6	80.4	80.3	80.4	62	80.6	73.6	16	
05/10/2020 11:30	62.9	76.6	72.4	76.6	60.1	76.1	70.9	16.3	
05/10/2020 11:45	64.1	78.3	73.4	78.3	59.7	78.6	70.9	16.6	
05/10/2020 12:00	65.9	78.5	74.6	78.5	61.1	78.7	72.7	16.9	
05/10/2020 12:15	66.3	80.3	76.3	80.3	62.2	80.6	73.6	17	
05/10/2020 12:30	65.6	80	76.5	80	62.3	80	73.6	17.3	
05/10/2020 12:45	64.3	79.9	77.7	79.9	61.5	79.9	74	17.6	
05/10/2020 13:00	64.2	77.4	73.6	77.4	60.5	77.7	71.3	18.1	
05/10/2020 13:15	65.1	79.5	75.2	79.5	60.7	79.7	72.9	18.3	
05/10/2020 13:30	65.6	79.1	75.4	79.1	61.5	79.2	72.8	17.7	
05/10/2020 13:45	65.4	80.1	76.1	80.1	61.8	80.2	73.4	17.2	
05/10/2020 14:00	64.9	79.9	76.2	79.9	61.6	80.4	72.5	17.1	
05/10/2020 14:15	64.7	79.4	75.3	79.4	61.1	79.4	72.7	17.5	
05/10/2020 14:30	64.9	80	75.7	80	61	80	73.7	18.5	
05/10/2020 14:45	65	77.5	74	77.5	61.3	78	71.6	17.2	
05/10/2020 15:00	65.1	78.2	74.5	78.2	61.4	78.3	70.6	14.3	
05/10/2020 15:15	65.1	75.2	72.6	75.2	61.5	75.4	66.3	13.5	
05/10/2020 15:30	64.8	81.8	76.8	81.8	61.3	82.3	69.8	13.3	
05/10/2020 15:45	65.1	76.4	73.3	76.4	61.4	76.8	69.5	13.2	
05/10/2020 16:00	65.1	79.2	75.4	79.2	61.3	79.2	71.6	13	
05/10/2020 16:15	65.1	79.4	75.5	79.4	61.5	79.7	71.2	13.2	
05/10/2020 16:30	65	78.9	75	78.9	61.3	78.9	71.4	13.1	
05/10/2020 16:45	64.9	79.3	75.4	79.3	61.3	79.5	71	12.8	
05/10/2020 17:00	65.1	78.7	75	78.7	61.3	78.8	71.1	12.8	
05/10/2020 17:15	64.9	78.6	74.8	78.6	61.2	78.7	71	12.8	
05/10/2020 17:30	63.9	67.4	66.3	67.4	61.1	69.3	57.7	12.5	
05/10/2020 17:45	65.4	80.9	76.1	80.9	60.7	81.3	70.7	12.4	
05/10/2020 18:00	66.1	79.1	75.9	79.1	62.1	77.1	70.7	12.4	
05/10/2020 18:15	65.3	77.7	74.5	77.7	62	78.3	67.8	12.4	
05/10/2020 18:30	64.7	78.5	75	78.5	61.4	78.4	69.3	12.4	
05/10/2020 18:45	64.4	77.2	73.6	77.2	60.9	77.3	68.3	12.3	
05/10/2020 19:00	64.7	76.7	73.3	76.7	60.9	76.8	68.3	12.3	
05/10/2020 19:15	65	76	72.9	76	61.2	76.2	67.8	12.2	
05/10/2020 19:30	65.5	79.1	75.3	79.1	61.5	79.2	70.2	11.9	
05/10/2020 19:45	65.4	79.5	75.7	79.5	61.8	79.7	70.4	11.7	
05/10/2020 20:00	65	80.5	76.6	80.5	61.6	80.6	71.1	11.6	
05/10/2020 20:15	64.7	79.4	75.6	79.4	61.3	79.8	69.8	11.5	
05/10/2020 20:30	64.8	79.5	75.3	79.5	61.1	79.4	70.8	11.4	
05/10/2020 20:45	65	79	75.2	79	61.2	79.2	70	11.4	
05/10/2020 21:00	65.2	79.9	75.9	79.9	61.4	80	70.9	11.4	
05/10/2020 21:15	65.2	79.5	75.6	79.5	61.5	79.5	70.8	11.4	
05/10/2020 21:30	64.9	80.3	76.2	80.3	61.4	80.4	70.8	11.3	
05/10/2020 21:45	64.8	80	75.9	80	61.2	80.3	70.4	11.3	
05/10/2020 22:00	64.9	78.9	75	78.9	61.2	79.1	70.2	11.3	
05/10/2020 22:15	65.1	79.7	75.7	79.7	61.3	79.8	70.8	11.2	
05/10/2020 22:30	65.1	79.7	75.8	79.7	61.4	80	70.6	11.2	
05/10/2020 22:45	65.1	79.4	75.5	79.4	61.4	79.5	70.7	11.2	
05/10/2020 23:00	64.9	79.6	75.7	79.6	61.4	79.8	70.1	11.2	
05/10/2020 23:15	64.9	79.7	75.7	79.7	61.3	79.8	70.6	11.2	
05/10/2020 23:30	65	79.2	75.3	79.2	61.3	79.3	70.5	11.1	
05/10/2020 23:45	65.1	79.7	75.8	79.7	61.3	79.9	70.7	11	

Sensors: Commissioning and operation stage:

- Ensure each sensor is correctly identified by the data collector
- Independently monitor the conditions being recorded at each sensor with calibrated instruments and check accuracy against recorded values at the data collector
- All sensors have their ACTUAL value recorded every 15 minutes. Do not use the interpolation setting which is designed to reduce space use in the BEMS database.
- Check the data is being sent each night after 00:00 and received at the K2n database

Example K2n Operational Data Input Table (Partial)

This table shows how the BMS Labels are used in the K2n asset sheet to connect the operational data to the right sensor

Name	Sensor Type	Unit Type	Unique Sensor Id (uses the labels from the csv file)			
1st Floor Corridor Air Temp 1	Room air temperature sensor	Centigrade	1st Floor Temp1			
1st Floor Corridor Air Temp 2	Room air temperature sensor	Centigrade	1st Floor Temp2			
Kitchen AHU Supply Temp	Room supply temperature	Centigrade	AHU Supply Temp			
CT Flow Temp	Hot water flow temperature	Centigrade	CT Flow Temp			
CT Return Temp	Hot water return temperature	Centigrade	CT RTN Temp			
Ground Floor Temp	Room air temperature sensor	Centigrade	Ground Floor Temp			
HWS Calorifier Temp	Storage Temperature	Centigrade	HWS Calorifier Temp			
HWS Flow Temp	Hot water flow temperature	Centigrade	HWS Flow Temp			
HWS Return Temp	Hot water return temperature	Centigrade	HWS RTN Temp			
HWS Secondary Flow Temp	Hot water flow temperature	Centigrade	HWS SECFLOW Temp			
HWS Secondary Return Temp	Hot water return temperature	Centigrade	HWS SECRTN Temp			
LTHW Flow Temp	Hot water flow temperature	Centigrade	LTHW Flow Temp			
LTHW Return Temp	Hot water return temperature	Centigrade	LTHW RTN Temp			
Outside Air Temp	Outside Air Temperature	Centigrade	Outside Air Temp			
VT Flow Temp	Hot water flow temperature	Centigrade	VT Flow Temp			
VT Return Temp	Hot water return temperature	Centigrade	VT RTN Temp			
Room 0021 Pupil Changing Temp	Room air temperature sensor	Centigrade	0021 Pupil Changing Temp			
Room 0022 Sports Hall CO2	CO2	ppm	0022 SportsHall CO2			
Room 0022 Sports Hall Temp	Room air temperature sensor	Centigrade	0022 SportsHall Temp			
Room 0026 Dining Room CO2	CO2	ppm	0026 Dining RM CO2			
Room 0026 Dining Room Temp	Room air temperature sensor	Centigrade	0026 Dining RM Temp			
Room 0027 Kitchen CO2	CO2	ppm	0027 Kitchen RM CO2			
Room 0032 Main Hall CO2	CO2	ppm	0032 MainHall CO2			
Room 0032 Main Hall Temp	Room air temperature sensor	Centigrade	0032 MainHall Temp			
Room 0042 YR6 Classroom CO2	CO2	ppm	0042 YR6 ClassRM CO2			
Room 0042 YR6 Classroom Temp	Room air temperature sensor	Centigrade	0042 YR6 ClassRM Temp			
Room 0047 Science Classroom CO2	CO2	ppm	0047 Science ClassRM CO2			
Room 0047 Science Classroom Temp	Room air temperature sensor	Centigrade	0047 Science ClassRM Temp			
Room 0051 Workshop CO2	CO2	ppm	0051 Workshop CO2			
Room 0051 Workshop Temp	Room air temperature sensor	Centigrade	0051 Workshop Temp			
Room 0054 Food Classroom CO2	CO2	ppm	0054 Food ClassRM CO2			
Room 0054 Food Classroom Temp	Room air temperature sensor	Centigrade	0054 Food ClassRM Temp			
Room 0057 ART Classroom CO2	CO2	ppm	0057 ART ClassRM CO2			
Room 0057 ART Classroom Temp	Room air temperature sensor	Centigrade	0057 ART ClassRM Temp			
Room 0065 ICT Classroom CO2	CO2	ppm	0065 ICT ClassRM CO2			
Room 0065 ICT Classroom Temp	Room air temperature sensor	Centigrade	0065 ICT ClassRM Temp			
Room 0068 General Classroom CO2	CO2	ppm	0068 GEN ClassRM CO2			
Room 0068 General Classroom Temp	Room air temperature sensor	Centigrade	0068 GEN ClassRM Temp			
Room 0071 Classroom CO2	CO2	ppm	0071 ClassRM CO2			
Room 0071 General Classroom Temp	Room air temperature sensor	Centigrade	0071 GEN ClassRM Temp			
Room 0074 Classroom CO2	CO2	ppm	0074 ClassRM CO2			
Room 0074 General Classroom Temp	Room air temperature sensor	Centigrade	0074 GEN ClassRM Temp			
Room 0080 General Classroom CO2	CO2	ppm	0080 GEN ClassRM CO2			
Room 0080 General Classroom Temp	Room air temperature sensor	Centigrade	0080 GEN ClassRM Temp			
Room 0083 General Classroom CO2	CO2	ppm	0083 GEN ClassRM CO2			
Room 0083 General Classroom Temp	Room air temperature sensor	Centigrade	0083 GEN ClassRM Temp			
Room 0086 General Classroom CO2	CO2	ppm	0086 GEN ClassRM CO2			
Room 0086 General Classroom Temp	Room air temperature sensor	Centigrade	0086 GEN ClassRM Temp			